ANALYSIS OF THE EXISTING STATE OF RESEARCH, DEVELOPMENT AND INNOVATION IN THE CZECH REPUBLIC AND A COMPARISON WITH THE SITUATION ABROAD IN 2013

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Introduction

Motto: "One of the priorities of this Government is developing a skilled labor force and close connection between science and industry."

For the Czech Republic science and research traditionally represent an irreplaceable phenomenon of its development. One of the priorities of the Government is strengthening the elements of competitiveness, among which science, research and innovation play the key role.

In economically advanced countries an important factor for retaining their competitive advantage is the ability of enterprises to innovate. The Czech Republic, according to the level of its economy, ranks among countries where the ability of companies to innovate represents the main factor for ensuring competitive advantage.

On the basis of the presented analysis it can be stated that in recent years the Czech Republic registered positive development in science and research. The total amount of public expenditure on research and development, including funds from the EU and the Norwegian funds, reached CZK 39.1 billion. The share of actual total public spending represented 1.02% of GDP.

The year 2012, similarly to the previous year 2011, was significant in terms of the enormous increase in total expenditure on research and development. During these two years the total R&D expenditure increased in absolute terms by CZK 19.4 billion and amounted to CZK 72.4 billion in 2012. In relative terms the share of R&D expenditure of the gross domestic product rose almost to 1.9% and the Czech Republic in this crucial indicators considerably converged to the European average.

The preparation of annual Analyses of Research, Development and Innovation in the Czech Republic in International Comparison is a task given to the Research, Development and Innovation Council by the Act No. 130/2002 Coll., on the Support of Research, Experimental Development and Innovation from Public Sources and Changes to Certain Related Acts (Act on the Support of Research, Experimental Development and Innovation), as amended. This is already the twelfth analysis. Its goal is to provide the broader expert public and other interested parties with a thorough and clear balance of inputs of research and development and their impact on the outputs, especially on innovation and competitiveness including international comparison.

I believe that the presented publication will provide necessary information and guidance to everybody, who is interested in the Czech research and development.

MVDr. Pavel Bělobrádek, Ph.D., MPA

Deputy Prime Minister for Science, Research and Innovation

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Abbreviations and acronyms

FP6	Sixth Framework Program of the European Union for research and technological development
FP7	Seventh Framework Program of the European Union for research and technological development
AIPCR	Association of Innovative Entrepreneurship of the Czech Republic
AS CR	Academy of Sciences of the Czech Republic
BERD	Business Enterprise Expenditure on R&D
CEP	Central R&D Project Register
CEZ	Central Register of Research Intentions
CIP	EU Competitiveness and Innovation Framework Program
CIS	Community Innovation Survey
CZSO	Czech Statistical Office
CZ-NACE	Classification of economic activities
EFTA	European Free Trade Association (Iceland, Liechtenstein, Norway and Switzerland)
EC	European Commission
EPO	European Patent Office
ERA	European Research Area
ERC	European Research Council
EU	European Union
EU15	the following EU Member States - Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, United Kingdom, Greece
EU25	EU15 + Czech Republic, Estonia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Slovakia and Slovenia
EU27	all EU Member States by June 2013 (EU25 + Bulgaria and Romania)
EU28	all EU Member States as of July 2013 (including Croatia)
Eurostat	Statistical Office of the European Communities
FTE	Full time equivalent
GACR	Czech Science Foundation
GBAORD	Government Budget Appropriations and Outlays for R&D
GERD	Gross Expenditure on R&D
GOVERD	Government Expenditure on R&D
GDP	Gross Domestic Product
HERD	Expenditure on R&D in Higher Education Sector
ICT	Information and communication technology
IPC	International patent classification
ISCED	International Standard Classification of Education
R&D&I IS	Research, development and innovation information system
JRC	Joint Research Centre
Kgoe	Kilogram(s) of oil equivalent
Lic 5-01	CZSO annual survey on licensing
MIT	Ministry of Industry and Trade
IPC	International patent classification
SME	Small and medium-sized enterprise
MSTI	Main Science and Technology Indicators, OECD
MoEYS	Ministry of Education, Youth and Sports
MoI	Ministry of the Interior
MoH	Ministry of Health
MoA	Ministry of Agriculture
OECD	Organization for Economic Cooperation and Development
OP	Operational Program
OP RDI	Operational Program Research and Development for Innovation
LNP	Legal and natural persons
PCT	Patent Cooperation Treaty

PPS	Purchasing Power Standard - a unit for measuring the purchasing power of the relevant currency unit
RCI	Relative citation index
RCIO	Relative citation index of disciplines RIV Results Information Register
FP	EU Framework Programs for research and technological development
RVVI	Research, Development and Innovation Council
SIMS	Student Information Management System
TI	CZSO survey on innovation in the business sector
TCAS CR	Technology Centre of the Academy of Sciences of the Czech Republic
TR	Thomson Reuters
UIV	Institute for Information on Education
UPV	Industrial Property Office of the Czech Republic
USPTO	United States Patent and Trademark Office
SaT	Science and technology
R&D	Research and development
R&D&I	Research, development and innovation
VS	University (state, public, private, for-profit company)
STI	Science, technology and innovation
VTR 5-01	CZSO Annual Survey on Research and Development
VVS	Public or state university

Summary

- **The Czech Republic is a small, open economy with a strong industrial and export-oriented focus.** The level of its economy ranks it among countries where the main factor for retaining the competitive advantage is the ability of companies to develop and introduce new products, technological processes, changes in work organization or new ways of selling products and services.
- The Czech Republic's position in the overall competitiveness rankings annually publishes by the World Economic Forum and the IMD World Competitiveness Center worsened in 2012. The decline of the overall position primarily reflected the weakened performance of the Czech economy and the deterioration of the institutional factors of competitiveness, such as low efficiency and transparency of public administration and the extent of corruption in public administration, a rigid legal framework for business development and restrictive regulation of the labor market. There was also an increase in the risk of reallocation of research and development capacity of the corporate sector out of the Czech Republic. In contrast, the Czech Republic enjoys relatively good conditions in the macroeconomic environment, the quality of education and the availability of skilled workforce and the overall technological readiness. In terms of the conditions for the development of research and innovation activities it is positive that there was a year-to-year improvement of the Czech Republic's position in the technological infrastructure (particularly ICT), in scientific and research infrastructure, as well as in education.
- From the perspective of innovation performance parameters reported by the European Commission in its publication Innovation Scoreboard 2013, the Czech Republic also has **a relatively high level of business investment in innovation and a high number of innovative small and medium-sized enterprises**. On the contrary the Czech Republic has a long-term weaker position in the area of research system (including indicators of quality and openness of public research) and the use of intellectual property (including applications for PCT patents, community trademarks and design).
- The performance of the Czech economy as measured by gross domestic product has not returned to the pre-crisis level of 2008 even more than three years since the crisis. In the context of the economic development of Central Europe **the Czech Republic records one of the longest and cumulatively deepest downturns of economic performance**. This is, of course, reflected in the halting of the process of real convergence of the Czech economy to the European average.
- Of the expenditure components of GDP the decline of the performance of the Czech Republic's economy was most significantly affected by the decrease of household and government institutions spending on final consumption and from the end of 2012 also the decrease in foreign demand for Czech exports. Although the improving economic situation in Europe (especially in Germany) contributed to a slight recovery of the Czech economy in the second quarter of 2013, the **long-term sustainability of economic growth will greatly depend on the overall restructuring of the Czech economy** towards enhancing the importance of production with higher added value, which is closely linked to strengthening the importance of innovation activities.
- **Foreign-controlled companies**, whose proportion grew in connection with the large inflow of foreign direct investments between 2000 and 2005 (especially in financial, telecommunication and logistics services, and in the automotive industry), may have significant impact on the restructuring of the Czech economy.
- An important impetus for increasing the intensity of research and innovation activities in the Czech Republic is also a **relatively high energy intensity of production of the Czech economy**. In comparison with the EU28 average the Czech Republic needs 2.5 times the amount of energy to produce a unit of GDP. Although the development of energy intensity indicators suggests that the efficiency of transformation of primary energy sources into economic performance in the Czech Republic is growing in the long term, the Czech Republic's considerable lag behind the European average in the energy intensity of GDP is an important signal to increase the energy efficiency of production and to achieve significant energy savings in the economy.

- An effective and systematic support for educational and research activities in the government policy plays an important role in stimulating factors of long-term economic development. **In terms of the percentage of public spending on education, research and development in public budgets, the Czech Republic with 11.1% of public expenditures belongs among countries below the European average (12.4%)**, while this figure is more or less stagnant since 2006. It is mainly affected by the stagnating percentage of public spending on education, in contrast, **the proportion of expenditure on research and development in the public budgets is slightly growing**, in line with the Czech Republic's commitment for the implementation of the Europe 2020 strategy. The proportion of the state budget expenditures on R&D in 2012 amounted to 0.68% of GDP (after annual growth of 1.5%)[1].
- The year 2012, similarly to the previous year 2011, was significant in terms of the **enormous increase in total expenditure on research and development**. During these two years the total R&D expenditure increased in absolute terms by CZK 19.4 billion, and while in 2010 reached CZK 53 billion, it amounted to CZK 72.4 billion in 2012.[2] In relative terms the share of R&D expenditure of the gross domestic product rose from 1.4% in 2010 to almost 1.9% in 2012 and the Czech Republic made considerable progress towards the European average in this crucial indicator. In terms of the conditions for long-term economic development it is positive that **R&D expenditure increased in the past five years despite the unfavorable developments in the performance of the Czech economy**. A significant role in the funding of research activities was played by the structural funds, whose intense utilization for research and development activities began in 2011. However, it is also important that, in 2011 and 2012, there was an increase of business resources, of both domestic and foreign enterprises, that were invested in R&D.
- More than half of the research and development in the Czech Republic is carried out in the business sector. In terms of the importance of the business sector in the structure of R&D the Czech Republic is comparable to other economically advanced European countries. However, in the long run the business sector's share of the total R&D expenditure declines. While in 2004 the business sector carried out more than 62% of all research and development activities, by 2012 the business sector's share of the total R&D expenditure dropped to less than 54%. The fastest change in the structure of Czech research occurred in the past two years, when the share of research conducted in the higher education sector significantly grew at the expense of the business sector's R&D. The link between the growing higher education sector's share of the total R&D expenditure and the increased share of foreign public financial resources is not coincidental, since in 2011 and 2012 the universities absorbed a significant portion of resources from the structural funds flowing into research and development.
- The increase in R&D expenditure in the business sector is accompanied by an increase in the number of employees in R&D. In 2012 more than 32 thousand people, as converted to full-time equivalency, worked in corporate research, which was about 5 thousand more than in 2010. **A negative feature of employment in the corporate research is a relatively low proportion of women**, which is around 20% in the long term. In 2012 women accounted for only 19% of the R&D staff in the business sector, which in an international comparison ranks the Czech Republic among the lowest among the European countries.
- **A significant position in the corporate research is held by foreign-controlled firms**, which account for more than 52% of the total business R&D expenditure and 48% of all employees in research and development in the business sector. The recent trend suggests that the share of foreign affiliates in the business sector research and development activities in the Czech Republic is on the rise.
- There are significant differences in the way of funding research and development activities between domestic and foreign-controlled enterprises. While **foreign-controlled enterprises financed more than 95% of their R&D expenditures in 2012 from private sources** (domestic and foreign),

1The total amount of public expenditure on R&D, including funds from the EU and the EEA/Norway Financial Mechanisms, reached CZK 39.1 billion. The share of actual total public spending represented 1.02% of GDP.

2It is important to note that in 2013 a special revision of research and development data was conducted on the basis of a retrospective inspection to determine correct methodological distinction of costs for the performed R&D and the costs of R&D services (expenditure on R&D performed for the monitored unit by another entity). For this reason, some of the figures for 2005-2011 differ from data reported in previous years.

domestic firms to a much larger extent use public funds to finance research and development activities. In 2012 the **domestic enterprises used public funds** (domestic and foreign) to finance almost a third of all R&D expenditure. This "dependency" of the domestic business sector on public resources for research and development presents a risk to the long-term sustainability of the positive trend of growth of R&D expenditures of domestic enterprises.

- In terms of sectoral structure **the driving force behind the business sector R&D is the automotive industry**, which represents the dominant sector in the long term both in terms of investment in industrial R&D, as well as the number of employees in R&D. It is obvious that the leader in this area is Škoda Auto, which invests into R&D around 80% of the total investment in the automotive industry. **The second most important industry in terms of R&D investment and the number of employees in R&D is engineering**, which includes production of machines and equipment, their repair and installation. Additional industries with rapidly increasing R&D investment include the food and electro technical industries. Both of these industries are among the rather larger industries in terms of the creation of added value.

- High proportions of the automotive and engineering industry in the total investment in industrial R&D, of course, are largely affected by the size of these industries in the Czech economy, since these two industries create almost a third of the gross added value of the manufacturing industry. It is therefore more appropriate to consider **the intensity of industrial R&D (and its development) in various sectors. In the automotive industry and engineering it keeps steadily above the average of the manufacturing industry** and reaches 7% in the automotive industry and 4% in engineering.

- Thanks to Škoda Auto the highest investment in corporate research is traditionally in the Central Bohemia region. The greatest concentration of the business sector's research capacity, by the number of employees in R&D, however, is in Prague, where there are 26% of all employees of the business sector's R&D, followed by the South Moravian region with a 16% share of the total employment in R&D in the business sector. The South Moravian region, together with the Pilsen region, is also among the fastest growing regions in terms of the number of employees in R&D in the business sector.

- Companies in the Czech Republic (in particular small and medium-sized enterprises) get relatively intensively involved in international cooperation projects in research, development and innovation. In the **Seventh EU Framework Program for research, technological development and demonstration alone (FP7) the share of small and medium-sized enterprises reached over 21% of the** total Czech participation, as well as the total volume of obtained funds, while the objective of the European Commission is to achieve a 15% share of the private sector. From the sectoral point of view, businesses get involved in particular in projects in the field of nanotechnology and the provision of ICT services. There is intensive international cooperation among companies in other European programs and initiatives, particularly in the EUREKA program.

- In addition to their own research and development activities, the overall absorption capacity to use knowledge and new information and their application in innovation is also important for strengthening companies' competitiveness. **In comparison of the intensity of innovation activities the Czech Republic is among the countries where more than half of the companies show innovation activities**. In the innovation cost structure the investment in acquisition of machinery, equipment and software, which make up over half of the total innovation costs, play the most important role in the long term in the Czech Republic. This largely suggests the adaptive nature of innovation, where companies in the Czech Republic are more likely to adopt advanced technologies and production processes and implement them in their productions. There is a certain difference in the innovation cost structure in the foreign-controlled companies, which spend a significantly higher volume of R&D funds to purchase external services (possibly from the parent companies, or firms within the group).

- A positive sign for the growth of competitiveness of the business sector in the Czech Republic is the long-term export growth of high-tech products and the relatively high proportion of exports of high-tech products in total exports. The largest share of high-tech exports consists of computers, electronics and communication technology. However, these are the sectors that have relatively low volume of added value. This suggests that the **export of high-tech production is not associated with the**

knowledge-intensive manufacturing activities and it is rather about product assembly. The total share of the high-tech sectors of the manufacturing industry in the Czech Republic of the manufacturing industry's added value in comparison with European countries is very low. The Czech Republic thus remains competitive in the manufacturing industry mainly in the medium high-tech and medium low-tech activities.

- An important condition for maintaining economic competitiveness, a high level of education and cultural development of society is the quality of research carried out in the public sector. The range and quality of public research represents a sign of maturity of society and at the same time an important factor for making decisions about the extent of the private sector's investment into the business activities based on the use of new knowledge and findings. In the Czech Republic public research is traditionally carried out by universities and the governmental sector, which includes mainly the Czech Academy of Sciences and also research institutes established by individual ministries (departmental research institutes). In 2012 the total expenditure on R&D within public research reached CZK 33.2 billion, which represents almost 46% of the total R&D spending. **The last two years saw a fairly significant increase in the share of public research in the research system of the Czech Republic**, since in 2010 public research accounted for less than 42% of the total R&D expenditure. There was also an increase in the number of employees in public research, which employed more than 28 thousand people, as converted to full-time equivalency, in 2012. The increase in the number of employees in the public R&D between 2010 and 2012 of 10.8% was, however, lower than the increase in the number of employees in the business sector R&D (19.3%). Similarly the increase in the number of employees in the public R&D did not correspond with the increase in R&D expenditure in this sector (more than 50% in 2010–2012), which confirms that in this period there was substantial investment in public research into the development of research infrastructure.

- While the sectoral, ownership and regional structure of corporate research in the Czech Republic remains relatively stable, **public research has been undergoing significant changes in recent years in the sectoral structure of expenditures, sites and employees**. Structural changes of public R&D are manifested by rapid growth of financial and human-resource capacities of the higher education sector with a relatively slower strengthening of R&D in the governmental sector. While in 2005, 50% of all FTE employees of the public R&D worked in the higher education sector, by 2012 their share rose to more than 59%. Even more significant in the higher education sector was the increase of R&D expenditure and the share of this sector in total R&D expenditure in the public sector. **While in 2010 the ratio of R&D expenditure in the higher education and governmental sector was 48:52, by 2012 the ratio was completely turned over to 60:40**. As was already mentioned above, a significant proportion of this growth can be attributed to the higher education sector's investments into construction and modernization of research infrastructure financed by the EU structural funds. However, the financial plans of the newly built research centers and infrastructures suggest that to maintain them will create considerable demands not only on the state budget, but also on the ability of these institutions to obtain additional financial resources from abroad and from the private sector.

- Information about sources of funding of public research suggests a relatively greater ability to raise funds from the private sector (domestic and foreign) on the part of the institutes of the Academy of Sciences of the Czech Republic compared to universities. While in 2012 the universities funded only 0.8% of the total R&D expenditure from private sources, the institutes of the Academy of Sciences were able to raise 14.7% for R&D from private sources. However, a dominant position of the Institute of Organic Chemistry and Biochemistry AS CR should be noted as it gets the bulk of its resources from foreign private sources.

- The most important source of financing for public research remains, of course, the state budget, which is used to finance almost 64% of the R&D expenditure in the public sector. **In recent years there has been a significant change in funding of public research from the State budget with the growing proportion of targeted support at the expense of institutional funding**. While in 2005 institutional support accounted for 68% of the state budget funds allocated to public research, in 2012 public research received 60% of the state budget funds on R&D in the form of institutional support. The increase in the share of public research funded by targeted support raises the demands on researchers who must compete for targeted grants more often.

- The growth of R&D expenditure in the public sector recorded since 2005 was accompanied by absolute growth in publication outputs by authors from the Czech Republic, as well as by growth of these publications' share of the world production. However, in 2012 there was a slight drop, compared to the previous year, in the number of publications registered in the Thomson Reuters Web of Science database and the Czech Republic's share of the world publication production stagnated at the level of 0.76%. However, the number of publications per R&D worker in the public sector, in the Czech Republic is still keeping up with the European average.
- In case of citations of publications the situation is different, with **less citations of Czech authors' publications on average per public R&D worker than the average in the EU27**. Nevertheless in global comparison the rate of citations of Czech authors' publications is growing in time, and since 2010 the industry-standardized rate of citations of Czech authors' publications exceeds the world average. In the global context, the relatively large (according to the number of publications) and at the same time frequently cited fields in the Czech Republic are multidisciplinary physics, nuclear physics, nuclear science and technology. The most cited fields in a five-year average are general medicine and other medical disciplines, such as rheumatology, cardiovascular medicine and medical laboratory technology.
- Public research outputs in the form of granted patents have experienced a relatively rapid increase in recent years as well. While in 2008, the universities and public research institutions were granted or received validation from the Czech Industrial Property Office (IPO) for only 47 patents for the territory of the Czech Republic, in 2011 the number of granted patents grew to 144, and in 2012 to 190. **Enormous growth was recorded for patents granted for the Czech Republic to universities**, namely from 19 in 2008 to 142 in 2012. However, despite continuous growth the patent activity of the Czech entities (research organizations and enterprises) abroad considerably lags behind the developed EU countries. While in the EU27 in 2012 there was an average of 129 patent applications at the EPO per one million inhabitants, there were only 13 applications in the Czech Republic.
- The growth in patent activity in public research in recent years is, however, not accompanied by a corresponding increase in the number of licensed patents and related licensing revenue. When not considering the licensing revenue of the Institute of Organic Chemistry and Biochemistry AS CR, which enjoys an exceptional position in this respect, in 2012 the universities and public research institutions received less than CZK 19 million in licensing fees for the right to use inventions or technical solutions protected by patent or utility model, with only CZK 1.2 million being generated by new contracts.
- An important part of the development of the research system is the strengthening of international cooperation in research. The main tool to support European research cooperation is FP7, which as of 2014 will be replaced by the new framework program for research and innovation Horizon 2020. **Until the end of 2012 research organizations engaged in 676 FP7 research projects with a contribution of more than EUR 136 million**. Participation rate of higher education and governmental sector in the Czech Republic is very balanced with a slight predominance of teams from the higher education sector. Among the most active participants in FP7 projects are Charles University in Prague, CTU in Prague, Masaryk University and the Nuclear Research Institute Řež, whose participation is based in particular on its EURATOM program activities. In the future the involvement of public research in international cooperation will play an important role in obtaining extra-budgetary sources of funding for research activities, in the use of the newly built research infrastructures and in acquiring new partnerships to increase the quality and international openness of the Czech research.

Table 1: Key indicators – Czech Republic in time

	1995	2000	2005	2007	2008	2009	2010	2011	2012
Financing									
GERD (in CZK billion)	14,0	26,5	38,1	50,0	49,9	50,9	53,0	62,8	72,4
BERD (% of GDP)	0,91	1,17	1,22	1,36	1,30	1,36	1,40	1,65	1,89
BERD (% of GERD)	65,1	60,0	59,3	58,7	58,6	56,5	57,7	55,3	53,6
GOVERD (% of GERD)	26,4	25,3	22,1	22,6	22,7	23,3	21,7	19,8	18,4
HERD (% of GERD)	8,5	14,2	18,1	18,3	18,2	19,7	20,0	24,4	27,5
Percentage of BERD financed from public sources	4,5	14,7	17,0	15,3	15,1	17,1	15,4	15,7	13,7
Percentage of GOVERD financed by business sources	11,3	9,6	9,2	6,7	5,9	4,2	4,7	3,4	4,0
Percentage of HERD financed by business sources	2,0	1,1	0,8	0,7	0,6	1,1	1,1	1,0	0,8
GERD (in CZK billion)	6,2	11,9	16,4	20,5	20,5	23,0	22,6	25,8	26,2
Percentage of GBAORD in state budget expenditures	1,3	1,8	1,6	1,9	1,9	2,0	2,0	2,2	2,3
Human resources									
Employed in R&D (in FTE)	.	.	43 370	49 192	50 808	50 961	52 290	55 697	60 223
Employed in R&D (in FTE per 1000 inhabitants)	4,5	5,0	8,8	9,7	9,8	10,0	10,3	11,0	.
Researchers (in FTE)	.	.	24 169	27 878	29 785	28 759	29 228	30 682	33 169
Researchers (in FTE per 1000 inhabitants)	2,3	2,9	4,9	5,5	5,7	5,6	5,8	6,1	.
Proportion of women in the number of researchers (FTE, in %)	.	.	26,3	25,4	25,4	26	25,4	25,1	24,7
Proportion of persons with university education (% of population of 25-64 years)	.	11,5	13,1	13,7	14,5	15,5	16,8	18,2	19,2
Results									
Number of publications per 1000 inhabitants	0,34	0,43	0,60	0,73	0,79	0,84	0,84	0,93	0,92
Subject field standard citation rate of professional publications (% of the world average)	55,0	67,9	81,1	87,6	92,5	94,5	104,6	112,4	145,8
Number of patent applications at the EPO (per 1 million inhabitants)	1,4	4,5	7,5	9,4	10,5	12,9	15,9	15,4	13,1
Revenue from licensing patents and utility models (in CZK millions)	.	.	538	1 257	1 160	1 332	1 586	1 745	1 675
License revenue from abroad (% of total revenue for exports of services)	.	1,1	0,6	0,3	0,4	0,8	0,6	0,6	.
Innovation									
Proportion of enterprises with technological innovation activity (% of the total number of enterprises)	.	31,0	.	.	39,3	.	34,8	.	.
Percentage of revenues from the sale of new products in the market (% of total revenues of technologically innovative enterprises)	.	12,9	.	.	16,1	.	12,4	.	.
Export of high-tech products (% of total exports)	5,0	7,8	11,7	14,2	14,2	15,4	16,2	16,5	16,4
Employment in high-tech industry (% of employment in the manufacturing industry)	3,6	4,0	4,5	4,8	4,9	4,7	4,5	4,5	4,6
BERD in high-tech industry (% of BERD of the manufacturing industry)	.	.	13,4	14,3	12,9	12,2	9,7	8,1	.
Venture capital investment (% of GDP)	.	0,025	0,000	0,002	0,003	0,001	0,008	0,005	0,003
International cooperation									
GERD financed from foreign sources (in %)	3,3	3,1	5,4	7,3	8,9	11,3	13,9	19,7	25,9
The proportion of co-authored publications of Czech and foreign researchers (in % of the total number of publications in the Czech Republic)	39,1	42,6	44,4	43,3	45,1	45,7	47,4	47,5	49,1
The proportion of technically innovative enterprises cooperating on innovations with a partner from the EU or EFTA (in %)	.	.	.	.	19,8	.	20,9	.	.
Students studying in another country of the EU27, EEA or candidate country (in % of all students)	.	1,3	1,8	2,1	2,6	2,7	2,9	2,9	.

Note: The definitions of the selected indicators are listed in the annex G.1. Missing data were not available at the time of the preparation of the publication.

Source: Data included in the various chapters of the analysis

Table 2: Key indicators – Czech Republic in international comparison

	Year	Czech Republic	Germany	Austria	Slovakia	Poland
Financing						
GERD (in EUR billion)	2011	2 552	73 692	8 263	468	2 836
BERD (% of GDP)	2011	1,65	2,84	2,75	0,68	0,76
BERD (% of GERD)	2011	55,3	67,0	68,1	37,2	30,1
GOVERD (% of GERD)	2011	19,8	14,8	5,3	27,7	34,5
HERD (% of GERD)	2011	24,4	18,3	26,1	35,0	35,1
Percentage of BERD financed from public sources	2011	15,7	4,5	10.3 (2007)	10,4	12,7
Percentage of GOVERD financed by business sources	2011	3,4	9,0	9.3 (2007)	12,5	7,4
Percentage of HERD financed by business sources	2011	1,0	13,9	5.7 (2007)	3,5	2,6
GBAORD (in EUR million)	2012	1 058	24 120	2 472	178	1 475 (2010)
Percentage of GBAORD in state budget (in %)	2011	2,2	2,0	1,5	1,2	0.9 (2010)
Human resources						
Employed in R&D (in FTE)	2011	55 697	562 763	60 378	18 112	85 219
Employed in R&D (in FTE per 1000 employed persons)	2011	11,0	13,7	14,6	8,2	5,3
Researchers (in FTE)	2011	30 682	327 953	37 084	15 326	64 133
Researchers (in FTE per 1000 employed persons)	2011	6,1	8,1	9,0	6,9	4,0
Proportion of women in the number of researchers (HC, in %)	2011	28,2	24.9 (2009)	28.4 (2009)	42,6	38,6
Proportion of persons with university education (% of population of 25-64 years)	2012	19,2	28,1	20,0	19,0	24,5
Results						
Number of publications per 1000 inhabitants	2012	0,92	1,16	1,50	0,55	0,54
Number of citations of publications from 2008 per 1000 inhabitants	2012	4,86	8,33	11,29	2,41	1,98
Number of patent applications at the EPO (per 1 million inhabitants)	2011	15,4	272,3	194,0	4,3	9,9
License fee revenue collected from abroad as % of total revenue for exports of services	2010	0,6	6,0	1,2	0,9	0,8
Innovation						
Proportion of enterprises with technological innovation activity (% of the total number of enterprises)	2010	34,8	64,2	43,9	28,1	16,2
Percentage of revenues from the sale of new products in the market (% of total revenues of technologically innovative enterprises)	2010	15,1	5,3	8,5	27,9	11,5
Proportion of high-tech exports (% of total exports)	2012	16,2	13,9	12,7	8,2	5,9
Employment in high-tech (% of employment in the manufacturing industry)	2011	4,5	4,2	3,5	4,1	2,7
BERD in high-tech industry (% of BERD of the manufacturing industry)	2011	8,1	24,1	21,0 (2009)	15,1	21,8 (2010)
Venture capital investment (% of GDP)	2012	0,003	0,021	0,011	0,000	0,002
International cooperation						
GERD financed from foreign sources (in %)	2011	19,7	3,9	15,9	14,2	13,4
Proportion of co-authored publications of domestic and foreign researchers (% of the total number of publications in the country)	2011	47,5	50,4	62,8	45.3 (2010)	32.7 (2010)
Proportion of technologically innovative enterprises cooperating on innovations with a partner from the EU or EFTA	2010	20,9	8,2	30,1	30,0	15,6
Proportion of students studying in another country of the EU27, EEA or candidate country as % of all students	2011	2,9	3,9	4,5	13,8	2,0

Note: The definitions of the selected indicators are listed in the annex G.1.
Source: Data included in the various chapters of the analysis

Macroeconomic framework of the analysis of research, development and innovation

The level and intensity of research, development and innovation are closely linked to the economic advancement of the country, the dynamics of the economic development and the structure of the creation of added value and employment. Therefore this introductory chapter provides basic economic framework for the follow-up analysis of R&D&I, which summarizes the main current trends of the Czech economy and the structural aspects of this development, including international comparison.

Table 3: Basic indicators of the macroeconomic development of the Czech Republic

	1995	2000	2005	2007	2009	2010	2011	2012	EU28 (2012)
GDP per capita in PPS (EU28 = 100)	77,0	71,0	79,0	83,0	83,0	80,0	80,0	79,0	100,0
Rate of growth of real GDP (in %; previous year prices)	6,2	4,2	6,8	5,7	-4,5	2,5	1,9	-1,3	-0,4
Labor productivity per person employed (PPS; EU28 = 99.9)	64,4	65,6	72,9	76,2	75,8	73,5	73,8	72,0	99,9
Total government debt (% of GDP)	14,0	17,8	28,4	27,9	34,2	37,8	40,8	45,8	85,3
Foreign direct investment (% of GDP)	4,4	4,3	4,5	3,3	1,0	2,1	1,5	5,4	2,4 (2011)
Inflation rate (in %)	9,1	3,9	1,6	3,0	0,6	1,2	2,1	3,5	2,6
Comparative price level (EU28 = 99.9)	38,1	48,1	58,2	62,4	73,1	75,2	76,7	74,5	99,9
Employment rate (in %)	69,4	65,0	64,8	66,1	65,4	65,0	65,7	66,5	64,1
Unemployment rate (in %)	4,0	8,8	7,9	5,3	6,7	7,3	6,7	7,0	10,5
Long-term unemployment rate (in %)	1,1	4,3	4,2	2,8	2,0	3,0	2,7	3,0	4,7
Public spending on education (% of GDP)	4.7 (1996)	4,0	4,1	4,1	4,4	4,2	:	:	5.4 (2010)
Energy intensity of the economy (Kgoe/in EUR thousands)	533,4	481,9	432,7	390,9	363,9	374,9	355,9	:	144,2 (2011)

Note: The definitions of the selected indicators are listed in annex G.1., Source: CZSO, Eurostat

Competitiveness

The economic development at the micro and the macro level is determined by the set of policies, institutions, and other factors that affect the level of productivity of production factors in the economy, generally characterized as the competitiveness of the country[3]. The growth of the economic development of countries is accompanied by gradual changes in the key factors of competitiveness. The economically less advanced countries can achieve economic growth through investment in expansion of production capacity associated with the transfer of modern technology developed in economically and technologically more advanced countries. Due to the fact that in the economically more advanced countries these sources of competitive advantages are usually exhausted, a precondition for maintaining competitiveness becomes the shifting of technology limits of production (i.e. shifting the frontier of production capabilities), which is subject to introduction of new products, technological processes, changes in the organization of work or introduction of new ways of selling products and services. The Czech Republic, according to the level of its economy, ranks among countries where the ability of companies to innovate represents the main factor for ensuring competitive advantage.

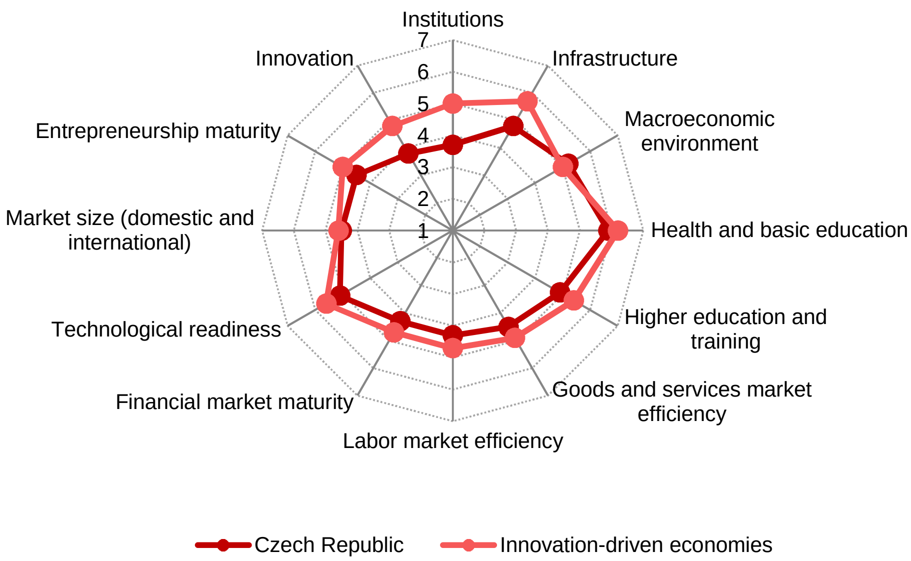
Among the most comprehensive and, at the same time, the most respected international comparisons of competitiveness of countries and individual factors, which affect the countries' competitiveness, are the Global Competitiveness Index compiled by the World Economic Forum and the IMD Index, published annually in The World Competitiveness Yearbook. More focus on the innovation performance of the individual (especially European) countries and on the assessment of the strengths and weaknesses of the

3 This concept of competitiveness is used by the World Economic Forum, which regularly publishes a report on the competitiveness of countries called The Global Competitiveness Report.

research and innovation systems is provided by the Innovation Scoreboard, published annually by the European Commission (DG Enterprise and Industry).

A summary index of competitiveness published annually by the World Economic Forum is composed of more than 110 of quantitative and qualitative indicators grouped into 12 pillars according to different aspects of the competitive advantage. In 2012, the Czech Republic ranked on the 39th position of 144 countries, which represented a decline by one position. From the perspective of the individual groups of factors of competitiveness in comparison with the economically most advanced countries the Czech Republic has a relatively good position in the area of a stable macroeconomic environment, the quality of education and the overall technological readiness (e.g., availability and use of the Internet). On the contrary, the relatively weakest long-term point of growth of the Czech Republic's competitiveness is the institutional environment (e.g., low efficiency and transparency of public administration, a high level of corruption, restrictive labor market regulations).

Chart 1: Sub indexes of the individual factors of competitiveness

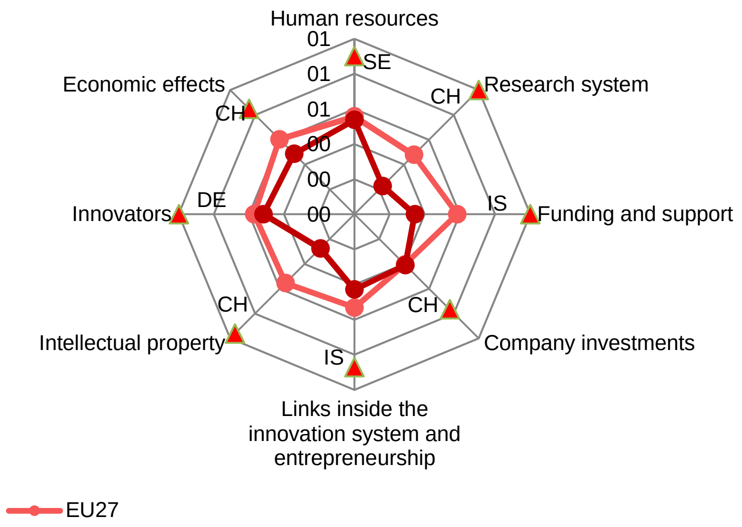


Source: WEF (2012): The Global Competitiveness Report 2012-2013

In addition to the above mentioned report of the World Economic Forum, the deterioration of the overall competitiveness of the Czech Republic is also indicated by the IMD World Competitiveness Center in its summary report (IMD World Competitiveness Yearbook) from 2013. According to the report the Czech Republic's standing in the countries' competitiveness ranking declined year-to-year by two positions and dropped to 35th place out of 60 compared countries. The decline of the overall position in particular reflected the weakened performance of the Czech economy and the institutional factors, such as the extent of corruption in public administration and a rigid legal framework for business development and employment. It is also worth noting the growing risk of reallocation of research and development capacity of the corporate sector out of the Czech Republic. On the contrary, there was improvement in the inflow of foreign direct investment in the Czech Republic, in the coverage of ICT infrastructure (in particular the broadband internet) and in the total R&D expenditure. The main factors increasing the attractiveness of the Czech Republic for the development of economic activities include skilled workforce, reliable infrastructure, price competitiveness and a high level of education. In terms of the major factors that hinder the development of the Czech Republic's competitiveness, the IMD report largely agrees with the World Economic Forum's report suggesting the most significant deficiencies to be the institutional environment for initiation and development of entrepreneurship and the quality of public administration. In terms of the conditions for the development of research and innovation activities it is positive that there was a year-to-year improvement of the Czech Republic's position in the technological infrastructure (particularly ICT) from 35th to 34th place, in scientific and research infrastructure (especially financial and human resources for R&D and R&D results) from 30th to 26the place, as well as in education (primary, secondary and tertiary) from 32nd to 31st place.

A more detailed look at the innovative performance and its individual factors is provided by the Innovation Union Scoreboard 2013. The overall position of the Czech Republic, as measured by the summary innovation index (composite indicator consisting of 25 sub-indicators) deteriorated year-to-year (from 17th to 18th place among the EU27) and among the European countries the Czech Republic belongs to the third group (of four) showing slight innovation activity (*moderate innovators*). As for the individual groups of factors affecting the overall innovation performance of a country, the Czech Republic has a long-term weaker position in the area of research system (including indicators of quality and openness of public research) and the use of intellectual property (including applications for PCT patents, community trademarks and design). On the contrary, the Czech Republic has a relatively comparable level with the average of the EU27 in the areas of human resources (including the range of secondary and tertiary education), corporate investment in innovation and innovative small and medium-sized enterprises (here in "Innovators" groups).

Chart 2: Dimensions of the innovation performance according to the Innovation Union Scoreboard

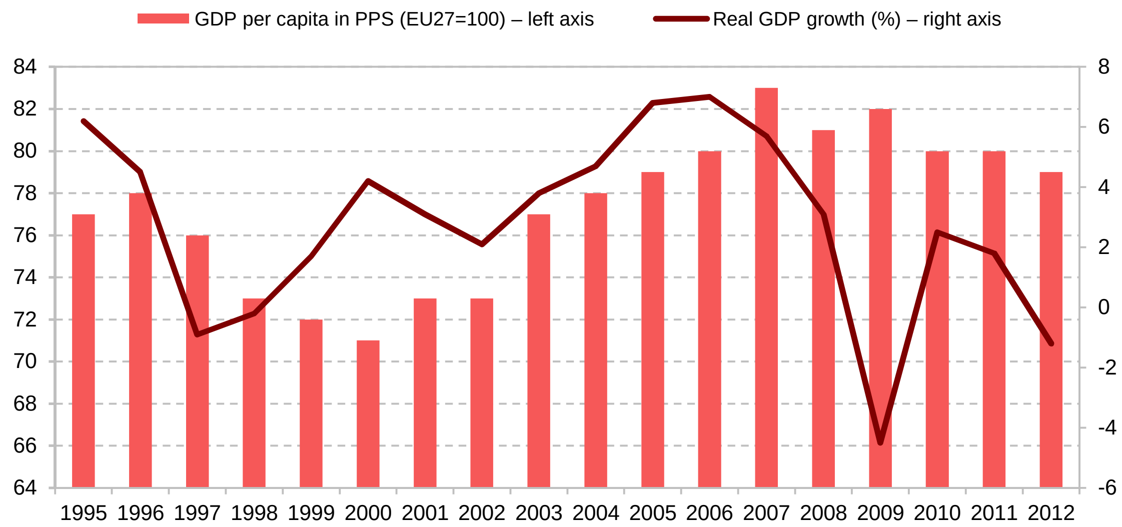


Source: EC (2013): Innovation Union Scoreboard 2013

Economic performance

The performance of the Czech economy following the sharp and deep decline in 2009 and after a slight two-year recovery did not return to the expected faster growth, but on the contrary in 2012 and in the first quarter of 2013, was gradually weakening. Therefore the scenario of the crisis and post-crisis development characterized by the letter "W" was confirmed and the performance of the Czech economy as measured by GDP has not returned to the pre-crisis level of 2008 even more than three years since the crisis. In the context of the economic development of Central Europe the Czech Republic records one of the longest and cumulatively deepest downturns of economic performance (together with Hungary). This is, of course, reflected in the halting of the process of real convergence of the Czech economy to the European average. While in the years 2004-2007, the Czech economy as measured by GDP per capita in purchasing power standard (PPS) increased from 77% to 83% of the European average, in the following years it gradually declined to 79% of the European average in 2012. The other countries of the region and all the Baltic States, by contrast, continued to converge to the EU average economic performance even after 2007.

Chart 3: GDP development and real convergence of the Czech Republic



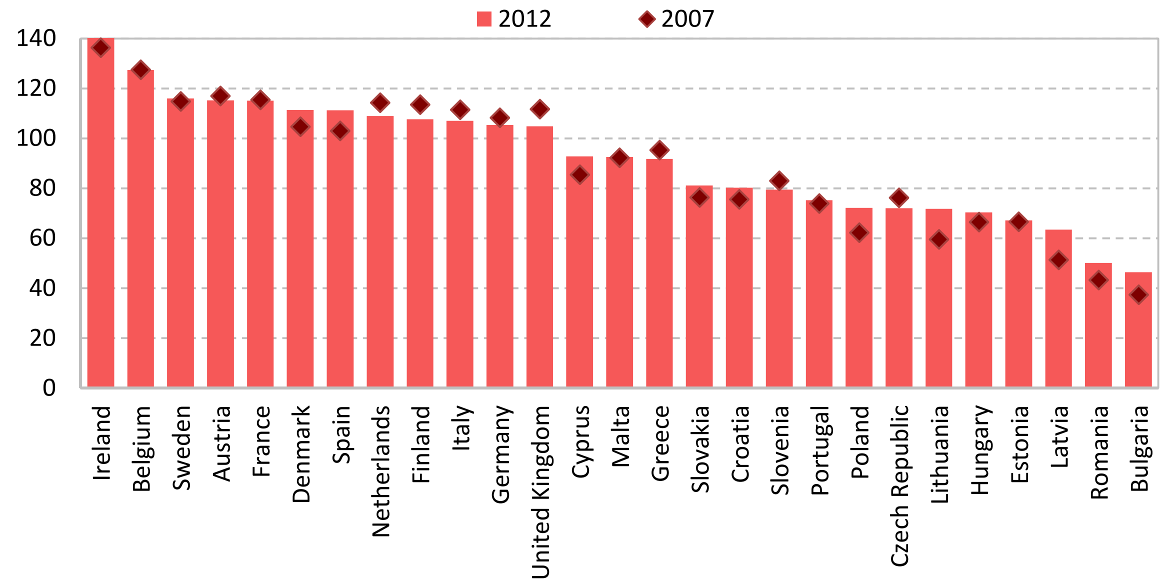
Source: CZSO and Eurostat

Of the expenditure components of GDP the decline of the performance of the Czech Republic's economy was most significantly affected by the decrease of household and government institutions spending on final consumption and later (end of 2012 and beginning of 2013) also the decrease in foreign demand for Czech exports. Gross capital formation also contributed to the decline in GDP, in particular as a result of the decline in stocks, not because of the decline in investment by the businesses. It is also a reason for some optimism regarding the future development of the Czech economy. The fact that the almost two-year decline in the economic performance of the Czech Republic has stopped is also suggested by the GDP figures for the second quarter of 2013, which after some time again increased on a quarterly basis. One of the impulses is also the improving economic situation in Europe, particularly in Germany, our most important trading partner. The long-term sustainability of economic growth will greatly depend on the overall restructuring of the Czech economy towards enhancing the importance of production with higher added value, which is closely linked to strengthening the importance of innovation activities - research and other activities based on utilizing new knowledge.

Labor productivity

The decline in the economic performance of the Czech Republic is also reflected in the development of the aggregate labor productivity, which is an important indicator of the performance and competitiveness of the economy and is indirectly reflected in the development of the standard of living of the society. In the long run, the aggregate labor productivity in the Czech Republic (as measured by GDP per 1 employee) is increasing. The fastest growth was recorded in 2003-2007, when the annual growth in labor productivity averaged 4.7%. Since 2008, however, in the context of decline in economic performance the pace of labor productivity growth slowed to an average of 0.3% per year. Particularly significant was the decline in aggregate labor productivity in 2009 (by 2.2% year-to-year) and in 2012 (by 1.4% year-to-year). As a result of these annual declines 2012 saw a divergence of the aggregate labor productivity in the Czech Republic from the European average. While in the pre-crisis year 2007 labor productivity in the Czech Republic amounted to 76.2% of the European average, by 2012 it declined to 72,0% of the EU28 average. In comparison with Central European countries the Czech Republic also displays a relatively low level of labor productivity and is behind Slovakia, Slovenia, Poland and the new EU member Croatia.

Chart 4: Labor productivity per person employed in PPS (EU28 = 99.9)



Source: CZSO and Eurostat

Foreign direct investment

The Czech Republic is a small open economy, whose development is highly dependent on the ability to integrate into the global production networks and to take advantage of the opportunities of economic globalization. One of the indicators of a country's economic globalization is the share of GDP of foreign direct investment flows into the economy, which also reflects the country's attractiveness for foreign investors. The Czech Republic recorded significant influx of foreign direct investment, particularly between 2000 and 2005, in particular in connection with the investments in financial, telecommunication and logistics services and the automotive industry. In the wake of the global financial and economic turbulence there was a decline in the influx of foreign direct investment in the Czech Republic after 2008. Given that the decline of the influx of foreign direct investment after 2008 occurred in other European countries as well, the share of GDP of foreign direct investment inflows in the Czech Republic remains at approximately the average of the Central European countries. The large influx of foreign direct investment into the Czech Republic after 1999 significantly affected the structure of the Czech economy in terms of the type of ownership. While in 1998 the share of foreign-controlled enterprises in the creation of gross value added represented less than 9%, by 2006 this proportion grew to almost 29%. In the following years the share of foreign-controlled enterprises in the creation of gross value added remains stable at around 30%. Even more significant dynamics of this indicator were recorded in the manufacturing industry, where foreign-controlled businesses create over 57% of the gross value added (compared to 17% in 1998).

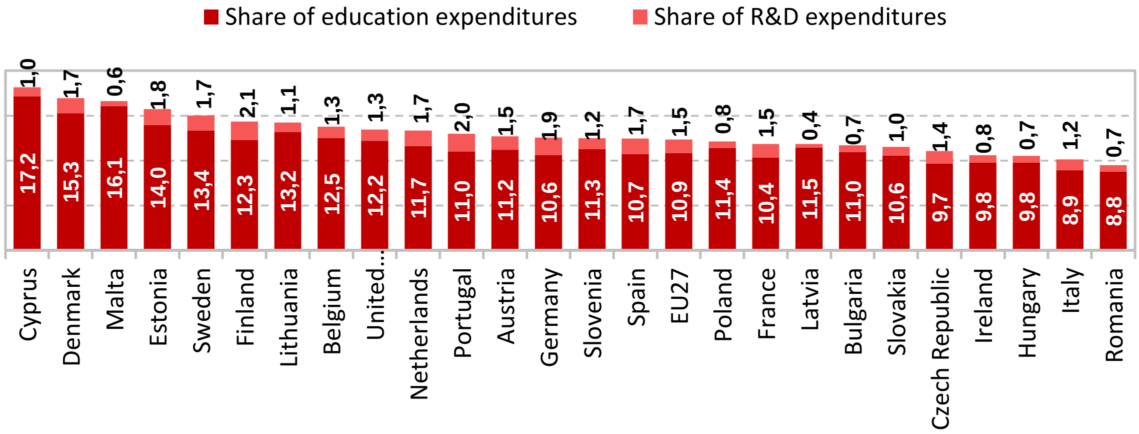
Energy intensity

In a European comparison the Czech Republic, together with other post-Communist countries, shows significantly higher energy intensity of production. The gross energy consumption share of GDP indicates that the Czech Republic needs 2.5 times the amount of energy to produce a unit of GDP compared to the EU28 average. This points to the fact that the added value of the Czech economy is being created in relatively more demanding sectors for materials and energy. The development of the energy intensity indicator, however, suggests that in the long term the efficiency of transformation of primary energy sources into economic performance in the Czech Republic is growing. It also shows the ability of the business sector to introduce new more energy efficient technologies and the gradual change in the structure of the economy, with the increasing share of the service sector. The Czech Republic's considerable lag behind the European average in the energy intensity of GDP creation is an important signal to increase the energy efficiency of production and to achieve significant energy savings in the economy. It is also confirmed by the comparison of the energy intensity of production in the Czech Republic and in other countries in Central Europe. The energy intensity of production in the Czech Republic is higher than in Poland, Hungary and Slovakia.

Long-term growth support in the government's policy

The government's fiscal policy after the economic crisis in 2009 set a significantly restrictive direction and the public budgets deficit gradually converges to the limit of 3% of GDP, which in the European context represents a better average. Also the indicator of the government debt, which in 2012 reached less than 46%, is approximately at half the level of the EU28. Despite these relatively positive parameters of public finances, their long-term sustainability depends on the ability and willingness to address the fundamental questions of financing the pension and healthcare system. The stability of public finances affects and will continue to affect the government policy options to stimulate the long-term factors of economic growth through investments in education, research and development. In terms of the share of public expenditures on education, research and development in public budgets the Czech Republic is among countries below the European average. In 2010 the Czech Republic directed 11.1% of public expenditures to these activities as compared to the European average of 12.4%. Countries, where spending on education and research policy represents a major part of public budgets, traditionally include the Nordic countries, as well as Estonia and Lithuania.

Chart 5: Share of public expenditures on education and R&D in public budgets (2010; %)



Note: the figures for Greece and Luxembourg are not available for 2010
Source: Eurostat

The percentage of public spending on education, research and development in the Czech Republic moderately grew until 2006, since then the percentage has stabilized around 11%. In terms of the structure of these expenditures there is a moderate increase in the share of R&D spending in the public budgets of the Czech Republic. On the contrary, the share of public expenditures on education has been stagnating.

A Investments into research and development

Research and development (R&D) plays a key role in the creation of new knowledge, products and technological processes, which are a prerequisite for stable and sustainable economic growth of society. Public direct and indirect support of R&D represents one of the ways for the advanced countries to contribute in the long-term to increasing the competitiveness of their economies. Without the corresponding volume of financial resources from both the government and the business sector, it cannot be expected that R&D in the Czech Republic will produce internationally competitive knowledge, innovation and technology that will contribute to increasing the productivity, employment and economic competitiveness of the Czech economy, and thus contribute to the above mentioned sustainable development of society and social cohesion.

R&D has in recent years become one of the central areas of national and international policies. Despite the above listed common declarations on science, education and a broad spectrum of innovative activities as fundamental factors of economic prosperity of society and highlighting their importance, the promises associated with supporting their further development are not backed by relevant facts and knowledge of reality.

Business sector R&D, which is mainly related to innovation, is playing an increasingly important role thanks to the advancing globalization, which introduces new companies and products to the national markets, and thereby increases competition in individual business areas. The focus of publicly funded R&D is primarily based on the national science policy of the individual countries. However, the priority in this sector, which is becoming prevalent in R&D, is connecting the acquired scientific knowledge with its subsequent practical use. Research in the governmental and the higher education sectors is therefore focused on acquiring unique knowledge in frontier areas, which facilitate both the general growth of knowledge and strengthening the innovation performance of enterprises and maintaining sustainable development.

Main trends

- There was a retrospective inspection of the correct methodological distinction of costs for the performed R&D in the monitored unit and the costs of R&D services in 2013. The results of this inspection were reflected in the extraordinary revision of data on R&D expenditures in the Czech Republic for 2005 - 2011. It is primarily the changes in R&D expenditure funded by the domestic and foreign business sources.
- In 2012 R&D in the Czech Republic was conducted at 2 778 research institutes, of which 84% were in the business sector. Less than a tenth of the entities engaged in R&D as its predominant economic activity.
- In 2012, after two record increases, the total R&D expenditure (GERD) carried out in the CZECH REPUBLIC reached CZK 72.4 billion, which represents 1.89% of GDP - the highest recorded level in the entire reporting period.
- In the past two years R&D funding comes predominantly from the public sources, mainly thanks to the European funds' resources. In 2012, the share of public resources has reached 54%, which indicates a move away from the two-thirds representation of private resources declared in the Europe 2020 strategy.
- The share of domestic resources in 2012 dropped to 73%, which put the Czech Republic among countries with a strong influence of foreign resources on R&D funding.
- In 2012, the direct R&D support from the state budget increased by CZK 0.4 billion, compared to 2011, to a total of CZK 26.2 billion, which amounts to approximately 2.27% of the total expenditure in the state budget and 0.68% of GDP. The direct R&D support from the state budget has reached the highest level in the reporting period since 2001. At the same time the Czech Republic is also one of the countries with significant direct support for the business sector R&D expenditures from public sources. In 2012 the Czech government invested CZK 5.3 billion in the business sector R&D, which amounted to one-fifth of the total public R&D spending.
- The share of domestic private R&D funding sources in the Czech Republic has been declining since 2008, first because of their absolute decline, in recent years mainly due to the faster growth of other sources. There continues to be a low share of these sources in funding R&D carried out in the governmental and the higher education sectors.
- The increasing private foreign resources consist mainly of income of foreign-controlled businesses for custom R&D carried out for foreign companies in the same group.

Main trends - continued

- Although the trend in strengthening higher education research can be observed for some time, there has been significant acceleration in the past two years. The higher education sector's share of the total R&D expenditure increased to 28% and the share of public research even to 60%.
- Over the past five years the volume of funds has increased most in technical sciences (by CZK 10.3 billion) and natural sciences (by CZK 8.5 billion). The technical sciences are the main focus of the business and the higher education sectors. The natural sciences are most developed by the governmental sector, especially by the institutes of the AS CR.
- The area of R&D among the regions is dominated by Prague long-term - 680 R&D entities (24%), (22 164 employees (37%) and expenditure in the amount of CZK 25 billion (35%). The importance of the South Moravian region is growing.

The main objective of this part of the analysis is to provide relevant information and up-to-date overview of the development and structure of the total R&D expenditure by sources of financing and sectors of their use (Chapter A.1) and direct (Chapter A.2) and indirect (Chapter A.3) R&D support from the state budget in the Czech Republic and in the world.

A.1 Total R&D expenditures

The total R&D expenditures include all non-investment and investment expenditures incurred in the reference year on R&D carried out on the territory of the State, regardless of the source of their funding. These expenditures are referred to by the international abbreviation GERD.[4]

R&D expenditures can be expressed by two basic indicators: the current prices indicating the current prices of goods and services in a given year or the real (constant) prices, which eliminates inflationary devaluation. Due to the absence of a special R&D price index a GDP deflator was used for the calculation in constant prices.

The source of the data on the R&D expenditures is the Annual statistical survey on research and development (VTR 5-01), which the CZSO sends to all entities in the Czech Republic that perform R&D as their primary or secondary economic activity regardless of the number of employees, sector or branch in which they operate. For more information see methodological Appendix of chapter A.

In the first half of 2013 during the processing of data for 2012 from the above mentioned survey VTR 5-01, a retrospective inspection of selected data for previous years took place in the context of the ongoing work on the capitalization of research and development. The inspection focused in particular on the correct methodological distinction of costs for R&D performed in the monitored unit and the costs of R&D services (expenditures on R&D carried out for the monitored unit by another entity). The results of this inspection were reflected in the extraordinary revision of data on expenditures for performed R&D in the Czech Republic for the period 2005 - 2011. For this reason, the information referred to in this analysis differs from data published in previous years. It is primarily the changes in R&D expenditures funded from domestic and foreign business sources, which subsequently were also reflected in the data on R&D expenditure carried out in the business sector and in the total R&D expenditure (GERD) and related ratio indicators (percentage of GDP) and annual increases.[5]

The table annex to this chapter contains detailed data for the Czech Republic for 2000, 2007 through 2012. The data for the international comparison comes from the OECD publication: "Main Science and Technology Indicators (MSTI 2013/1)". The data for the EU Member States, which are not members of the OECD, was calculated by the CZSO using the Eurostat data sources. The figures for Brazil and India come from the United Nations Educational, Scientific and Cultural Organization (UNESCO) and its database: "UIS Data Centre". The table annex with the international comparison includes data that was available as of September 30, 2013 for all member states of the EU, OECD and BRICS (Brazil, Russia, India, China and South Africa). The charts include available data for the EU Member States and from the other countries for China, Russia, Japan, Korea, the United States and Switzerland.

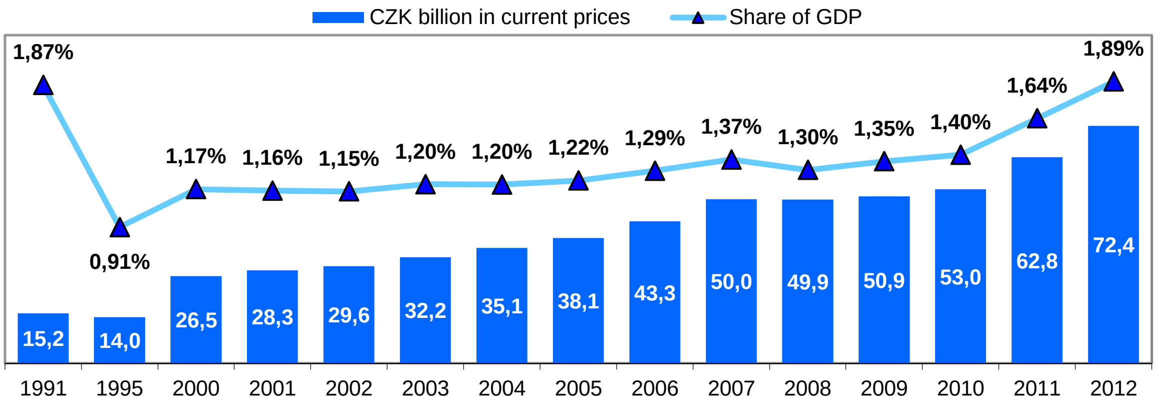
In 2012 R&D in the Czech Republic was carried out in 2.6 economic entities at 2 778 research institutes, of which 2 334 (84%) were in the business sector. Less than one-tenth of the above entities carried out R&D as their predominant economic activity (CZ-NACE division 72), half conducted R&D in one of the industrial sectors and one-tenth in one of the sectors of information and communication activities (CZ-NACE section J). Only every twentieth research institute reported R&D expenditures of CZK 100 million or more in 2012. Specifically, there were 149 research institutes that exceeded this level of R&D expenditures, of which 57 were from the business sector, 41 from the higher education sector and 33 were institutes of public research institutions.

In 2012, after two consecutive record-setting increases, the total R&D expenditure carried out in the Czech Republic reached CZK 72.4 billion, which corresponds to 1.89% of GDP. Both cases represent the highest recorded values for the entire reporting period.

4In addition to these, so-called intramural R&D expenditures for R&D carried out in monitored entities, since 2008 the CZSO also monitors, as part of the R&D capitalization, these entities' expenditures for purchases of R&D services (R&D conducted for the monitored entity by contract by another entity), which are called Extramural R&D expenditures. This data can be found in the table annex.

5Detailed information is available in the press release issued by the CZSO about the review: http://www.czso.cz/csu/redakce.nsf/i/mimoradna_revize_udaju_o_vydajich_na_vyzkum_a_vyvoj_za_roky_2005_2011

Chart A.1: Total expenditures for R&D carried out in the Czech Republic (GERD), 1991, 1995, 2000-2012



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Following a fairly significant decline in the total R&D expenditures in 1990 - 1993[6] there was continuous growth, albeit with varying intensity, of the total investment in R&D at current prices since 1993 in the Czech Republic (with the exception of 2008, with a moderate year-to-year decrease). The decline in 2008 was probably due to the global financial and economic crisis, which had a particular impact on business investment in R&D. In 2008, the R&D expenditures in the Czech Republic financed from private domestic sources dropped by 6.6% in real terms and in the following year even by 12%. The global economic crisis, however, had a strongly negative impact on the R&D expenditures not only in Czech Republic but throughout the world. For example, in the OECD countries the spending on R&D financed by business sources decreased by a record 5.5% in 2009. The decline in business R&D investment in 2009 in the Czech Republic was fully compensated for from other sources of R&D funding, mainly from the state budget of the Czech Republic.

In the past three years (2010 to 2012) the Czech Republic recorded an annual increase of the total R&D expenditures, with a particularly strong growth in the last two years. Both in 2011 and 2012 the total R&D expenditures (GERD) have increased by almost CZK 10 billion. In addition to the private (business) domestic and foreign sources, which together grew in the past two years by a quarter (CZK 6.7 billion) and the state budget (an increase of CZK 3 billion; or 13%), the above mentioned growth was due primarily to the public foreign sources. In 2010 the R&D funding from these sources amounted to CZK 2.2 billion, two years later it was already CZK 11.6 billion.

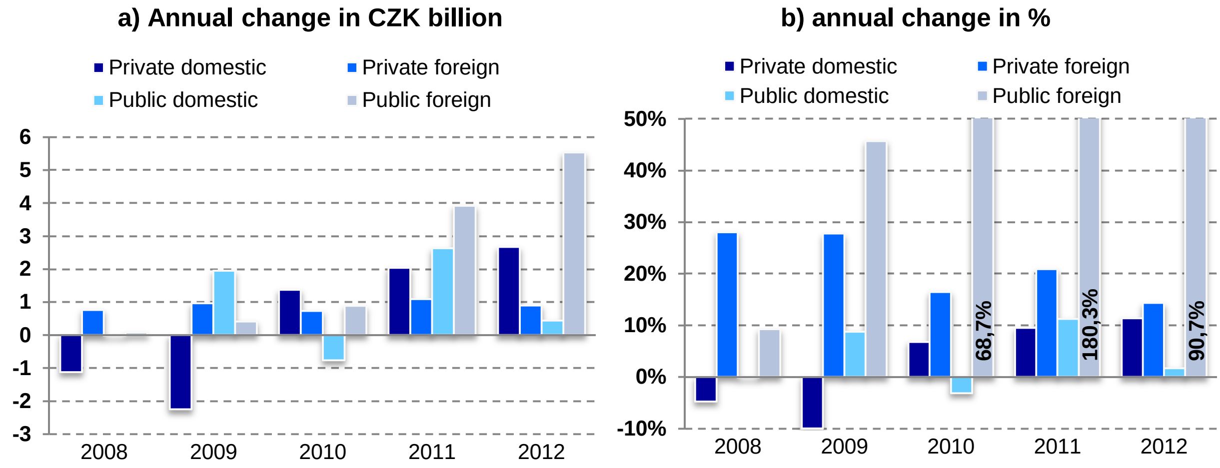
Table A.1: The annual change in total R&D expenditures conducted in the Czech Republic, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
CZK Billion at current prices	**3,1**	**5,1**	**6,7**	**-0,1**	**1,0**	**2,1**	**9,8**	**9,6**
% at current prices	*8,7*	*13,4*	*15,6*	*-0,3*	*2,0*	*4,1*	*18,5*	*15,3*
% in constant prices in 2005	*9,1*	*12,8*	*11,9*	*-2,1*	*-0,3*	*5,8*	*19,6*	*13,7*

Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

6 Only in 2006 did the total R&D expenditures in constant prices in the Czech Republic reach the 1991 level.

Chart A.2: The annual changes in sources of R&D funding in the Czech Republic, 2008-2012 (CZK billions, %)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

GERD by sources of funding and sectors of R&D performance

The structure of R&D expenditures by the institutional point of view is based on the different types of entities, which finance or carry out research and development. The expenditures on R&D carried out in each of the monitored entities and hence the sectors of R&D performance are tracked by the main sources of their funding, which include:

- Private domestic (domestic business) sources, including R&D financing from own sources of monitored enterprises (without the income from the sales of R&D services abroad), which are intended for R&D carried out internally and other sources from the domestic business sector intended for funding of R&D carried out most often by contract in other companies in the Czech Republic and in public universities and research institutions.
- Public domestic sources including in particular R&D funding from the state budget
- Foreign sources including all funds from abroad provided for financing of R&D carried out in the particular country. In the case of the Czech Republic it is primarily the EU financial resources (foreign public sources), and funding from business sources, primarily through the parent companies in foreign affiliates (private foreign sources).

In addition to the sources of R&D funding, the basic characteristics monitored in R&D expenditures also include information about their use, i.e., where the financial resources earmarked for R&D are spent, where the actual R&D is performed (sectors of R&D performance). The main R&D indicators (the number of reporting units, the available financial and human resources) are normally published, even at the international level, in the four sectors of performance of research and development (business, government, university and private non-profit). The detailed definition of the sectors of R&D performance can be found in the methodological annex.

The above mentioned double tracking of R&D expenditures by sectors (sources) of financing and sectors of R&D performance allows to track flows of funds between sectors and to assess the state of mutual interactions (their openness or closeness). For this reason a separate graphical (schematic) annex to this analysis was created: "Cooperation between sectors in R&D in the Czech Republic in 2012" showing the above mentioned financial flows in R&D.

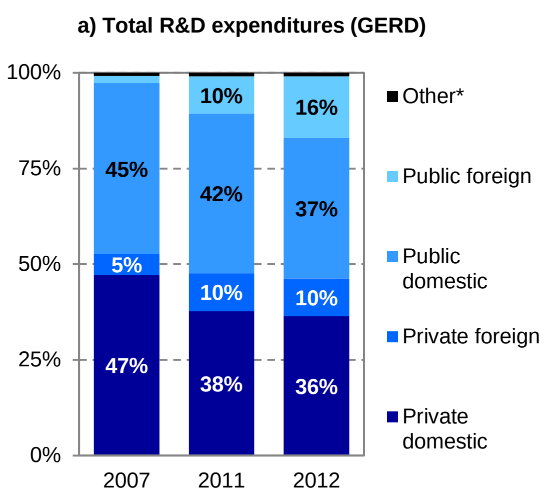
From 1995 until 2008 more than half of the funding for R&D carried out in the Czech Republic (GERD) came from private sources. In the following years, in the first period mainly due to the decline in the domestic private sources and the increase in the R&D funding from the state budget, in the last two years mainly due to the EU resources, the public sources have taken over the predominant position in R&D funding. In 2012 their share of funding of R&D in the Czech Republic reached 54%, which indicates a departure from a proportion agreed within the framework of the Lisbon strategy and, later, the Europe 2020 strategy, which mentions that private sources should participate by 2/3 in the R&D funding in the EU countries.

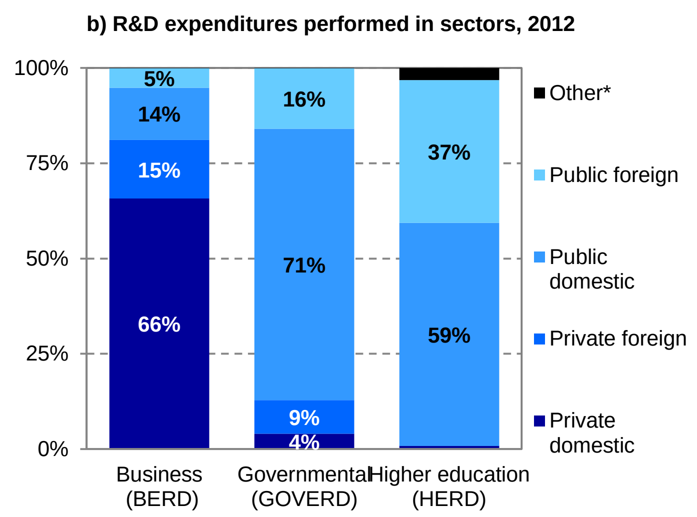
With the growing importance of both private and in recent years also the public foreign sources of R&D funding in the Czech Republic, it is no longer true that R&D in the Czech Republic is almost exclusively dependent on domestic sources. Until 2010 the domestic sources of R&D funding accounted for more than 85% and before 2005 it was even 95%. In 2012 the share of these sources dropped to 73%, which put the Czech Republic among countries with a strong influence of foreign resources on R&D funding (for more information see the international comparison).

The chart A.3 below shows not only how the share of individual resources of funding for R&D carried out in the Czech Republic changes overall (GERD), but also the share of these resources in the individual sectors of R&D performance, and vice versa.

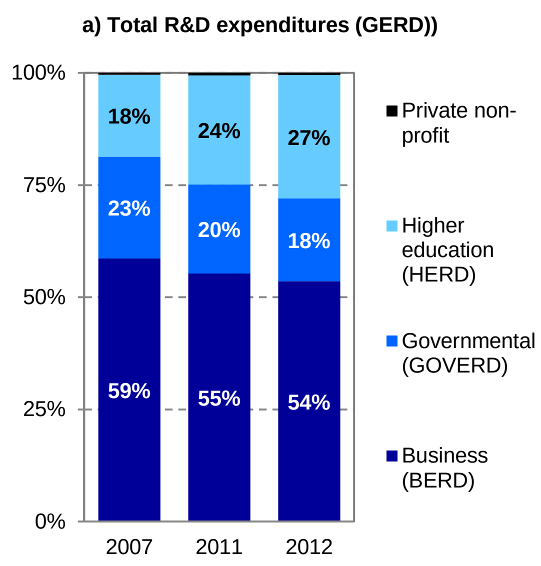
Chart A.3: Expenditure for R&D carried out in the Czech Republic according to the sources of funding and sector of use (%)

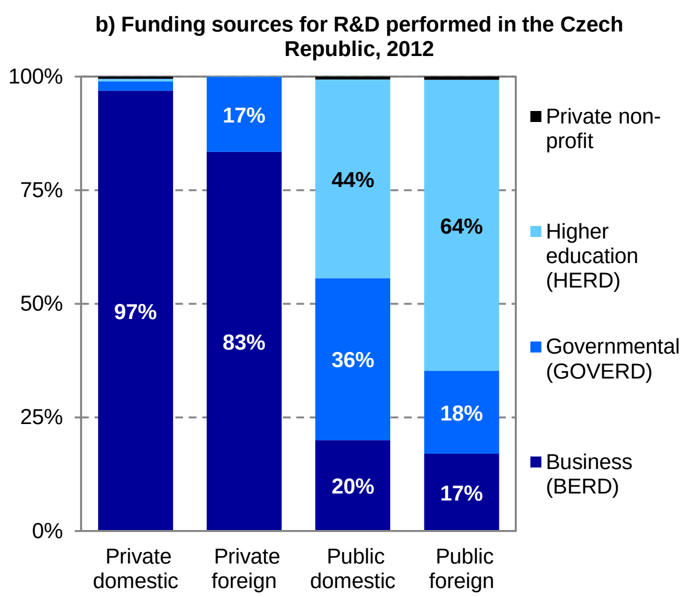
1) According to the sources of their funding





2) According to the sectors of their use





Note: In chart 1,2 a) 1% for 2007 amounted to CZK 500.1 million, for 2011: CZK 627.5 million and for 2012: CZK 723.6 million.
In chart 1b) 1% for BERD was equivalent to CZK 387.9 million, for GOVERD it was CZK 133.2 million and for HERD it was CZK 198,8 million.
In chart 2b) 1% for private domestic sources amounted to CZK 263,3 million, for private foreign sources it was CZK 71.4 million, for public domestic sources it was CZK 266,6 million and for foreign public sources it was CZK 116,2 million.
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Since 2009 the spending from the state budget of the Czech Republic became the most important source of funding for R&D activities carried out in the Czech Republic. In 2012 CZK 26.2 billion was directed to R&D from domestic public sources in the Czech Republic, which corresponded to 0.68% of GDP and 2.27% of the total expenditures of the Czech Republic's budget. These are the highest recorded values for the entire reporting period. During the last 3 years CZK 76.3 billion flowed into R&D from domestic public sources, i.e. one-tenth more than in the previous three years. Since 2011 most of the money from these sources is spent on R&D carried out at public universities. The second largest recipient of R&D funding from the state budget are the public research institutions, in particular the institutes of the Academy of Sciences of the Czech Republic, which are part of the governmental sector. Both in the governmental and the higher education sectors, R&D funding from the state budget played a crucial role until 2009. In 2009 public domestic sources' share in R&D in the governmental sector was 86% and in the higher education sector even 91%, which is considerably more than in 2012. At the same time the Czech Republic is also one of the countries with significant direct support for the business sector R&D expenditures from public sources. In 2012 the Czech government invested CZK 5.3 billion in the business sector R&D, which amounted to one-fifth of the total public R&D spending. In the last six years this proportion has not fundamentally changed, even with the increasing total support for R&D from the state budget, and the subsequently growing amount of support for the business sector R&D.

Although in the last two years, spending from domestic public sources on R&D grew, their share of GERD has decreased, largely due to the significant rise of the public foreign sources. In the past two years these resources, in particular the operating programs focused on R&D&I funded by the EU structural funds, have contributed a significant proportion of total R&D funding in the Czech Republic (16% share of GERD in 2012), and primarily the higher education R&D funding. In 2012 the public foreign sources contributed 37% of funding for R&D performed in the higher education sector, compared with 8% in 2010. It can be expected that in the next several years (2013-2015) the Czech Republic will see an increase in the importance of R&D funding from these sources. Detailed information on the R&D funding from domestic and foreign public sources is available in chapters A2 and E1, and in the table annex of this analysis.

The share of private R&D funding sources in the Czech Republic has been declining since 2008. In the first two years it was due to their above mentioned absolute decline, in recent years mainly due to the faster growth of other sources (Chart A.2). Nevertheless the proportion of private sources of R&D funding in the Czech Republic remains one of the highest among the new EU member countries (Chart A.12).

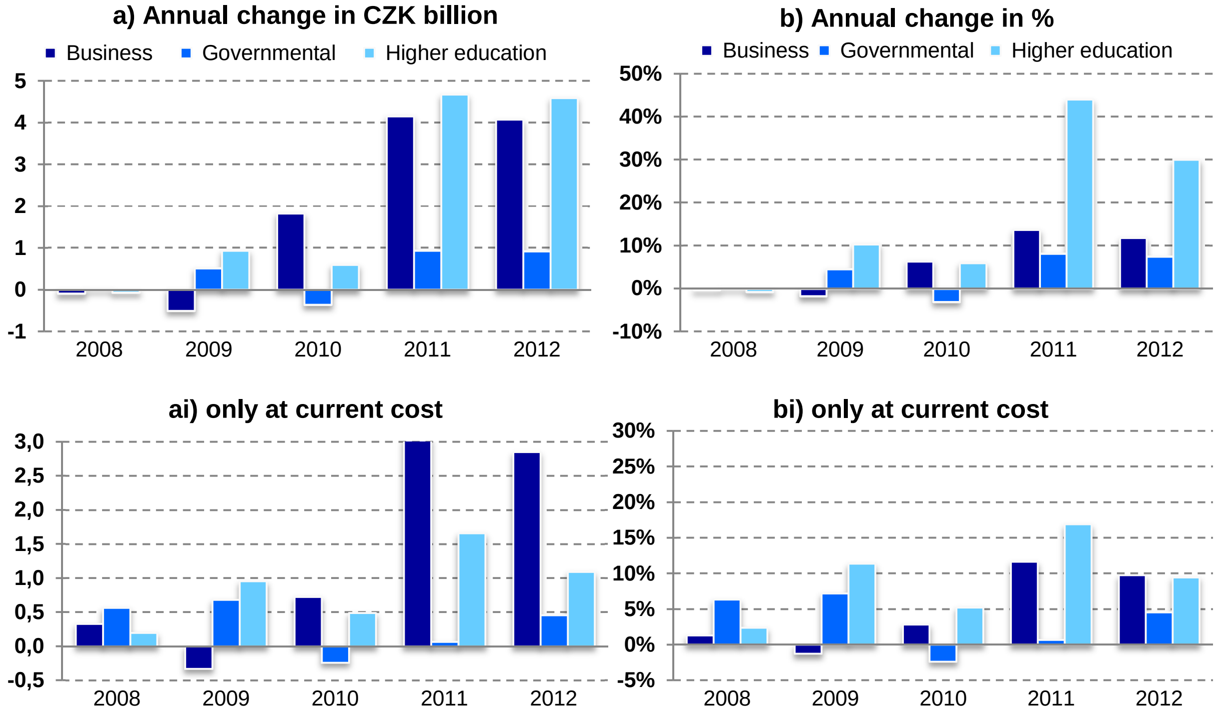
The continuing low share of these sources of funding for R&D carried out in the governmental and the higher education sectors is alarming (Chart A.3b). Although in the last three years businesses have invested their own resources in R&D performed in the Czech Republic in the amount of CZK 71.6 billion, only 2.7% (CZK 1.95 billion) of that amount was directed to co-financing R&D performed in the higher education and the governmental sectors.

If the share of private R&D funding sources in the Czech Republic is declining in time, the share of private foreign sources has been increasing in recent years. The private foreign sources consist mainly of income of foreign-controlled businesses for custom R&D performed for foreign companies in the same group (parent companies or subsidiaries). Detailed information about R&D funding from domestic and foreign private sources are available in the table annex.

In 2011, the spending on R&D in the higher education sector for the first time exceeded the expenditures for R&D performed in public research institutions and other entities of the governmental sector. Unlike in most of the new EU member countries, the business sector in the Czech Republic is not only the most important sector for funding R&D activities in the long term (for the first time in 2010 the state budget expenditures were higher), but also in terms of the volume of financial resources spent on R&D performed here. In recent years, however, the Czech Republic experienced a decline in the share of this sector in the performed R&D in favor of public research (R&D carried out in the governmental and the higher education sectors). This decline was due to the decline of the businesses' own available resources for R&D in 2008 and 2009, but above all to the growth of public foreign sources going particularly into the higher education sector in the past two years (Chart A.2).

Expenditures for R&D carried out in the sectors of R&D performance are discussed in more detail in separate chapters A1.2 and A1.3 of this part of the analysis. The following chart provides an overview of the development of R&D expenditures in these sectors over the past five years.

Chart A.4: Annual changes of expenditures in the sectors of R&D performance in the Czech Republic, 2008-2012 (CZK billion, %)



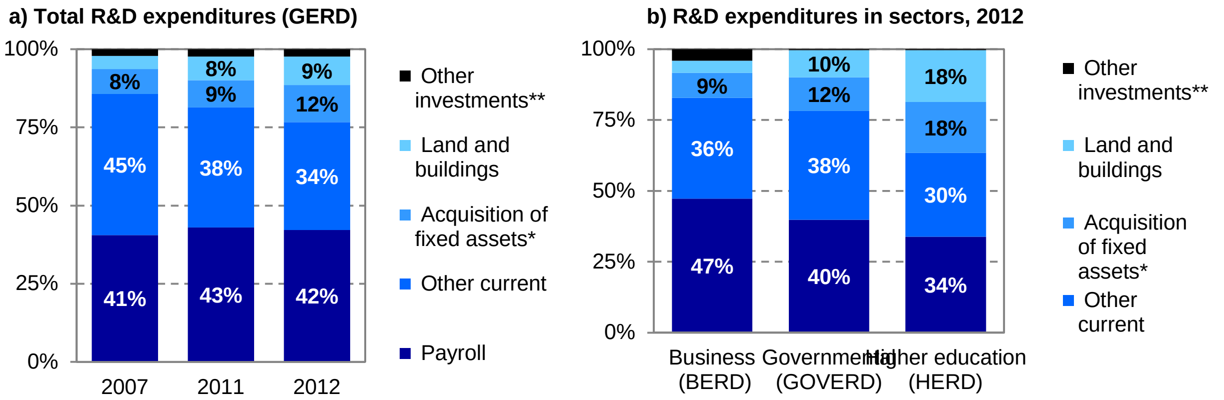
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

GERD according to the functional perspective

The structure of R&D expenditures according to the functional perspective is based on the characteristics of the R&D activities and is used in evaluating the policy focus in this area. The functional perspective of resources used on performed R&D includes the breakdown by type of costs/expenditures on R&D (payroll, other current and investment expenditures), type of performed R&D activities (basic research, applied research and experimental development) and the prevailing scientific group (natural, technical, agricultural, medical, social sciences and humanities) and economic (classification section CZ-NACE) areas of monitored entities. More detailed definitions and information are listed in the relevant methodological annex.

A significant part of the R&D expenditures in the Czech Republic, as well as in other countries, consists of payroll and other non-capital costs. In 2005 they accounted for 40.5% (CZK 15.5 billion) of total R&D expenditures, compared to 45.5% (CZK 24.1 billion) in 2010. Until 2010 payroll was the fastest growing expenditure of R&D and with this trend we came closer to the situation in advanced Western countries. Although in 2011 the payroll costs increased by CZK 2.9 billion (12%), due to the year-to-year increase in the investment costs by CZK 5 billion (75%), their share in total expenditures dropped by 3 percentage points. This trend has intensified in the following year as a result of the increase in investment expenditure on R&D related to accelerated drawing of resources from the EU structural funds, particularly in the higher education sector. In 2012 the investment expenditure on R&D in the higher education sector accounted for 36% of the total R&D expenditures in this sector.

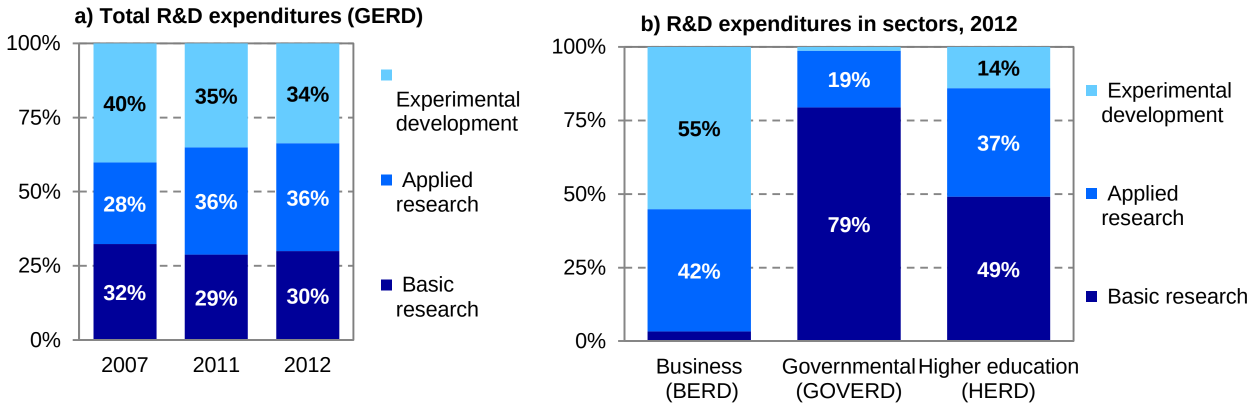
Chart A.5: R&D expenditures in the Czech Republic according to the type of costs/expenditures (%)



** Acquisition of technical and other equipment necessary for performing R&D activities (machinery, equipment, transport means, perennial crops, etc.)*
*** Acquisition of intangible fixed assets, including the activation of own R&D results and acquisition of software, production and technical knowledge (know-how), objects of industrial rights, etc. for the needs of performed R&D.*
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Regarding the type of performed R&D, until 2010 most funds in the Czech Republic were directed to experimental development. It relates to the fact that in the Czech Republic most financial resources on R&D are spent by the business sector. In recent years, there has been an increase in the share of applied research.[7]

Chart A.6: R&D expenditures in the Czech Republic according to the type of performed R&D activities (%)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

In terms of scientific areas the technical and natural sciences prevail in the Czech Republic. The technical sciences are the main focus of the business and the higher education sectors. The natural sciences are most developed by the governmental sector, especially by the institutes of the AS CR. In the past five years there has been a relatively highest increase, approximately by half, in the expenditures in humanities and natural sciences. In terms of the volume of funds, it increased the most during the same period in technical (by CZK 10.3 billion) and natural sciences (by CZK 8.5 billion). The structure of Czech R&D according to investment in scientific areas, however, remains essentially stable since 2005.

In terms of the predominant economic activity in the entire reference period, expenditures on R&D performed in entities with principal activities in one of the industrial areas prevailed in the Czech Republic (CZ-NACE sections B to D), thanks mainly to the business sector. The imaginary second place is held by entities engaged in professional, scientific and technical activities (CZ-NACE section M), including primarily private and public research institutions with prevailing R&D activities (CZ-NACE 72). In recent years, there

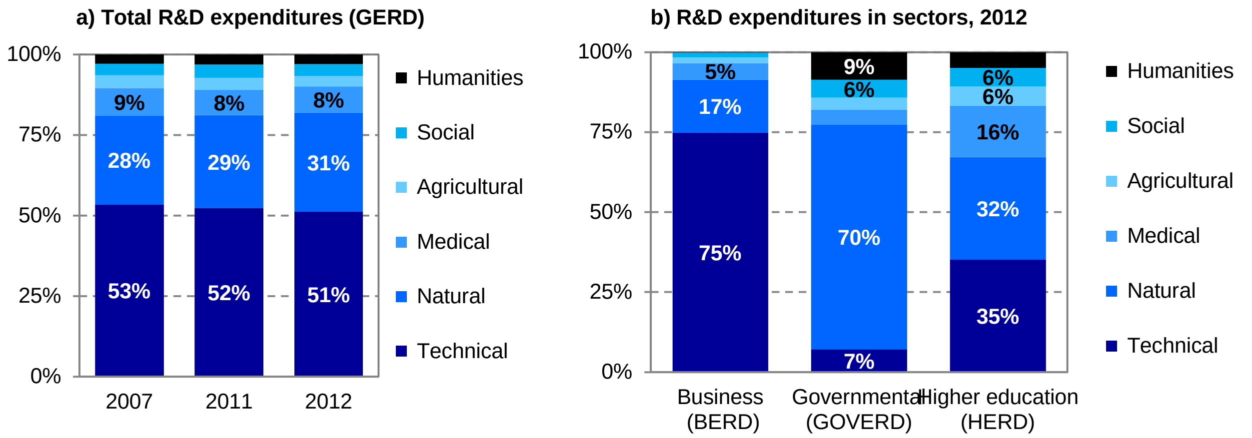
7Since there is not always a clear and unambiguous boundary between basic and applied research, it is necessary to proceed with great caution when interpretation the data broken down by type of R&D activities. The distinction between basic and applied research to a large extent depends on the term used by the researchers themselves, and therefore the distinction between these two types of research should not be used for the purpose of taking political decisions.

has been growing importance of entities with the predominant activities: Education (CZ-NACE section P), due to the growing R&D expenditures in public universities.

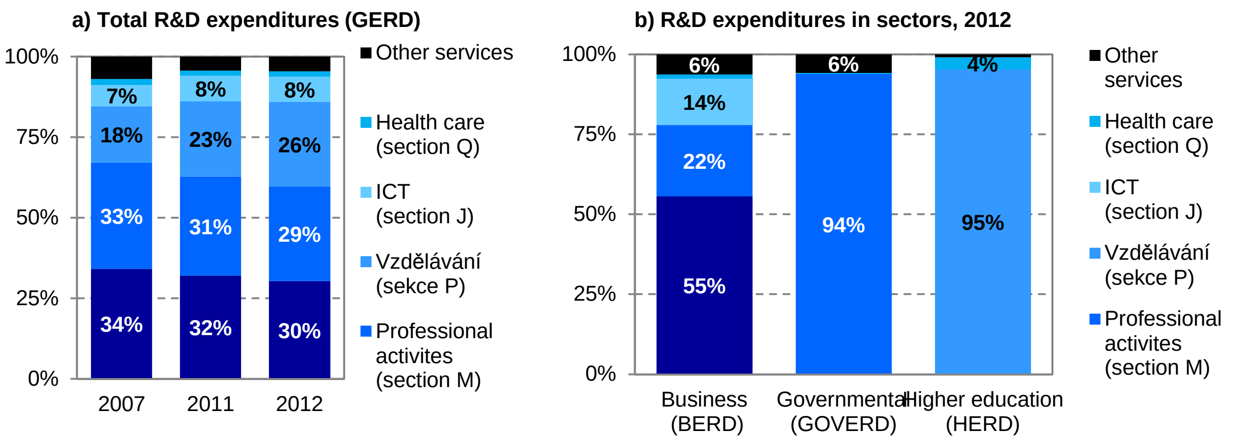
The following chart contains data according to the two above mentioned aspects, both for the total R&D expenditures (GERD) in 2007 - 2012, as well as in the major sectors of R&D performance (BERD, HERD and GOVERD) for 2012. However, it should be noted that data on R&D expenditures by scientific areas have a different informative value in case of the governmental and the higher education sectors than the business sector, where the preferred distinction is according to the prevailing economic activities.

Chart A.7: Total R&D expenditure in each of the sectors according to the prevailing scientific and economic areas of monitored entities (%)

1) According to the prevailing scientific area group (FOS classification)



2) According to the prevailing economic activities (classification section CZ-NACE)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

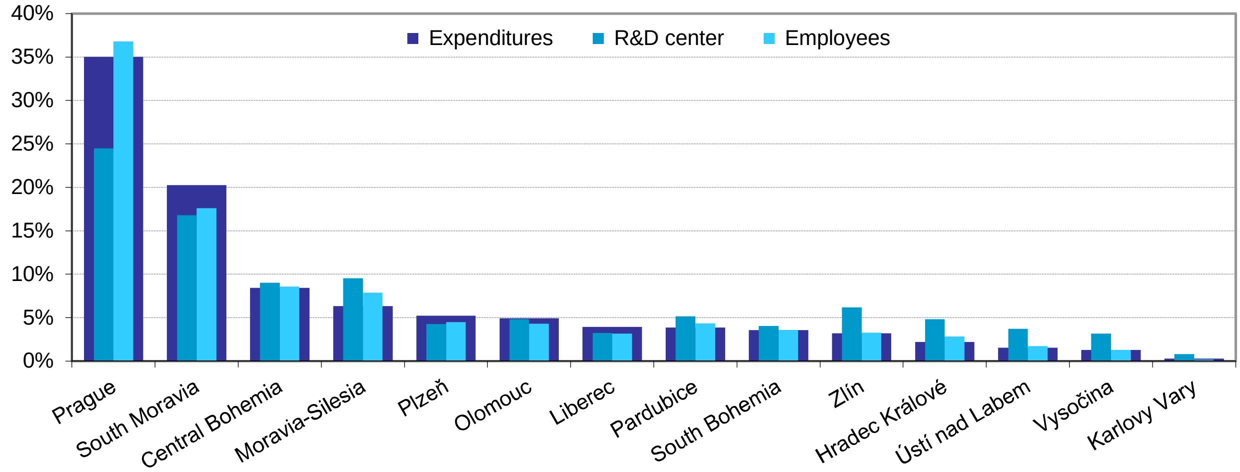
Since the development of the R&D expenditures according to the prevailing scientific and economic area in the past two years has been significantly influenced by the aforementioned increase in investment expenditures in R&D funded from the EU structural funds, the table annex includes additional data for non-investment costs and for individual sources of R&D funding. More detailed information on certain aspects of the breakdown of the R&D expenditures by functional terms can be found in the following two chapters (A1.2 and A1.3).

GERD by regional breakdown

In terms of regional breakdown, R&D is in the long term dominated by Prague, which in the last monitored year had the most R&D entities (680, 24% share), as well as the most employees (22 164, 37% share) and expenditures (CZK 25 billion, 35% share) directed to R&D. In recent years, R&D has been increasing its importance in the Southern Moravia region, where there were 466 research institutions (it was 321 in 2007) and the performed R&D received one-fifth (CZK 14.7 billion) of all the funds for R&D in the Czech Republic.

Five years ago, there was R&D performed in the South-Moravian region for CZK 5.7 billion and its share in the Czech Republic was only 11%. The main reason for the dominance of these regions is not only the presence of significant public universities and public research institutions, but also of private business entities with significant R&D activities.

Chart A.8: R&D in the Czech Republic's regions, 2012 (%)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Although a more detailed analysis of the R&D data in regional breakdown goes beyond the framework of this analysis, and there will be no further detailed comments, the table annex includes all the available monitored indicators for the Czech Republic and for each region.

International comparison - key indicators[8]

In 2011 the total expenditures on R&D performed in the EU28 reached EUR 246.3 billion, i.e., an increase of 5% (EUR 10.7 billion) over the previous year. Germany, France and the United Kingdom accounted for almost two-thirds of the total EU28 expenditures (62%), the Czech Republic with its EUR 2.6 billion exactly 1%. Despite Czech Republic's very low share of the total expenditures on R&D performed in the EU28 countries it is, together with Poland, by far the highest value of all the new EU member countries. For example, in comparison with Hungary the R&D investment in the Czech Republic (GERD) is double, and in comparison with Slovakia it is 5.5 times larger. Yet the Czech Republic significantly lags behind the EU15 countries of similar size, such as Austria, Finland or Denmark.

Besides the size, level of advancement and focus of individual economies the differences in R&D spending between countries are also affected by price levels in individual countries. The following table includes data on total R&D expenditures in selected countries according to purchasing power parity (PPP), which eliminates the differences in price levels between the individual countries. In this case, the position of the Czech Republic in relation to the total expenditure of the EU28 is better by half. Table indicates the significant increase in China's importance. If in 2000 the R&D spending in China in PPP reached 15% of the EU28, the figure grew to 65% in 2011, and China became a country with the second largest R&D investments after the United States. In the past 10 years it not only took over Japan and Germany but also France and the United Kingdom.

Table A.2: Total R&D expenditures in selected countries (US $ mil. in PPP; EU28 = 100)

	EU28	USA	China	Japan	Germany	Korea	Russia	Austria	Finland	Poland	Czech Republic	Hungary	Slovakia
2000	**184 153**	268 121	27 216	98 667	52 350	18 559	10 495	4 475	4 445	2 605	**1 864**	977	384
2007	**270 904**	380 088	102 323	147 702	74 016	40 723	26 554	7 917	6 637	3 620	**3 893**	1 871	518
2011	**320 456**	415 193	208 172	146 537	93 055	59 890	35 045	9 762	7 635	6 228	**5 086**	2 582	882
2000	***100,0***	*145,6*	*14,8*	*53,6*	*28,4*	*10,1*	*5,7*	*2,4*	*2,4*	*1,41*	***1,01***	*0,53*	*0,21*

8International comparison should be always carried out in the context of development, size and focus of individual economies. The comparison should primarily focus on countries with similar population, geographic and economic conditions.

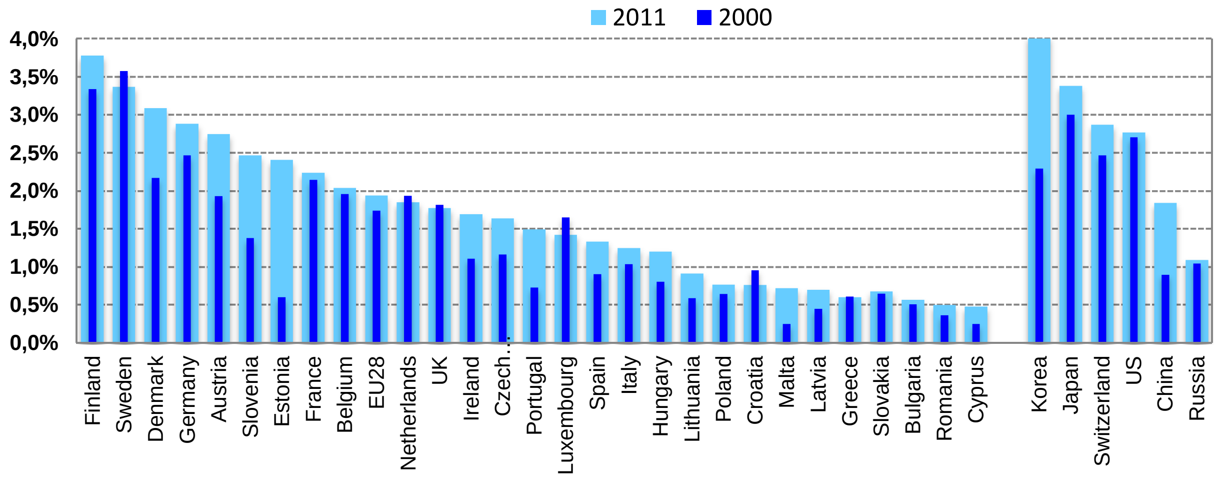
2007	**100,0**	140,3	37,8	54,5	27,3	15,0	9,8	2,9	2,4	1,34	**1,44**	0,69	0,19
2011	**100,0**	129,6	65,0	45,7	29,0	18,7	10,9	3,0	2,4	1,94	**1,59**	0,81	0,28

Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

Total R&D expenditure (GERD) are most commonly measured relative to GDP in international comparison. This ratio is called: "R&D Intensity" and belongs to a group of fundamental structural indicators evaluating the process of implementation of the objectives of the Lisbon strategy in the various EU countries. R&D intensity was included among the indicators to assess the implementation of the Europe 2020 strategy as well.[9]

Comparison with the EU Member States (data for 2011) shows that the Czech Republic has not only the highest intensity of research and development (GERD as % of GDP) among the new Member States (with the exception of Estonia and Slovenia), but also in comparison with all the Southern European states such as Spain, Italy, Portugal or Greece. In the imaginary ranking of the EU countries by this indicator we occupy the 13th place behind Ireland and Great Britain.

Chart A.9: Intensity of the total R&D expenditures, 2000 and 2011 (GERD as % of GDP)



Note: Denmark and Sweden: 1999; Greece: 1999 and 2007; Netherlands: 2010 and Switzerland: 2008
Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

In 2011, the highest R&D intensity in the EU28, over 3% of GDP, was reached in all three Scandinavian countries. In Denmark and especially Finland, there was a significant increase in the R&D intensity particularly in the second half of the 1990s. Sweden has been maintaining its 3% and higher share since 1993. Among the EU countries that reach higher values of the R&D intensity, over 2.5% of GDP, are also Germany and Austria. While Germany maintained the share of total R&D expenditures above 2.5% of GDP throughout the second half of the 1980s, Austria increased the R&D intensity in the last 15 years. Since 2000 Israel maintains the highest share of R&D expenditures in relation to GDP among the OECD countries, in 2011 the R&D investments amounted to 4.4% of GDP. Other OECD countries with the share of R&D expenditures higher than 3% of GDP include Korea, Japan, and Switzerland. In the United States the R&D spending has been steady between 2.5% and 2.9% of GDP since mid-1980s.

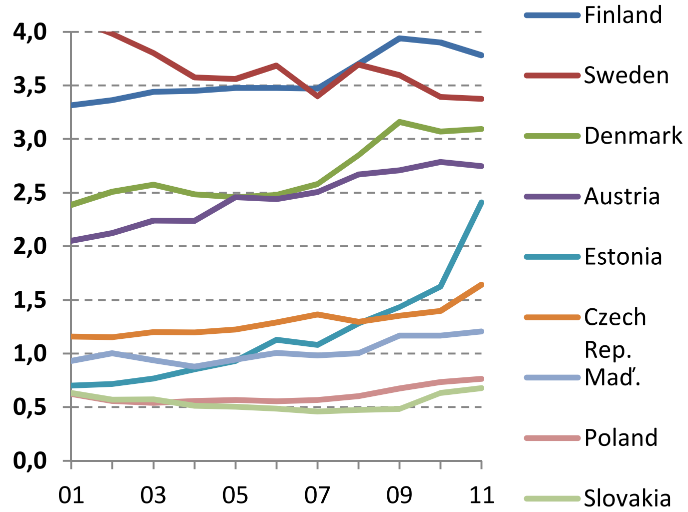
In addition to Germany and Sweden, the EU countries with the highest R&D intensity also included France and the United Kingdom until the beginning of the 1990s. These two countries, however, have been gradually losing its position in the EU. Among the new EU countries there is a very dynamic and stable growth in the R&D intensity in Estonia and Slovenia. On the contrary, in the longer term there was stagnation and even decline in R&D intensity in Bulgaria, Poland and Slovakia, where primarily in the 1990s the statistics recorded a substantial decline in R&D expenditures, which, unlike in the Czech Republic, has still not been fully compensated. A similar situation occurred in Russia after the collapse of the Soviet Union,

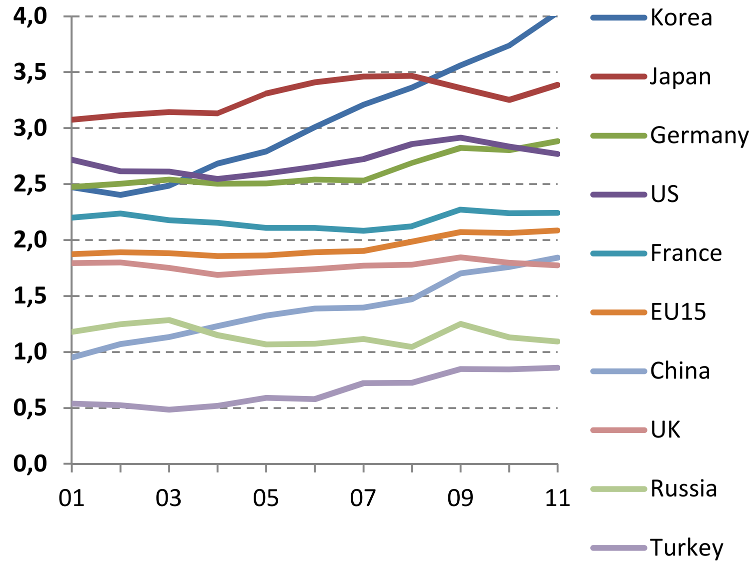
9The increase in the R&D intensity is a long-term targeted activity, which is also evidenced by the developments in Estonia, Finland, Denmark or Austria detailed below. It is not only about increasing public investments, but particularly the private ones, as we will see in the following chapter. A crucial role is played by the qualified human resources and related education policy (chapter B.2) and total economic and political development of society (section O).

whose level of R&D spending was around 2% of GDP in 1990, compared to 0.7% to 1% of GDP between 1992 and 1999.

As for countries outside the EU there is stable growth in R&D investments in Asia, particularly in Korea and China, where R&D intensity continues to increase despite very high annual GDP growth. The expenditure in real prices in these two countries within the past five years has increased by 200% in China and by 50% in Korea (the EU15 average for the same period amounted to a 12% increase).

Chart A.10: Development of intensity of the total R&D expenditures in selected large and smaller countries in the last ten years, 2001-2011 (GERD as % of GDP)



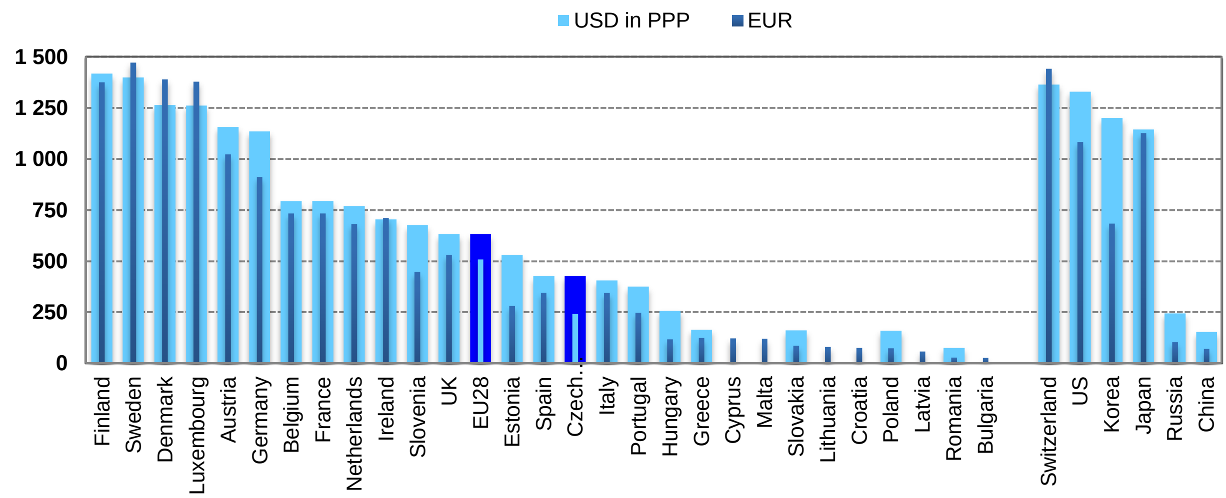


Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

In addition to the R&D intensity, which is affected by different levels and growth of GDP in the individual countries, international comparison utilizes total R&D spending in purchasing power parity (PPP) per capita. The assessment by this indicator is once again dominated by the Scandinavian countries (Finland and Sweden), together with Switzerland and the United States, with the overall R&D expenditures higher than USD 1 300 in PPP per capita. The EU28 average in 2011 reached USD 631 in PPP.

In relation to GERD per capita, we continue to reach only 2/3 of the EU28 average in PPP and half of the figure when using the standard currency exchange rates (EUR 242 per capita in the Czech Republic compared to EUR 509 in the EU28). In the Czech Republic the R&D spending per capita is twice as high as in Hungary and 3 times higher than in Poland, however, in terms of purchasing power parity, these expenditures are approximately 2.5 times lower than in Austria or Germany and even 3 times lower than in Denmark, Finland or Sweden or, among countries outside the EU, in Switzerland, United States or Israel.

Chart A.11: Total R&D expenditures (GERD) per capita, 2011 (USD in PPP and EUR)



Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

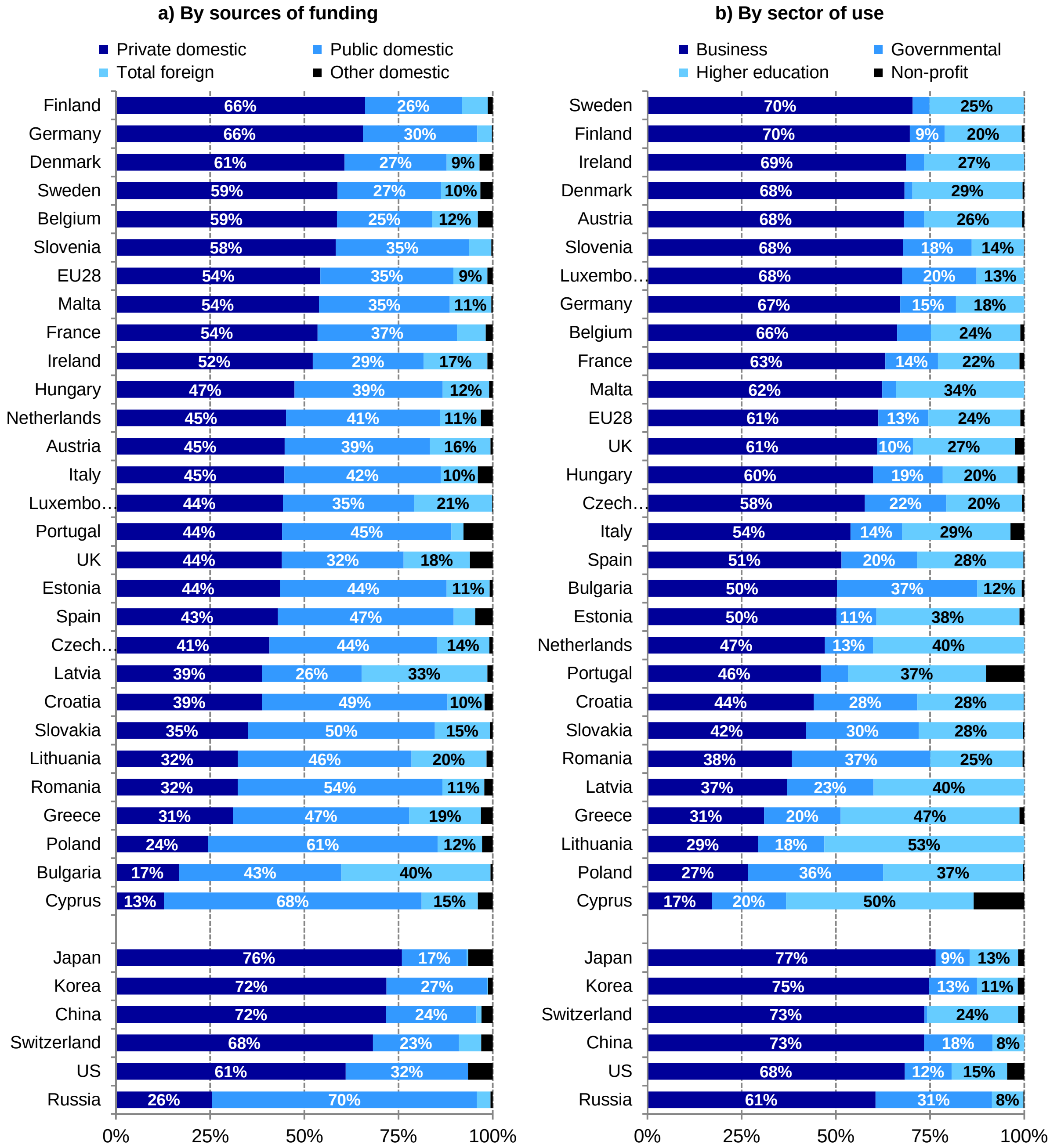
International comparison - GERD by sources of funding and sectors of R&D performance

In 2000 the European Commission set a goal to achieve, by 2010, the share of total R&D expenditures at the level of 3% of GDP, while two-thirds of these expenditures should be financed from (private) business sources. The first EU countries that fulfilled the second criterion in 2010 (latest data broken down by sources of financing for most countries are not yet available) were Finland and Germany. The EU28 as a whole, however, has not yet met the objective.

Besides Germany, Belgium and the Nordic EU countries, the structure of R&D funding with a low proportion of public sources and a high proportion of private sources is typical in particular for Asian countries. In 2010, the local business sector contributed its own resources to over 70% of R&D financing in Japan, Korea and China. In contrast, the high representation of public, and therefore low representation of private resources, in R&D financing is typical especially for the new EU28 Member States, with the exception of Slovenia, Estonia and partially the Czech Republic.

Since for the majority of monitored countries the latest available data for international comparison are for 2010, it can be expected that especially in the new EU member countries, similarly to the Czech Republic, there will be an increase in the share of R&D funding from foreign public sources. More detailed information on R&D funding from domestic and foreign public sources can be found in chapters A2 and E2.

Chart A.12: Total R&D expenditures according to sources of funding and sector of use, 2010 (%)



Note: Belgium, Netherlands and Sweden: 2009; Switzerland: 2008; Greece: 2007
Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

The structure of R&D expenditures by sector of their use shows fairly substantial differences across the EU and OECD member countries, which largely reflect the structure of R&D funding referred to in the previous section. The Czech Republic, with 58% of funds spent on R&D in the business sector, together with Hungary, is converging to the EU28 average. Detailed information on expenditures on R&D by sector of performance is included in the following chapters.

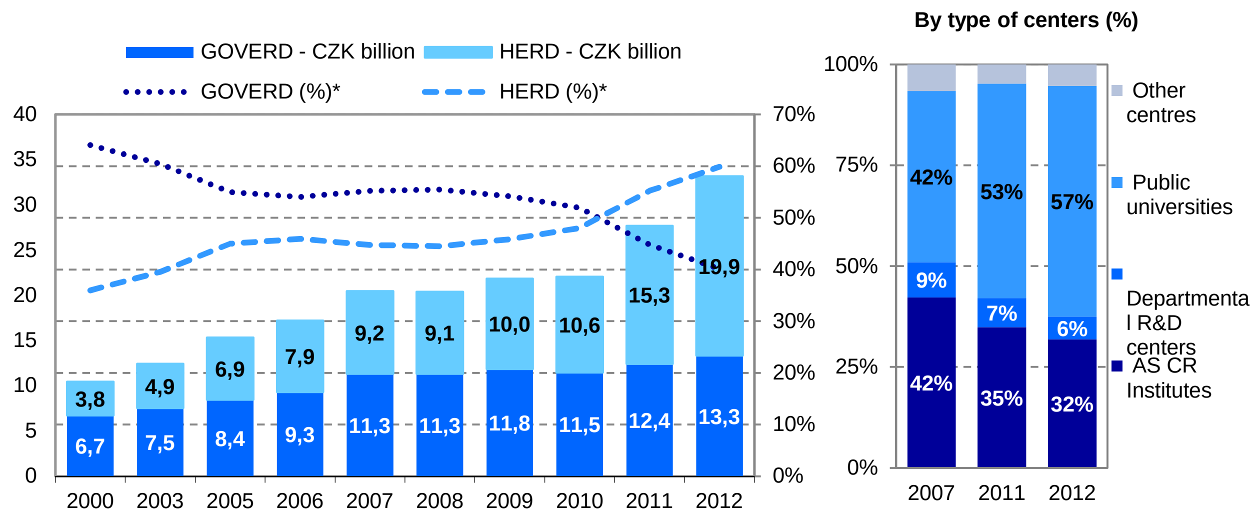
While the majority of countries with high R&D spending, as measured by their share of GDP, does not show significant changes over time in the aforementioned breakdown of GERD by sources of financing (in terms of the private and public sector's share of funding and use), countries with low R&D intensity show considerable volatility of these shares.

Expenditures on R&D performed in the governmental and the higher education sectors - Public R&D.

Public R&D in the governmental sector is primarily performed in the various institutes of the Academy of Sciences of the Czech Republic[10] and in departmental research centers[11] which carry out R&D as their primary economic activity (CZ-NACE 72). The other entities in the governmental sector, which perform R&D, include public libraries, archives, museums and other cultural facilities (CZ-NACE 91) and entities working in the field of public administration, economic and social policy (CZ-NACE 841). Although in terms of numbers these entities in the last 5 years accounted for nearly half of the R&D research institutes in the governmental sector, their share of the expenditure on performed R&D in the same period was only around 7%. As for the higher education sector, most of the entities, which perform R&D, consist of individual faculties of public universities, and since 2005 also 11 teaching hospitals. In addition to these research institutes, R&D is also performed at 24 private universities and other post-secondary education institutions. The importance of private higher education R&D, however, in terms of the amount of R&D expenditure, is quite negligible in the Czech Republic.

In 2012 R&D in the governmental and the higher education sectors was performed in 200 economic entities in 376 research institutes, most of which belonged to public universities (167 research institutes) and institutes of the Academy of Sciences of the Czech Republic (60 research institutes)[12]. Of the above mentioned 376 research institutes approximately only one-fifth of them spent more than CZK 100 million on R&D in 2012 and a quarter of them employed more than 100 FTE R&D workers. In terms of the individual groups of scientific areas most R&D research institutes in the governmental and the higher education sectors included their prevailing activity in humanities (92.25%). They are primarily public libraries, archives, museums and other cultural facilities that perform R&D as their secondary activity. As for the large research institutes with R&D spending higher than CZK 100 million, most of them perform R&D in technical and natural sciences. Detailed information on the number of research institutes in the governmental and the higher education sectors in various breakdowns is shown in the table annex of this analysis.

Chart A.13: R&D expenditures in the governmental and the higher education sectors in the Czech Republic, 2000-2012



** Proportion of the total expenditures on R&D performed in the governmental and the higher education sectors (GOVERD + HERD)*

10The centers of the Academy of Sciences of the Czech Republic (54 research institutes established by the AS CR pursuant to Act No. 283/1992 Coll., in 2012, of which 53 are research institutes and the Center of Administration and Operations of ASCR providing R&D infrastructure), whose primary mission is to conduct basic research, are organized into three scientific areas: mathematics, physics and earth sciences (18 institutes), life and chemical sciences (18 institutes) and humanities and social sciences (17 institutes)

11They are mostly industry public research institutions, which previously reported to individual ministries, such as the Ministry of agriculture or the Ministry of transport (therefore departmental). In 2007 most of them received the status of public research institutions (e.g., Crop Research Institute, Institute of Animal Science, T. G. Masaryk Water Research Institute, Transport Research Center, etc.).

12The term research institute used in the analysis is based on the methodology of the CZSO for the Annual report on research and development (see chapter G.1). In case of the Academy of Sciences of the CZECH REPUBLIC, however, it gets into a conflict with the concept of the same term according to Act No. 283/1992 Coll., on the Academy of Sciences of the Czech Republic - according to this law the AS CR is the founder of 54 research institutes. The conceptual inconsistency is caused by the CZSO's effort to better capture the regional breakdown and breakdown according to groups of scientific areas. Therefore, the CZSO uses as reporting agents the individual research centers, where R&D is performed (i.e., detached units of the entity belonging under one tax identification number).

Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

In 2012 in the Czech Republic the above mentioned 376 research institutes spent a total of CZK 33.2 billion for R&D performed in the governmental and the higher education sectors (in 2007 it was approximately CZK 12.8 billion less). In the past five years, the average annual R&D expenditures in the governmental and the higher education sectors grew twice faster than the in business sector (by 10.2% vs. 5.7%), therefore their share of the total R&D expenditure increased from 41% in 2007 to 46% in 2012. Similarly, there was an increase in the share of these expenditures on the GDP from 0.56% in 2007 to 0.87% in 2012.

University R&D in the Czech Republic is primarily performed by public and state universities. The total spending on R&D performed here in 2012 was CZK 19 billion, i.e., by approximately CZK 8.9 billion more than in 2010. These institutions contributed to 96% of the total R&D expenditures in the higher education sector, 3% (CZK 750 million) was spent at the university hospitals, and less than 1% (CZK 152 million) at private universities.

The largest portion of R&D expenditures in the governmental sector is traditionally consumed in the individual research institutes of the AS CR, in 2012 it was CZK 10.6 billion, i.e., 79% of the total expenditures on R&D performed in the governmental sector. The departmental research institutes in the same year received less than CZK 2 billion and CZK 882 million was earmarked for R&D in other entities of the governmental sector, with approximately half of this amount being spent in the public cultural facilities. In terms of the individual types of the R&D institutes in the governmental sector, there has been a gradual decline in importance of the departmental research institutes since 1995, as measured by their share of the total expenditure on R&D performed in the governmental sector, and in particular of the 'other' types of research sites (CZ-NACE 841).

In 2011, the R&D spending in the higher education sector for the first time exceeded the levels in the public research institutions and other entities of the governmental sector. If we compare the number of FTE workers employed in R&D, the higher education sector outperformed the governmental sector by this indicator as early as 2005 and in 2012 it employed approximately a third more people in R&D than the governmental sector – for more information see chapter B. Although the trend of strengthening higher education research, compared to research in the governmental sector, can be observed for some time, a significant acceleration occurred in the past two years. The higher education sector's share of the total R&D expenditure increased in the last 11 years from 14% in 2000 to 28% in 2012, and the share of public research even from 36% to 60%[13]. Unlike in the governmental sector, the R&D expenditures in higher education increased significantly during this period in relation to GDP as well, from 0.17% in 2000 to 0.52% in 2012.

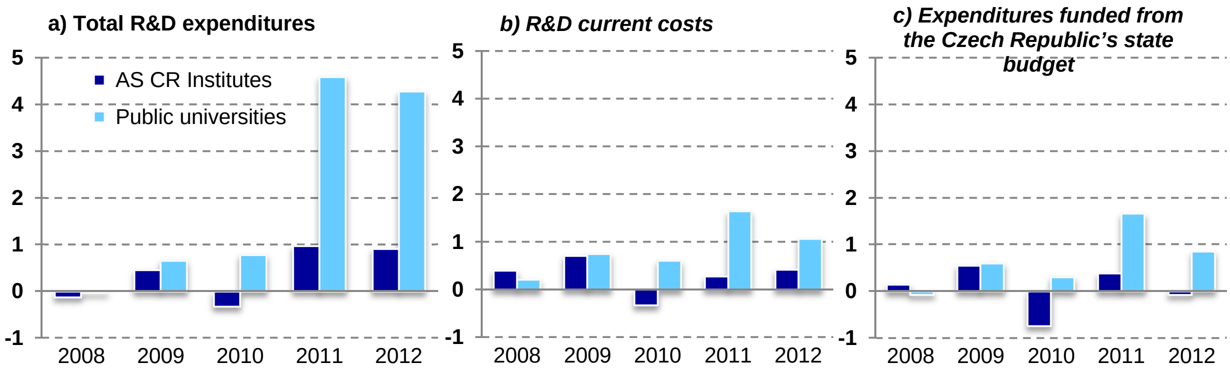
On the contrary, during the last 11 years there was a significant change in the importance of the governmental research, both in the overall R&D activities performed in the Czech Republic, as well as within the public sector. In 2000, the governmental sector's share of the total R&D expenditures performed in the Czech Republic was 25%, eleven years later it was less than a 20% (18.4%).

For the past five years, the R&D spending in the governmental sector grew at an average annual rate of 3.3%, i.e., significantly slower than spending on R&D performed in the higher education sector (average annual growth of 16.8%). The following chart provides detailed information not only on the increase in total expenditures for R&D performed at major research institutes in the governmental and the higher education sectors, but also the current R&D expenditures financed from domestic public sources. The reason for presenting the data is the fact that, especially in the past two years, due to public foreign sources, whose share at public universities increased 8.5 times (by approximately CZK 6.6 billion), there was an enormous increase of the R&D investment expenditures in the higher education sector.

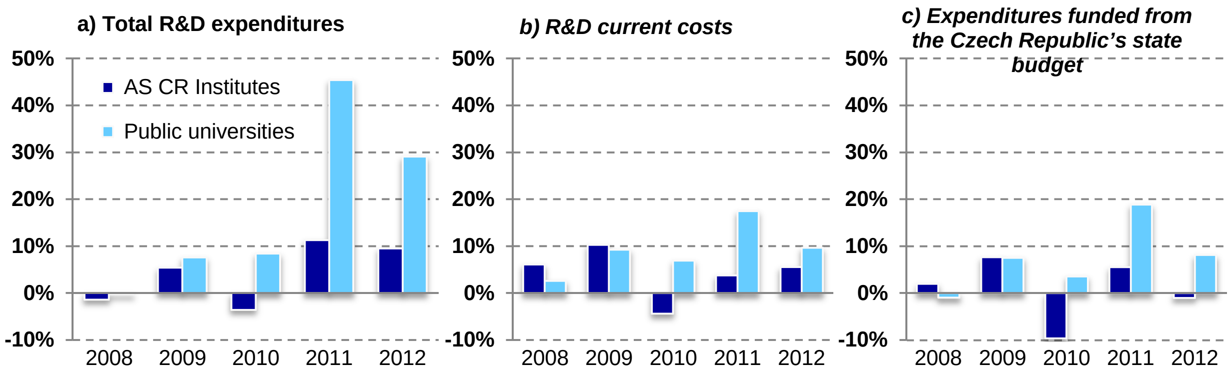
13The higher education sector began to build its research capacity in the Czech Republic, as well as in most other post-Communist (Eastern European) countries, only in the second half of the 1990s. Since until then the main mission of most universities was teaching, their share of the R&D expenditures in the Czech Republic was negligible. For example, in 1993, with 400 million spent on their R&D activities the universities' share of the total R&D expenditures was approximately 3%, and of the public research 0.10%.

Chart A.14: Annual changes in spending for R&D performed at major research institutes in the governmental and the higher education sectors in the Czech Republic, 2008–2012 (CZK billion, %)

1) Annual nominal increases in CZK billion



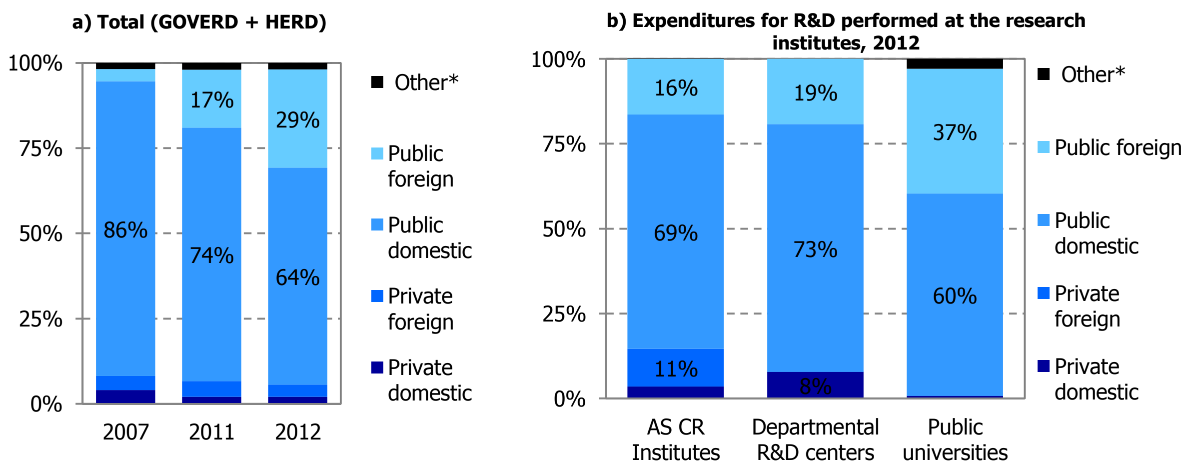
2) Annual percentage increases in current prices



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Although in the past three years quite significant changes occurred in the R&D funding in the governmental and particularly the higher education sector, both these sectors continue to be financed primarily from domestic public sources, although significantly less than in the past. It is interesting to examine the data on the increase in R&D funding in the higher education sector from public foreign sources. If in 2005 public foreign sources directed CZK 182 million into higher education, in 2010 the figure increased to CZK 881 million, and in the following two years even to CZK 3.6 and 7.4 billion respectively. Similar or even higher volume of funds from foreign public sources is expected in the next three years as well.

Chart A.15: R&D expenditures in the Czech Republic's public sector according to the sources of financing (%)



Note: In chart a) 1% for 2007 amounted to CZK 204.7 million, for 2011: CZK 276.9 million and for 2012: CZK 332.0 million. In chart b) 1% for the research institutes of the ASCR equaled CZK 105.6 million; for departmental research centers it was CZK 18.8 million, and for public universities it was CZK 189.8 million.

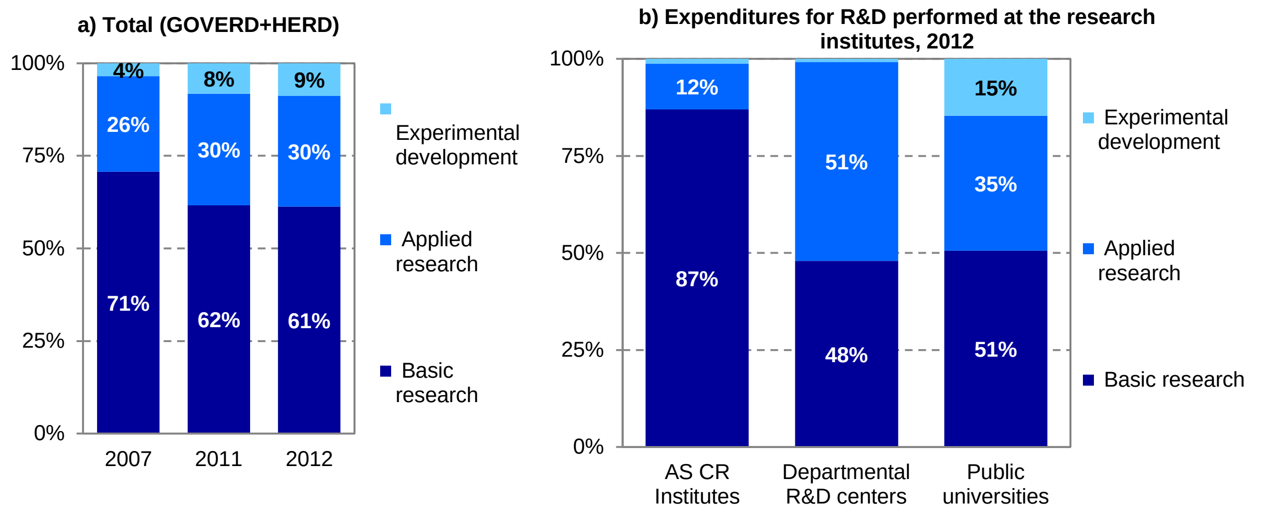
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Unlike in the higher education sector, private foreign sources play a significant role in the funding of R&D performed in the governmental sector. It is revenue from license fees collected for the granting of rights to use discoveries (inventions) protected by the patent law, which grow substantially each year (Chapter C.3).

In the higher education sector 22 research institutes (10%) reported that in 2012 they performed contract R&D for the business sector, the total revenue from these contracts, however, equaled only CZK 136 million, which was used to finance R&D performed by these entities. This amount equaled exactly 1% of the total expenditures on R&D performed in the higher education sector. Similar proportion has been observed since the beginning of the monitoring of this indicator. Although 61 research institutes (33%) in the governmental sector declared that in 2012 they performed contract R&D for the business sector, the total revenue from these contracts amounted to only CZK 245 million. As far as funding of R&D performed in the governmental sector using domestic business sources, similarly to universities, the source for governmental R&D can be considered negligible.

In terms of the type of the performed R&D, most of the R&D activities performed in the governmental and the higher education sectors belong in the area of basic research. However, we can still find significant differences in this indicator in time and, in particular, in the comparison of the types of research institutes. For more information see the following chart.

Chart A.16: R&D expenditures in the Czech Republic's public sector according to performed activities (%)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

On the basis of a limited international comparison of the type of R&D activities performed in the governmental sector (the data is available for approx. 20 EU countries in different years – see table annex), it can be concluded that the role and importance of public research institutions are different in most of the countries, not only within the EU but also in the analysis of OECD countries[14]. As was already mentioned, the predominant position in the post-Communist countries in the governmental sector is held by institution such as the AS CR, which are mainly focused on basic research. The situation is very different in some Western European countries, and also in the United States, Japan or China, where such institutions focus on experimental R&D. They are, therefore, institutions whose objective is to promote industrial development through the provision of services in the context of market-oriented R&D.[15]

The bulk of the R&D expenditures in the governmental sector is directed to natural sciences, which is particularly the domain of the research institutes of AS CR. The share of natural sciences in the

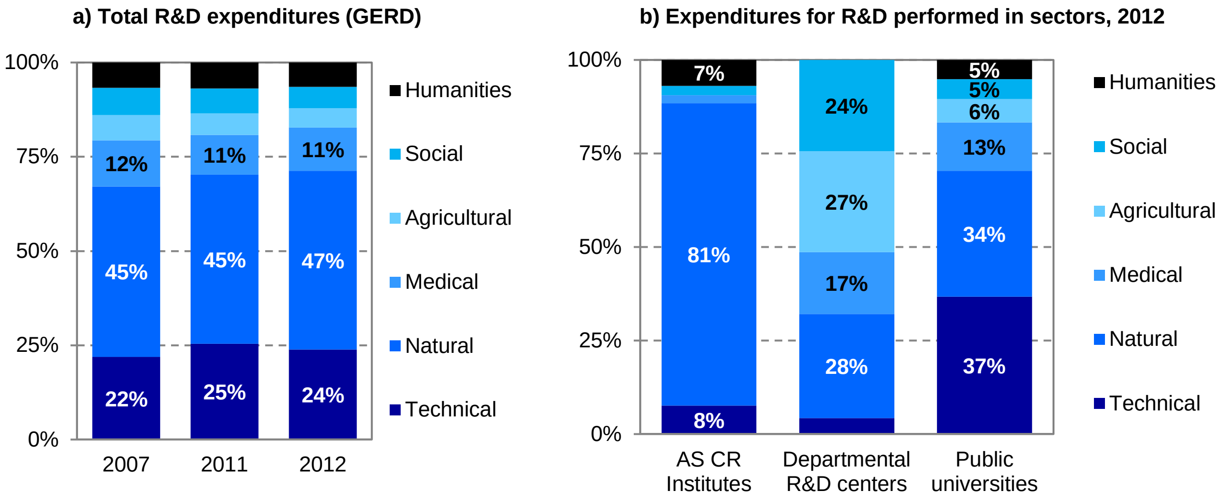
14Since there is not always a clear and unambiguous boundary between basic and applied research, it is necessary to proceed with great caution when interpretation the data broken down by type of R&D activities. The distinction between basic and applied research to a large extent depends on the term used by the researchers themselves, and therefore the distinction between these two types of research should not be used for the purpose of taking political decisions.

15In the Czech Republic with a similar function was served by the "departmental" research organizations. Many of these institutions, after their transformation or privatization, presently belongs to the business sector. They are public and private companies with the prevailing R&D activities with a significant share in business R&D, unlike in other countries (see Chapter A.1.6).

governmental sector in the Czech Republic is one of the highest among the data available for the EU countries. In addition to natural sciences, in contrast to the higher education sector, there is also a fairly significant representation of humanities. Aside from the research institutes of AS CR, they are primarily public libraries, archives, museums and other cultural facilities that perform R&D as their secondary activity in this field. In addition to natural sciences the main focus of departmental R&D institutes is also on agricultural and social sciences, areas of R&D not performed by the research institutes of AS CR. Since 2007, there was a significant increase in the proportion of natural sciences in the governmental sector, by contrast, agricultural and technical sciences experienced a decline during this period.

In the higher education sector the distribution of R&D expenditures among the different scientific areas is significantly different than in the governmental sector, or in the research institutes of the AS CR. In the higher education sector most R&D funds are directed to the technical sciences, there is high representation of natural sciences, as well as medical sciences and partially also social and agricultural sciences. In case of medical sciences, including the university hospitals in the higher education sector plays an important role.

Chart A.17: R&D expenditures in the Czech Republic's public sector according to performed activities (%)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

The share of technical sciences in the total R&D expenditures in the higher education sector in the Czech Republic is essential, which also applies in the available international comparison.[16] On the basis of this data and taking into account the Czech economy's structure, it can be assumed that the Czech higher education sector has potential for research collaboration with companies. However, measured by the share of the business resources in the financing of the higher education sector, the Czech higher education sector's figures are among the lowest of all the EU and OECD countries (EU27 average is 6% - for more information see international comparison).

International comparison

In 2010 the EU28 countries' spending on R&D performed in the governmental and the higher education sectors reached a total of EUR 91.6 billion, i.e., by 3% (EUR 2.7 billion) more than in the previous year. The EU countries' total spending on R&D performed in these sectors, as opposed to the total expenditure on R&D, was EUR 7 billion higher than the United States. The Czech Republic with its EUR 1.1 billion contributed 1.2% to this amount. The following table again lists the data on the public R&D expenditures in selected countries, according to purchasing power parity (PPP) in current prices, which eliminates the differences in price levels between countries.

16 Similarly to the case of the governmental sector and its share of R&D expenditures in natural sciences, also the Czech university research is specific, due to the fact that it achieves one of the highest percentages of technical sciences in its total R&D expenditures in comparison with the 20 EU Member States, for which data on the R&D expenditures broken down by scientific areas is available.

Table A.3: Total public R&D expenditures in selected countries (US $ mil. in PPP; EU28 = 100)

	EU28	USA	China	Japan	Germany	Russia	Korea	Poland	Austria	Finland	Czech Republic	Hungary	Slovakia
2000	**65 206**	58 378	10 897	24 093	15 532	3 043	4 564	1 662	1 339	1 264	**737**	489	131
2007	**97 179**	95 623	28 359	30 075	22 209	9 407	9 084	2 510	2 311	1 800	**1 468**	889	313
2011	**119 134**	113 544	50 507	31 632	30 405	13 622	13 067	4 337	3 068	2 201	**1 992**	928	552
2000	***100,0***	*89,5*	*16,7*	*36,9*	*23,8*	*4,7*	*7,0*	*2,5*	*2,1*	*1,9*	***1,13***	*0,75*	*0,20*
2007	***100,0***	*98,4*	*29,2*	*30,9*	*22,9*	*9,7*	*9,3*	*2,6*	*2,4*	*1,9*	***1,51***	*0,91*	*0,32*
2011	***100,0***	*95,3*	*42,4*	*26,6*	*25,5*	*11,4*	*11,0*	*3,6*	*2,6*	*1,8*	***1,67***	*0,78*	*0,46*

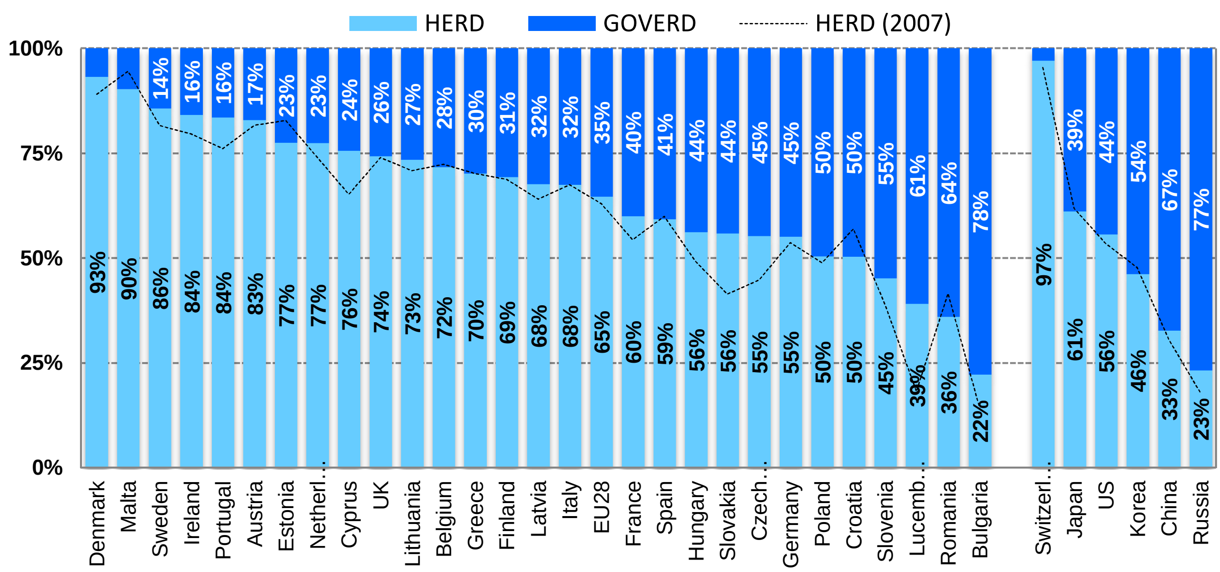
Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

R&D in the governmental and the higher education sectors plays a major role (with at least 40% share) in relation to the total R&D expenditure, not only in the new EU member countries (except Hungary, Estonia and Slovenia), but also in Greece, Spain, Portugal, Italy and, perhaps surprisingly, also in the Netherlands (Chart A.18). With the exception of the Netherlands, where the higher education sector has a significant position, it is states with relatively low overall R&D intensity.

The position of the higher education sector in the context of public R&D among the EU countries is strongest in Denmark, Malta, Ireland and Sweden, among non-EU countries, for example, in Switzerland[17]. It is certainly interesting that, in the case of Denmark, a decade ago the R&D spending in the governmental and the higher education sectors was nearly the same. Almost all the monitored countries, including the Czech Republic, in the past decade went through varying degrees of strengthening of the higher education sector's importance in the structure of public research.

On the contrary, in most of the new EU member states (except the Baltic countries) the major role is played by the governmental sector, in particular due to the strong position of the institutions such as the AS CR (e.g. in Poland or Hungary) and/or due to very low spending on R&D in the higher education sector (Bulgaria, Romania and Slovakia). The countries with a balanced share of the higher education and the governmental sector include France, United States and Korea with significant spending on defense R&D and Germany with a strong position of four research institutions (Max Planck Society, Leibniz Association, Helmholtz Association and Fraunhofer Society). The governmental sector clearly predominates, both in China, and especially in Russia with the strong position of its Academy of Sciences.

Chart A.18: Expenditures on R&D performed in the governmental (GOVERD) and the higher education (HERD) sector, 2011 (structure, %)



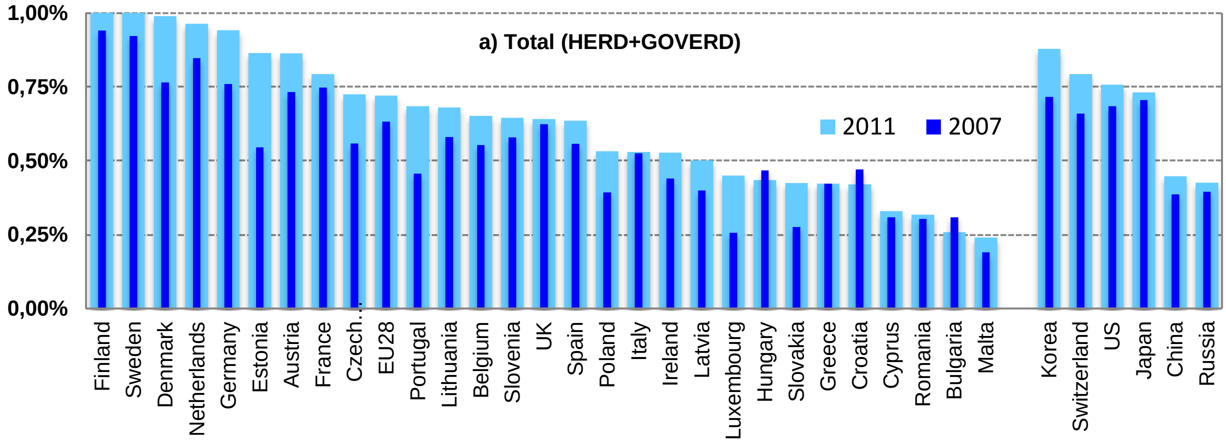
Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

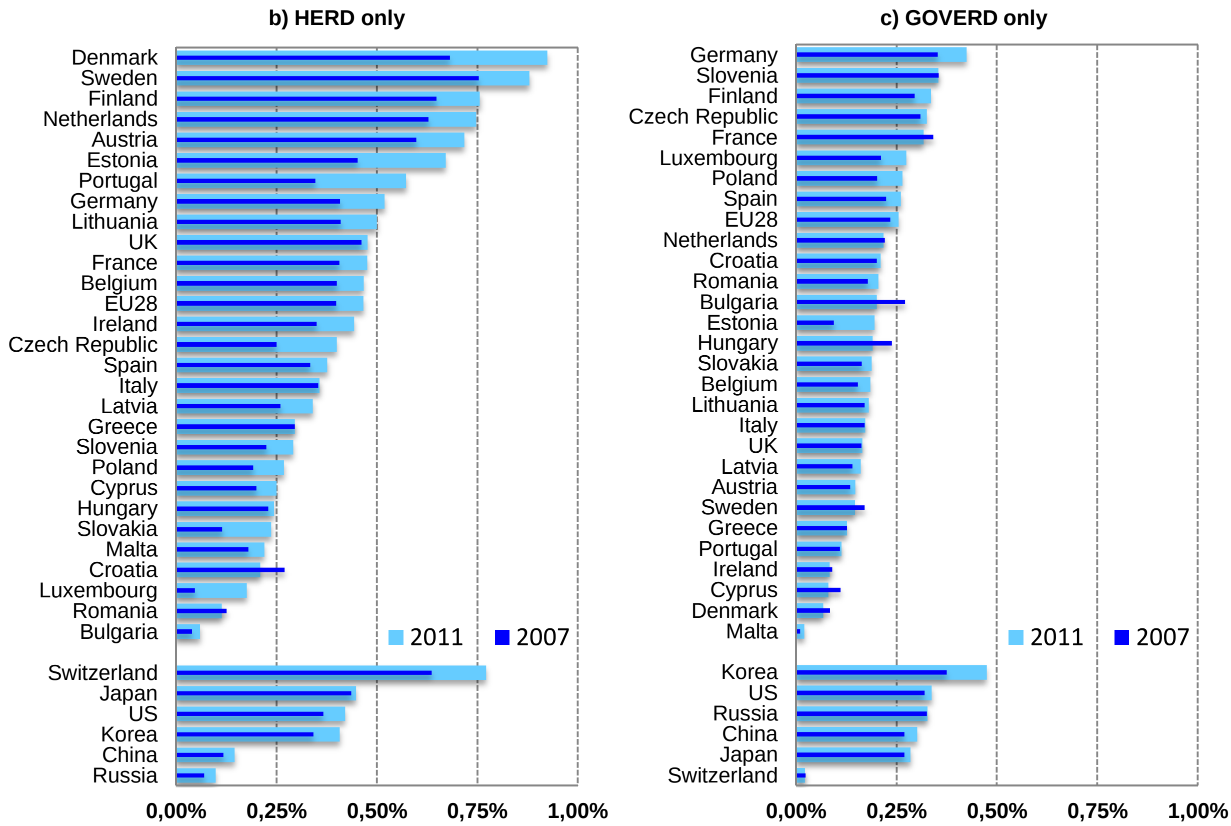
17With regard to the higher education and the governmental sector's share of public R&D, there is no optimal limit or rule that would stipulate the share of one or the other sector in public research. It rather reflects the setup of the public R&D system in that country, and its traditions.

There is a completely different picture about the importance of the governmental and the higher education sector in R&D, than the aforementioned ranking of EU countries assembled according to the share of these sectors in GERD, if spending in these sectors is expressed as % of the GDP of each country. In 2011, expenditures directed to public R&D in the EU countries accounted for 0.72% of GDP (in 2007 it was 0.63%), i.e., the same level as in the Czech Republic. The highest share of GDP, around 1%, by public R&D can be found in Finland, Sweden, Denmark and the Netherlands. This high proportion is not due to significant representation of public R&D in total R&D expenditures, since the figure for these countries, with the exception of the Netherlands, stands only at around 1/3, but due to generally very high expenditures directed to R&D. On the contrary, the lowest proportion of public R&D expenditures in GDP, less than 0.5%, was recorded in most of the new EU member countries, except for Estonia, Slovenia and the Czech Republic, despite a relatively significant representation of public R&D in total R&D expenditures.

The share of higher education R&D in GDP of the EU28 countries is the highest, similarly to a number of other indicators, in the Scandinavian countries ranging from 0.76% in Finland to 0.92% in Denmark. The Czech Republic, as well as the other new EU member countries, continues to lag behind the EU in terms of this indicator (0.47% in 2011), although in recent years it is converging quickly. In 2012 with a 0.52% share of GDP the Czech Republic would actually outperform the EU average.

Chart A.19: R&D expenditures intensity in the governmental and the higher education sector (% of GDP)





Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

After Germany, Slovenia and Finland, the Czech Republic is a country with the highest R&D spending in the governmental sector in relation to GDP. The share of R&D expenditures in the governmental sector on GDP is about a quarter higher in the Czech Republic than the EU28 average that in 2011, as well as in 2000, amounted to 0.25%.

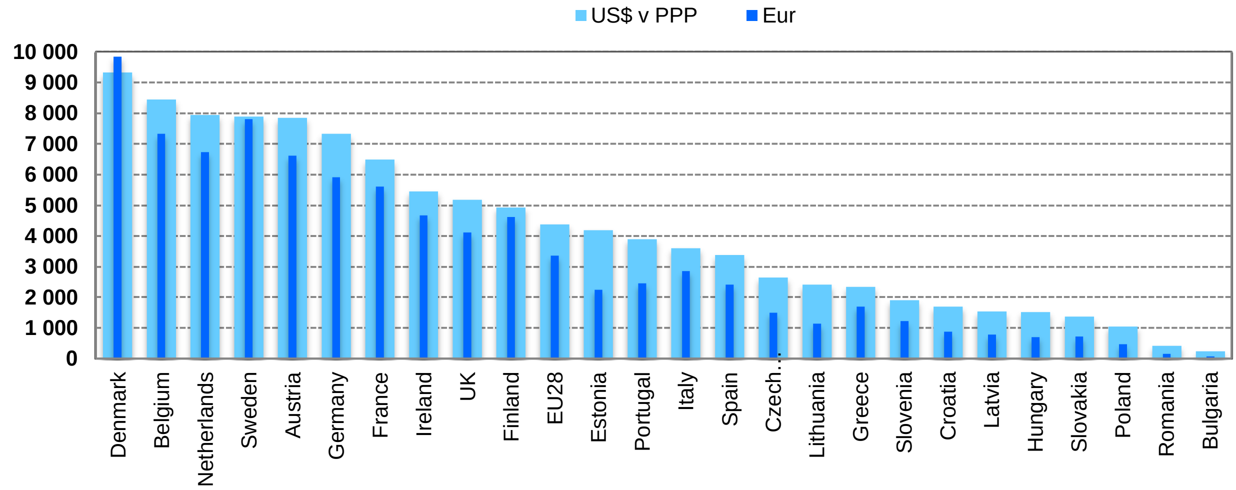
In absolute terms, the EU28 countries' spending on R&D performed at universities totaled EUR 59.3 billion in 2011, i.e., by approximately EUR 27 billion (by 83%) more than in the governmental sector. Most of this amount was used by higher education institutions in Germany (23%), in France (16%) and in the United Kingdom (14%). The Czech Republic participation in this amount amounted to exactly 1% (EUR 622 million).

The EU governmental sector spending on performed R&D in 2011 was EUR 32.3 billion, i.e., approx. a billion more than in the previous year. More than 1/3 (34.2%) of this amount went to Germany, and 1/5 to France. The Czech Republic's share with EUR 0.5 billion was 1.6%, i.e., with the exception of Poland, by far the most of all the new EU countries.

Unlike the R&D expenditures in the governmental sector, the higher education sector expenditures in the past 5 years (2006-2011) were growing in all monitored EU and OECD countries, although with different intensity. For example, in the EU15 countries these expenditures increased by a quarter in real terms during this period, and in Poland and the Czech Republic they almost doubled. The average real growth for the EU28 countries was 4% per annum. However, it should be noted that this significant growth in most of the new EU member states, in contrast to Denmark, Austria or Sweden, was not reflected in the corresponding increase in the number of researchers in higher education R&D.

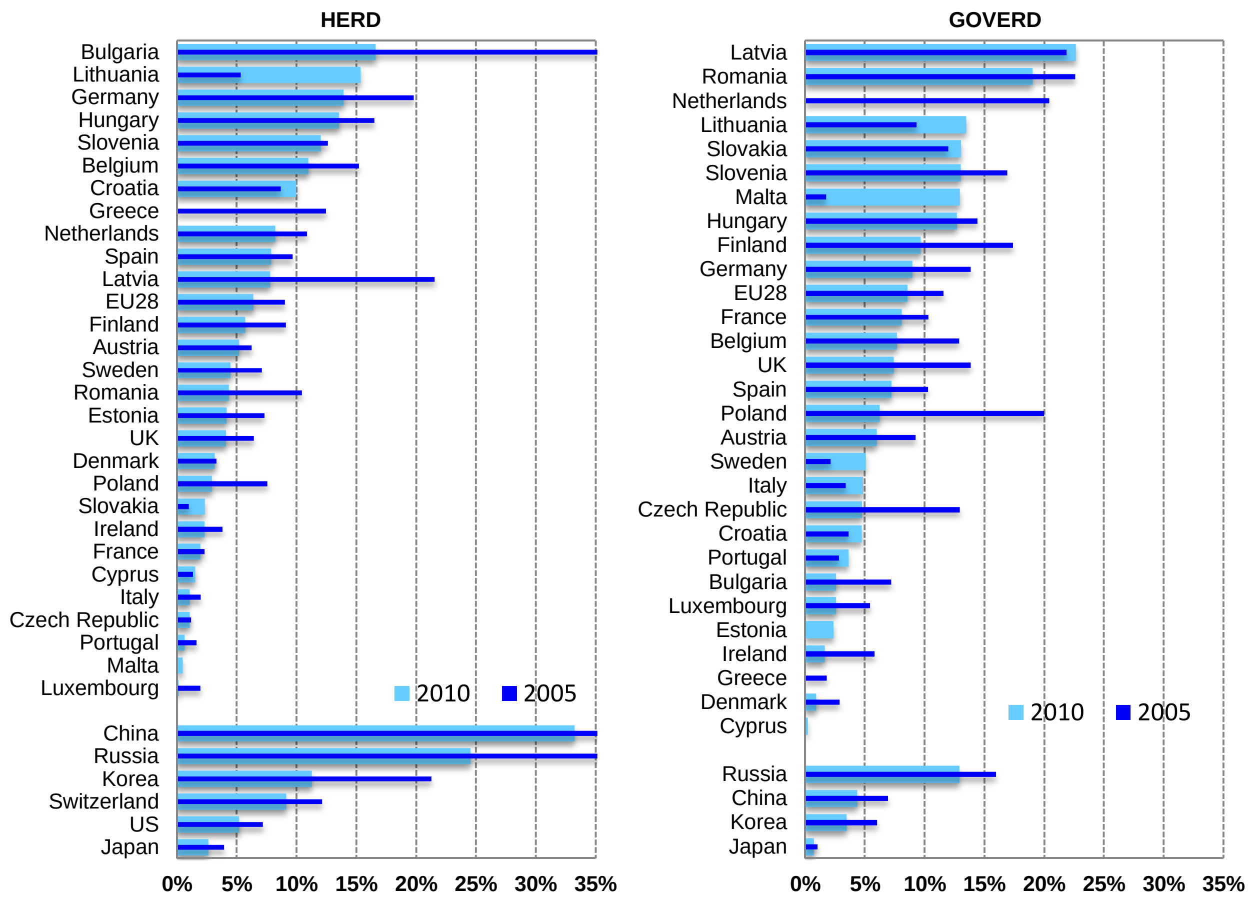
The following chart presents interesting information on R&D expenditures in the higher education sector per one student of these schools (ISCED 5A and ISCED6).

Chart A.20: R&D expenditures in the higher education sector per student (USD in PPP), 2011



Source: Eurostat September 2013 and CZSO's own calculations

Chart A.21: R&D expenditures in the governmental and the higher education sector funded from private domestic sources (%)



Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

In the Czech Republic data, the R&D funding in the governmental and higher education sector from private domestic sources received detailed attention. Chart and A.21 and Table A.3, present this information in the context of international comparison. In regard to the governmental sector, and especially the higher education sector, the Czech Republic is among the countries with a relatively low share of private sources in funding of R&D performed in these sectors.

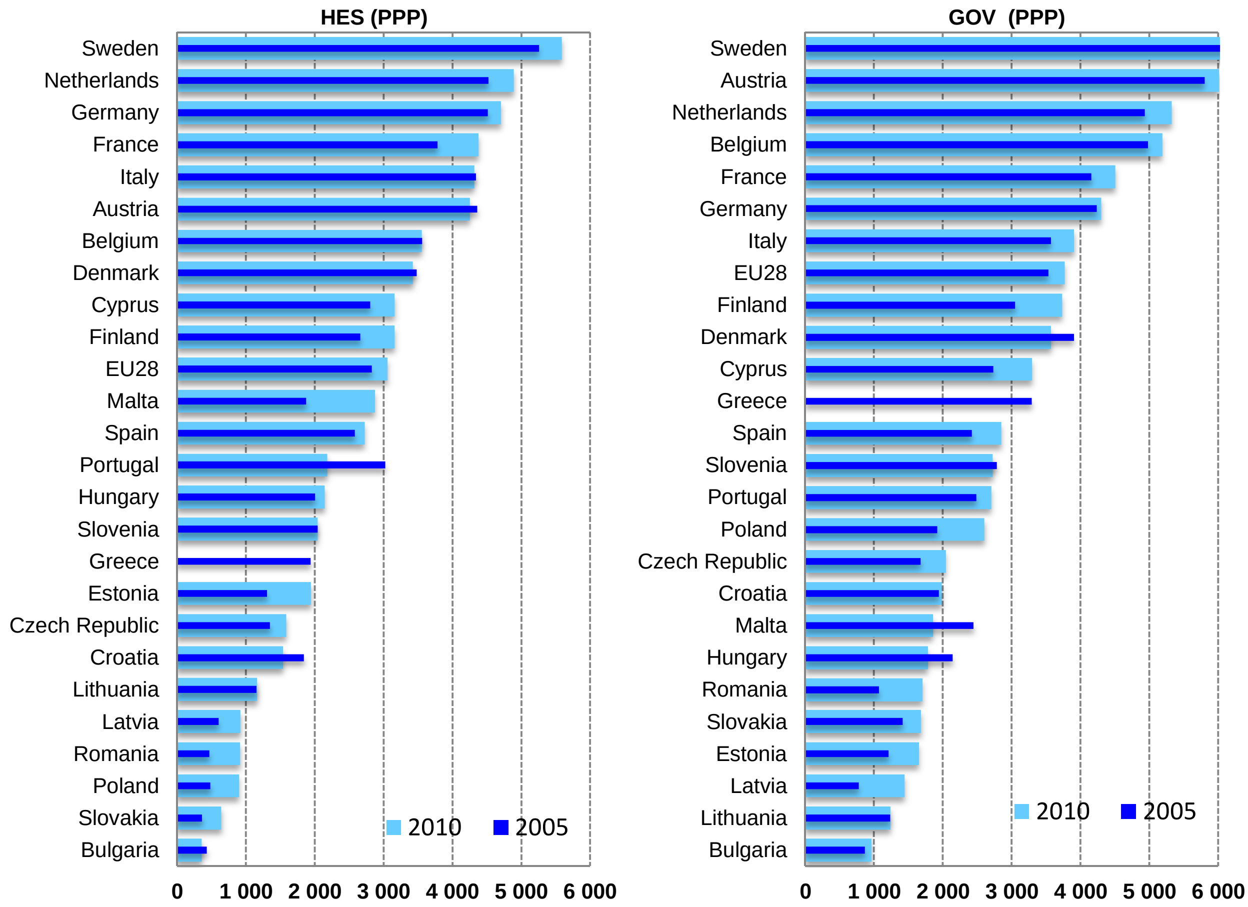
Table A.4: R&D expenditures in the governmental and the higher education sector funded from private domestic sources in selected countries (USD mil. in PPS; EU27 = 100)

		EU28	Germany	Korea	France	UK	Poland	Austria	Finland	Hungary	Czech Republic	Slovakia
Total	2005	6 049	2 401	618	634	759	206	98	136	94	58	12
	2010	8 251	3 322	878	776	718	187	158	155	121	46	36
	2005	*100,0*	*39,7*	*10,2*	*10,5*	*12,5*	*3,4*	*1,6*	*2,2*	*1,6*	*0,97*	*0,19*
	2010	*100,0*	*40,3*	*10,6*	*9,4*	*8,7*	*2,3*	*1,9*	*1,9*	*1,5*	*0,56*	*0,44*
HES only	2005	3 369	1 505	462	121	403	51	75	69	48	4,1	0,6
	2010	4 775	2 178	645	212	440	61	128	88	65	8,0	5,1
	2005	*100,0*	*44,7*	*13,7*	*3,6*	*12,0*	*1,5*	*2,2*	*2,1*	*1,4*	*0,12*	*0,02*
	2010	*100,0*	*45,6*	*13,5*	*4,4*	*9,2*	*1,3*	*2,7*	*1,8*	*1,4*	*0,17*	*0,11*

Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

In the governmental and the higher education sectors, the monthly R&D payroll costs per R&D employee (FTE) in the Czech Republic, as well as in the other new EU member countries, do not reach the EU15 average level. In all of the monitored countries (except Germany and Italy) the values for the governmental sector are higher than for the higher education sector.

Chart A.22: Monthly R&D payroll costs attributable to R&D employees (FTE) working in higher education (HES) and governmental (GOV) sector, 2010 (PPP)



Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

Expenditures for R&D performed in the business sector - private R&D

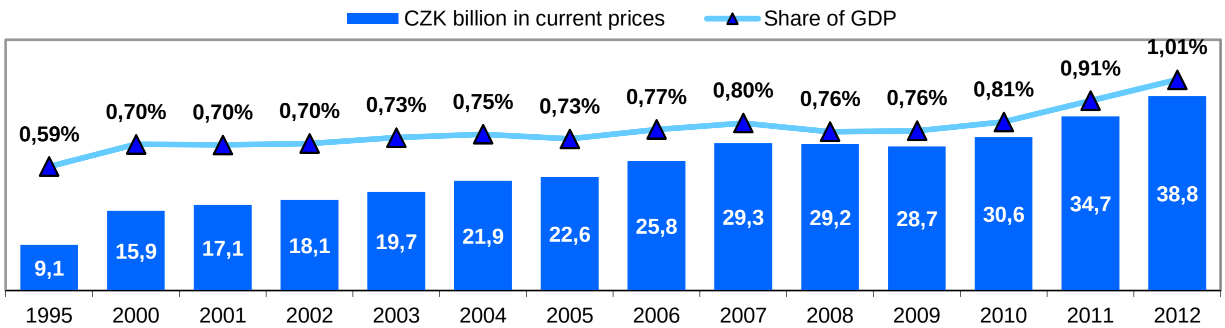
In the Czech Republic, R&D was performed in 2 311 companies at 2 334 research centers in 2012, of which approximately half have been consistently involved in the R&D activities in the past five years. Especially among smaller economic entities there is a higher representation of enterprises that did not perform R&D throughout the entire reporting period. Of the aforementioned 2 334 R&D centers in the business sector only a quarter of them spent more than CZK 10 million on R&D in 2012 and only three spent more than CZK 100 million. In contrast, almost a quarter of the research centers indicated spending less than CZK 1 million for performed R&D in 2012 and in three quarters of them employed less than 10 FTE workers in R&D.

In terms of the companies' ownership, approximately three quarters are private domestic firms (1 710), less than a quarter (549) are foreign-controlled businesses and 2.5% are public enterprises. In terms of the size of the monitored economic entities performing R&D in the business sector, one third of them are medium-sized enterprises with 50 to 249 employees, three out of ten are small enterprises with 10 to 49 employees and less than one-fifth of them are micro enterprises (0-9 employees) and large enterprises with 250 or more employees.

In 2012, as well as in the previous year, there were 113 companies with 153 research centers, which performed R&D as their primary economic activity (CZ-NACE 72). Most of them (83%, 126) are private domestic businesses. Many of these companies were created from the former departmental research institutes. More than half of the other R&D centers in the business sector belonged to entities with prevailing economic activities in the manufacturing industry. In 2012, there were specifically 1 218 enterprises, most of which (22%, 262) were involved in the engineering industry (CZ-NACE 28 + 331) and 11% each (128) in the electrical industry (CZ-NACE 27) and the production of metal structures and fabricated metal products (CZ-NACE 25). These sectors, together with the rubber and plastics industry (CZ-NACE 22), recorded the largest increase in absolute terms since 2007 in the number of enterprises performing R&D. In the services sector, most R&D centers, with the exception of the aforementioned CZ-NACE 72, were found in companies with the predominant activities in programming (CZ-NACE 6201) and engineering activities and related technical consultancy (CZ-NACE 7112). In most cases they are smaller private domestic businesses.

In 2012 the expenditures for R&D performed in the business sector for the first time exceeded the boundary of 1% of GDP and their share of the total investments in the business sector (non-financial businesses only) reached nearly 7%. Once again it is the highest value in the entire reporting period, for example, in 2005 - 2007, this indicator oscillated between 4.5% and 5%.

Chart A.23: Expenditures for R&D performed in the business sector in the Czech Republic (BERD), 1995–2012



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

As mentioned above, in terms of the volume of spent funds the business R&D represents the most important sector of performance in the Czech Republic, although in the past two years, its share of the total R&D expenditures in the Czech Republic has been declining. In 2012, the businesses' spending for R&D performed by them (BERD) totaled nearly CZK 40 billion (CZK 38.8 billion), i.e., approx. CZK 4.1 billion more than in the previous year, approx. CZK 8.3 billion more than in 2010, and approx. one-third (CZK 9.5 billion) more than in 2007. Following two years of decline the companies in the Czech Republic returned to the growth trajectory of the R&D expenditures.

Table A.5: Year-to-year changes in expenditures for R&D performed in the business sector in the Czech Republic, 2005–2012

	2005	2006	2007	2008	2009	2010	2011	2012
CZK Billion at current prices	**0,7**	**3,2**	**3,5**	**-0,1**	**-0,5**	**1,8**	**4,2**	**4,1**
% at current prices	3,2	14,3	13,6	-0,3	-1,7	6,3	13,6	11,7
% in constant prices in 2005	3,6	13,7	9,9	-2,2	-3,9	8,0	14,7	9,9

Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Although the business sector performs R&D in more than 2 300 research centers, the business R&D expenditures are mostly concentrated in a few major R&D centers. 38% of R&D expenditures in the business sector are performed in workplaces with more than 100 R&D employees that, however, represent only 2.5% (57) of the total number of R&D centers in the business sector. On the contrary, 1 700 business R&D centers with fewer than 10 R&D employees account for less than 17% of the total business R&D expenditures.

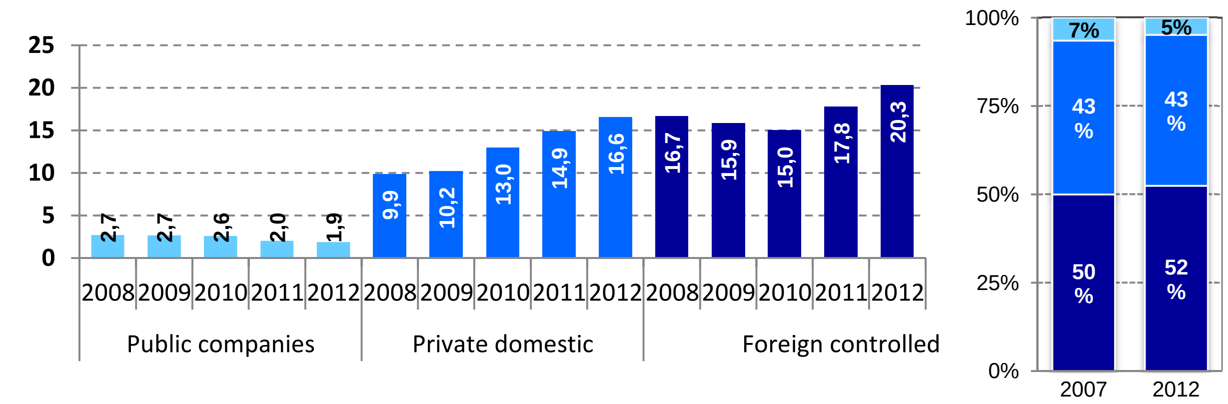
In terms of ownership of companies performing R&D in the Czech Republic, the largest volume of funds directed to R&D in the business sector since 2006 originates in the foreign-controlled enterprises (foreign affiliates). In 2012, foreign affiliates' share of the expenditures for R&D performed in the business sector was 52%[18], although they account for less than a quarter of companies that carry out R&D. Private domestic firms in the same year accounted for 40% of total R&D expenditures in the business sector and the state-owned enterprises (public companies) received the remaining 8%. However, during the reporting period the breakdown of the R&D expenditures according to the companies' ownership has substantially changed. As late as 1999, for example, public companies in the Czech Republic accounted for less than a quarter of total R&D expenditures in the business sector. Research is more concentrated in foreign-controlled enterprises over domestic private enterprises. While in 2012, the average annual expenditure for performed R&D per company in the foreign-controlled enterprises totaled CZK 37 million, in the domestic private enterprises it was nearly 4 times less (CZK 9.7 million).

In terms of company size, most R&D spending originates in enterprises with more than 250 employees. With regard to the prevailing economic activity of monitored businesses, the Czech Republic is dominated by companies in the industrial sector. In recent years we have seen growing importance of the service businesses, involved in the professional, scientific and technical activities (section M), as well as information and communication activities (section J). As regards the most important sector in terms of R&D expenditures among these sections, it is particularly enterprises engaged in the above mentioned activities: Research and development in the field of natural and technical sciences (CZ-NACE 721), programming (CZ-NACE 6201) and engineering activities and related technical consultancy (CZ-NACE 7112), where there was R&D performed in 2012 worth CZK 6 billion (CZ-NACE 721), CZK 3 billion (CZ-NACE 6201), or CZK 1.5 billion (CZ-NACE 7112) with more than one-quarter (28%) share of expenditure on R&D performed in the entire business sector and a two-third share in the services sector.

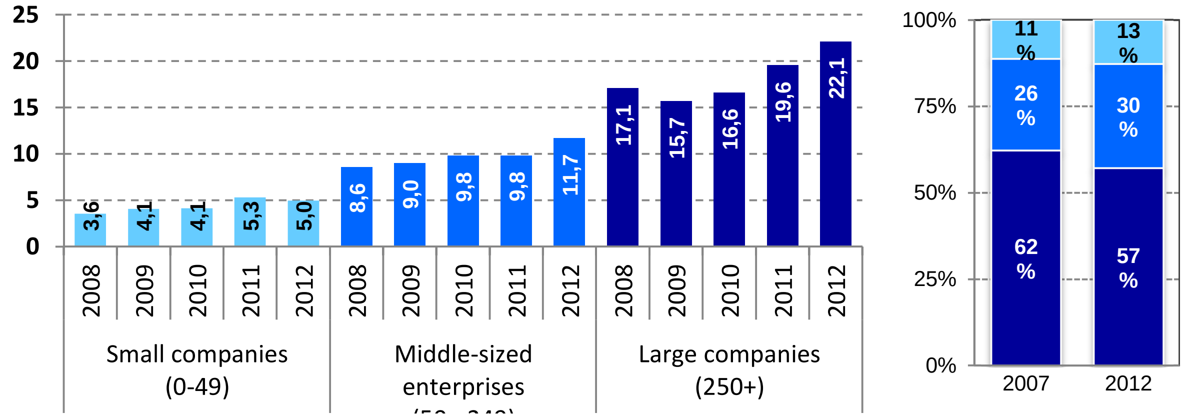
[18] The proportion of foreign-controlled companies in R&D expenditures in the business sector in the Czech Republic is one of the highest within the EU27 and OECD countries. According to the available information for 2009 (OECD, 2013), foreign affiliates reached higher levels only in Ireland and Israel, and similar levels in Austria, Belgium or Hungary.

Chart A.24: Expenditures on R&D performed in the business sector (BERD) according to ownership, size and prevailing activities of the monitored entities (CZK billion, %)

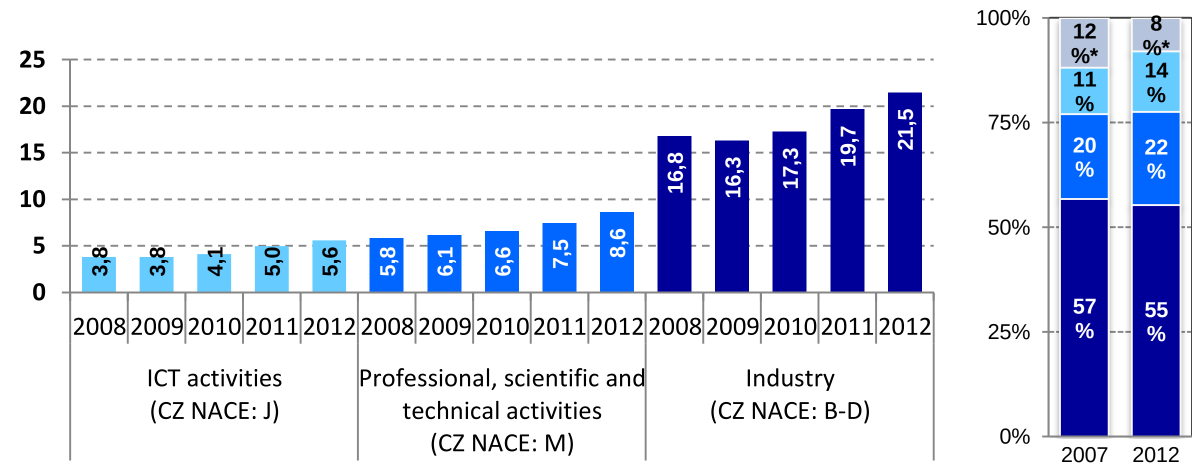
1) According to ownership of the monitored companies (Institutional subsectors)



2) According to size of the companies (Number of employees)



3) According to prevailing economic activities of the monitored companies (classification section CZ-NACE)



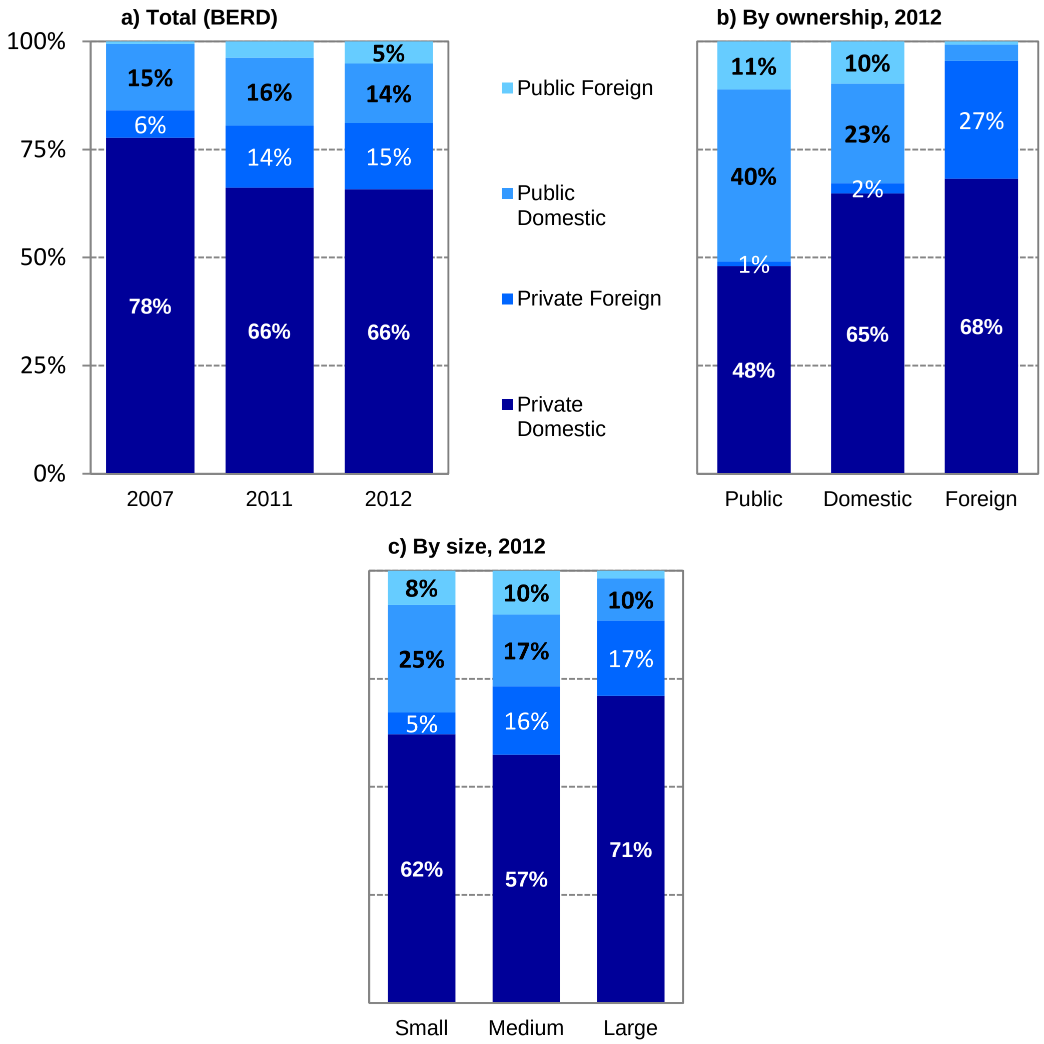
*Note: * Other sectors (CZ NACE section)*
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Research and development activities in the business sector over the long term are funded mostly from private sources, whether they are financial resources of the monitored firms performing R&D or other sources of domestic or foreign companies, they mostly come from R&D performed by contract for these entities. The share of these sources in the reporting period was around 75%, however in recent years it is possible to observe an increase in both private and public sources of funding for R&D performed in companies. In case of foreign sources they are mainly private funds of enterprises from the same ownership group.

Fairly significant differences in the funding of business R&D exist for each size and ownership category of monitored businesses. While public domestic sources contributed 4% of funding for foreign-controlled enterprises' R&D activities, the figure is 23% for private domestic enterprises and 40% for public enterprises (2012 data). Similar differences can be found depending on the size of the monitored enterprises.

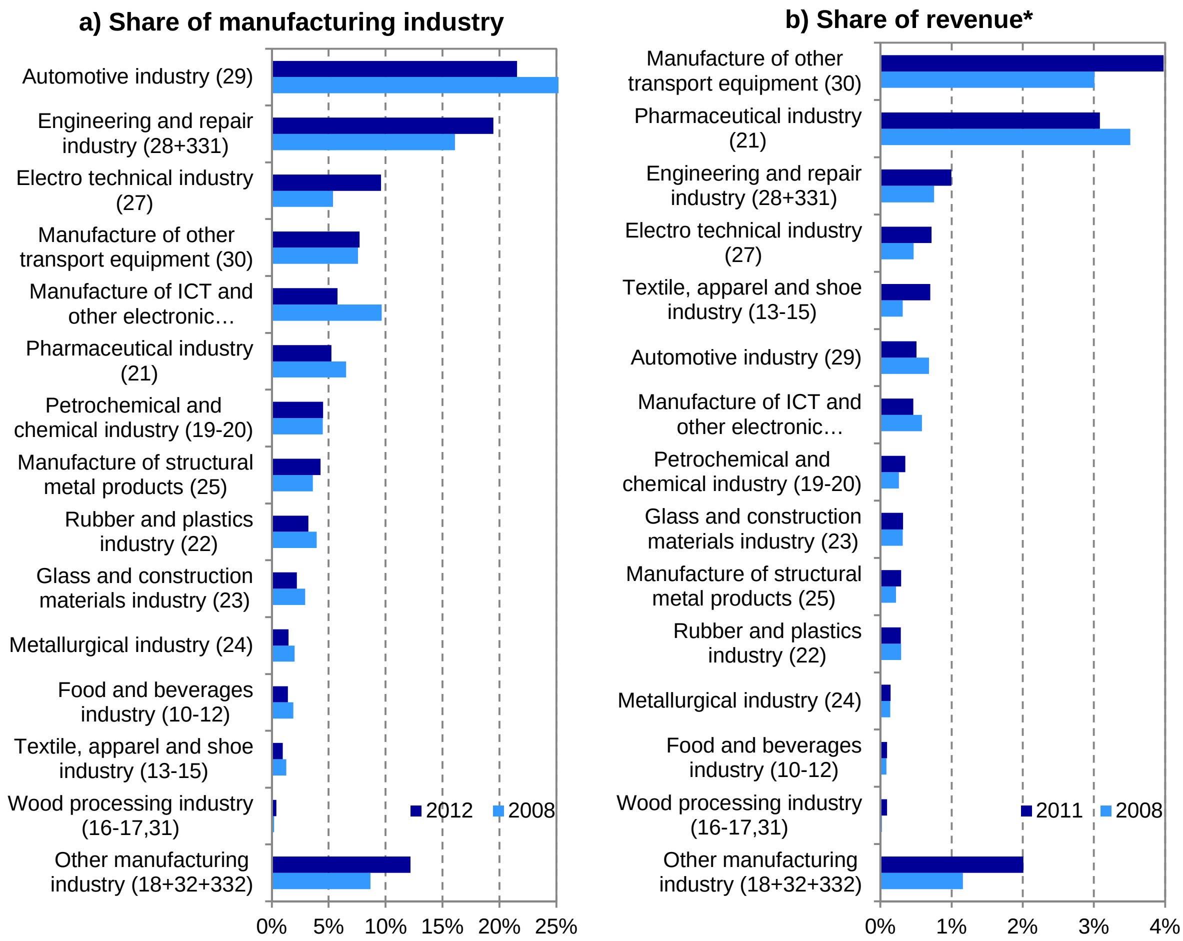
In the Czech Republic's business sector, as was already mentioned above, the most important role in R&D in the long-term is played by the manufacturing industry with a 55% (in 2012) and higher (in previous years) share of the total expenditure on R&D in the business sector. In terms of the various sectors of the manufacturing industry in the Czech Republic the most funds directed to R&D are traditionally used in the automotive and engineering sector. In 2012 the R&D expenditures in the automotive industry totaled CZK 4.6 billion and in the engineering industry CZK 4.2 billion, which represented 12% and 11% of the total R&D expenditures in the business sector and 22% and 20% in the manufacturing industry. In the past five years the fastest growth in R&D spending was recorded in the electronics industry and in the manufacture of other transport equipment (mainly production of railway locomotives and rolling stock) and in the manufacture of metal structures and fabricated metal products. Detailed information on R&D in the business sector broken down by the prevailing economic activity can be found in the table annex of this analysis.

Chart A.25: Expenditures for R&D performed in the business sector in the Czech Republic (BERD) according to the sources of funding (%)



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Chart A.26: Expenditure for R&D performed in the manufacturing industry in the Czech Republic by sector (%)

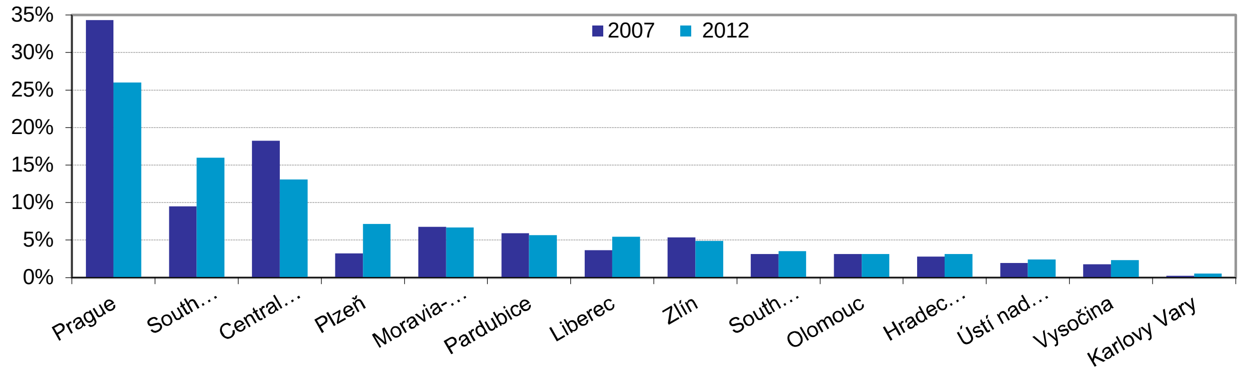


*Note: * Share of total revenue realized in the particular sector of the manufacturing industry*
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

If the R&D indicators for the manufacturing sector mentioned above were expressed as a proportion of their total sales, or the total number of employees, the ranking would be different. For example, the largest R&D intensity in relation to the total revenue for 2011 (more recent figures are not available) would be in the pharmaceutical industry or in the manufacture of other transport equipment, while the average for the manufacturing industry amounted to 0.56% (it was 0.49% in 2008).

Although in case of the business sector breakdown by regions, the dominant position in the R&D expenditures continues to be held by Prague, the past five years have seen a fairly interesting increase in the share of the business R&D activities in the South Moravian region and partially also the Plzeň and Liberec regions.

Chart A.27: R&D expenditures in the business sector in the regions of the Czech Republic (% BERD)

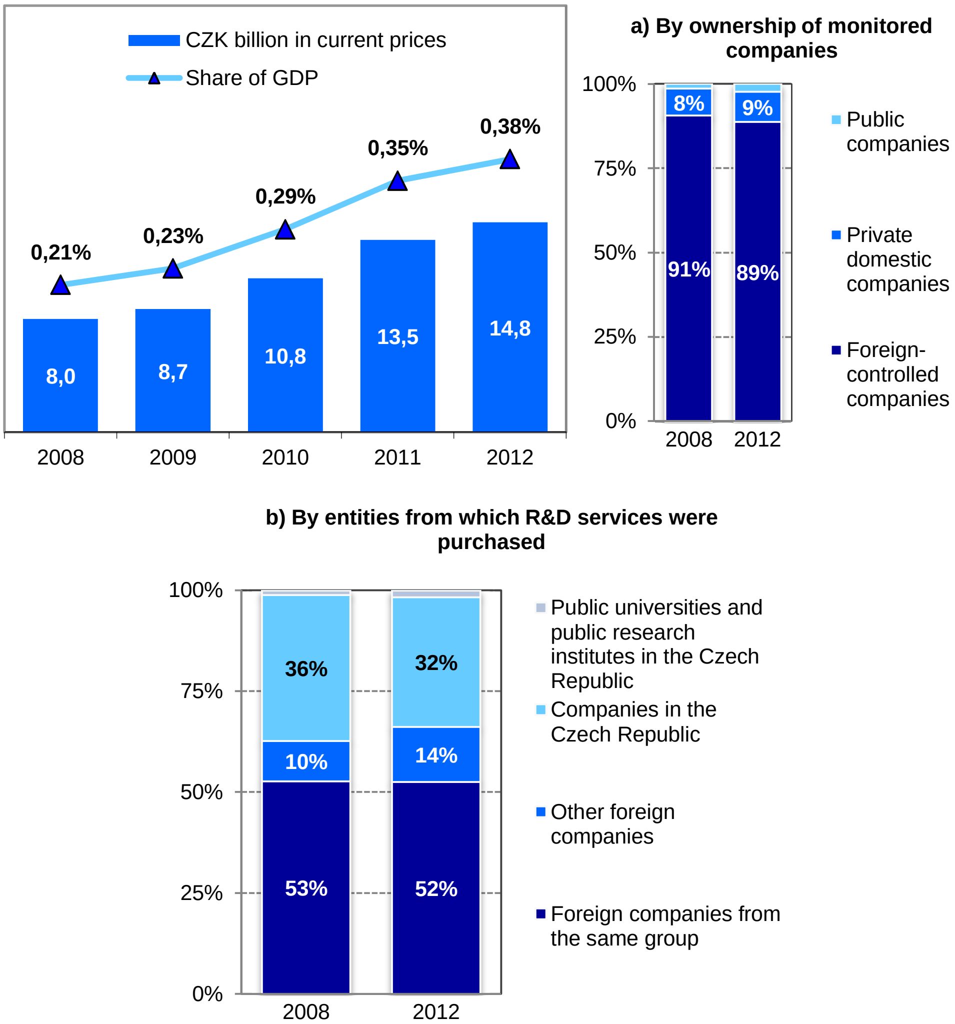


Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

As was already mentioned in the introduction of chapter A.1 in note no. 1, in addition to expenditures for performed R&D, labeled intramural R&D expenditures, since 2008 CZSO monitors the R&D entities' expenditures on R&D services, which are called extramural R&D expenditures.[19] These costs of R&D services mainly concern entities in the business sector (96% in 2012) and in particular the foreign-controlled businesses (89% share). In 2012, in addition to the aforementioned CZK 38.8 billion for the R&D they performed (BERD), they spent additional CZK 15.2 billion to purchase R&D services from other entities intended mainly as a subcontract of the R&D performed by them.

[19] Until 2007, this data was available within the technological balance of payments statistics (only for the purchase of R&D services abroad), since 2008, data from this statistic for entities not performing R&D bodies is utilized.

Chart A.28: The cost of R&D services* of enterprises performing R&D in the Czech Republic, 2008-2012



*Note: * Includes external expenditures, which the reporting agent reports as paid or committed to pay to another entity for the contractual performance of R&D during the past period.*
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

The negative fact is not only that just 217 (9%) of businesses in the Czech Republic in 2012 reported to have purchased an R&D service from entities in the Czech governmental or the higher education sector represented by public universities (VVŠ) and public research institutions, but above all, that the cost of these services totaled only CZK 253 million, i.e., less than 1% in comparison with the total expenditures of businesses for the R&D performed by them (BERD).

International comparison

In absolute terms the enterprises in the EU countries spent a total of EUR 152 billion for performed R&D in 2011. This amount corresponds to 72% of R&D spending by companies in the United States. Of the EU countries the most money in R&D, one-third, is directed to enterprises operating in Germany. In 2011 it was ERU 50 billion, i.e., for example, nearly twice more than in France occupying second place, 2.5 times more than in the UK, 5 times more than in Italy and over 35 times more than in the Czech Republic. However, in 2011 businesses operating in the Czech Republic invested the largest sum in R&D of all the new EU member countries (EUR 1.4 billion). In the Central European area, the Czech Republic's position is solid, since businesses in Hungary, as well as Poland, are investing into R&D approximately half of the amount invested by Czech businesses. Data on business R&D expenditures in purchasing power parity (PPP) is used for the business sector as well to facilitate better international comparison.

Table A.6: R&D expenditures carried out in the business sector (BERD) in selected countries (US $ mil. in PPP; EU28 = 100)

	EU28	USA	China	Japan	Germany	Korea	Russia	Austria	Finland	Czech Republic	Poland	Hungary	Slovakia
2000	**117 217**	199 961	16 319	70 015	36 817	13 742	7 429	2 991	3 152	**1 117**	940	433	253
2007	**170 566**	269 267	73 964	115 046	51 807	31 048	17 058	5 586	4 798	**2 104**	1 099	942	205
2011	**198 286**	283 784	157 664	112 779	62 650	45 836	21 362	6 647	5 379	**2 498**	1 877	1 612	328
2000	***100,0***	*170,6*	*13,9*	*59,7*	*31,4*	*11,7*	*6,3*	*2,6*	*2,7*	***0,95***	*0,80*	*0,37*	*0,22*
2007	***100,0***	*157,9*	*43,4*	*67,4*	*30,4*	*18,2*	*10,0*	*3,3*	*2,8*	***1,23***	*0,64*	*0,55*	*0,12*
2011	***100,0***	*143,1*	*79,5*	*56,9*	*31,6*	*23,1*	*10,8*	*3,4*	*2,7*	***1,26***	*0,95*	*0,81*	*0,17*

Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

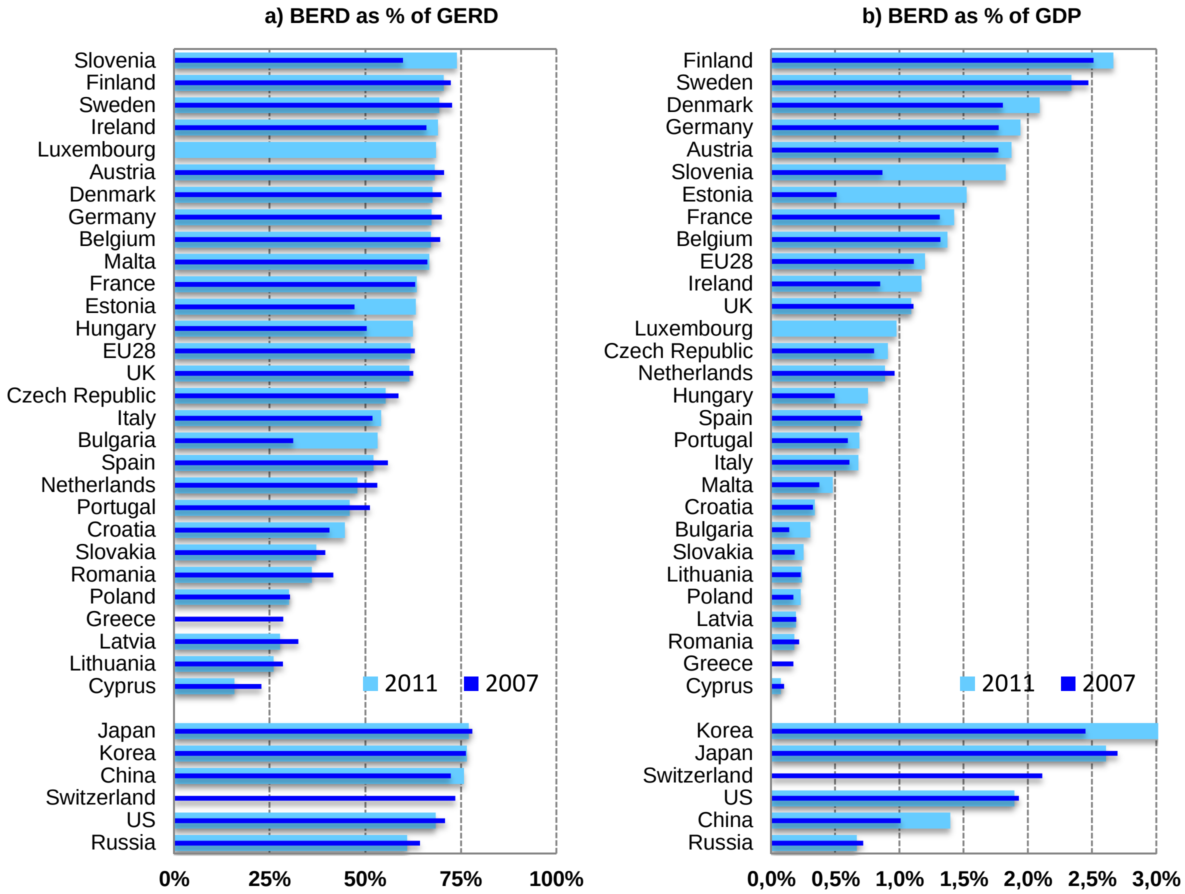
The business sector has a dominant role in R&D, as measured by its share of the total expenditure on R&D, especially in the Asian OECD countries (Japan, Korea, and China) with more than a 75% share. More than a two-thirds share was recorded in the Scandinavian countries, Germany, Austria, Belgium, Slovenia and the United States (2011 data). The business sector, unlike in the other new EU member countries, plays a major role in the R&D performance in Slovenia, as well as Estonia, Hungary and with a smaller gap in the Czech Republic as well. The EU28 average reached 62%, and this percentage has not significantly changed in the last ten years.

In contrast to the R&D expenditures in the public sector, when BERD is expressed as a % of GDP we still get similar comparison as with the previous ratio indicator (BERD as % of GERD). In 2011 the EU28 highest intensity of R&D expenditures in the business sector, more than 2% of GDP, was achieved by the Scandinavian countries, which also reported the highest intensity of the total R&D expenditures. Very high levels (almost 2%) of R&D expenditures relative to GDP are also achieved by the business sector in Germany and Austria, as well as in slightly trailing Slovenia and Estonia (2011 data). The average of the EU28 R&D expenditures in the business sector remains around 1.1% since 2000. In contrast, in the Czech Republic there is a gradual increase in this share from 0.7% in 2000 to 0.9% of GDP in 2011 (1% in 2012), or, in other words, to the level of countries such as the Netherlands or the United Kingdom. Of the OECD countries the investment in business R&D in relation to GDP was by far the highest in Israel (3.5% of GDP) and Korea (3.1% of GDP).

Similarly to the detailed discussion of the R&D expenditures in the governmental and the higher education sectors and their funding from private sources, chart A.30, by contrast, provides information about the involvement of domestic public sources in funding of business R&D in EU countries. While in case of R&D performed in the governmental and the higher education sectors the Czech Republic was among the EU countries with a relatively low share of private sources of funding public R&D, in case of the private R&D we are among countries with one of the highest shares of public resources in funding R&D performed in the business sector (chart A.30a).

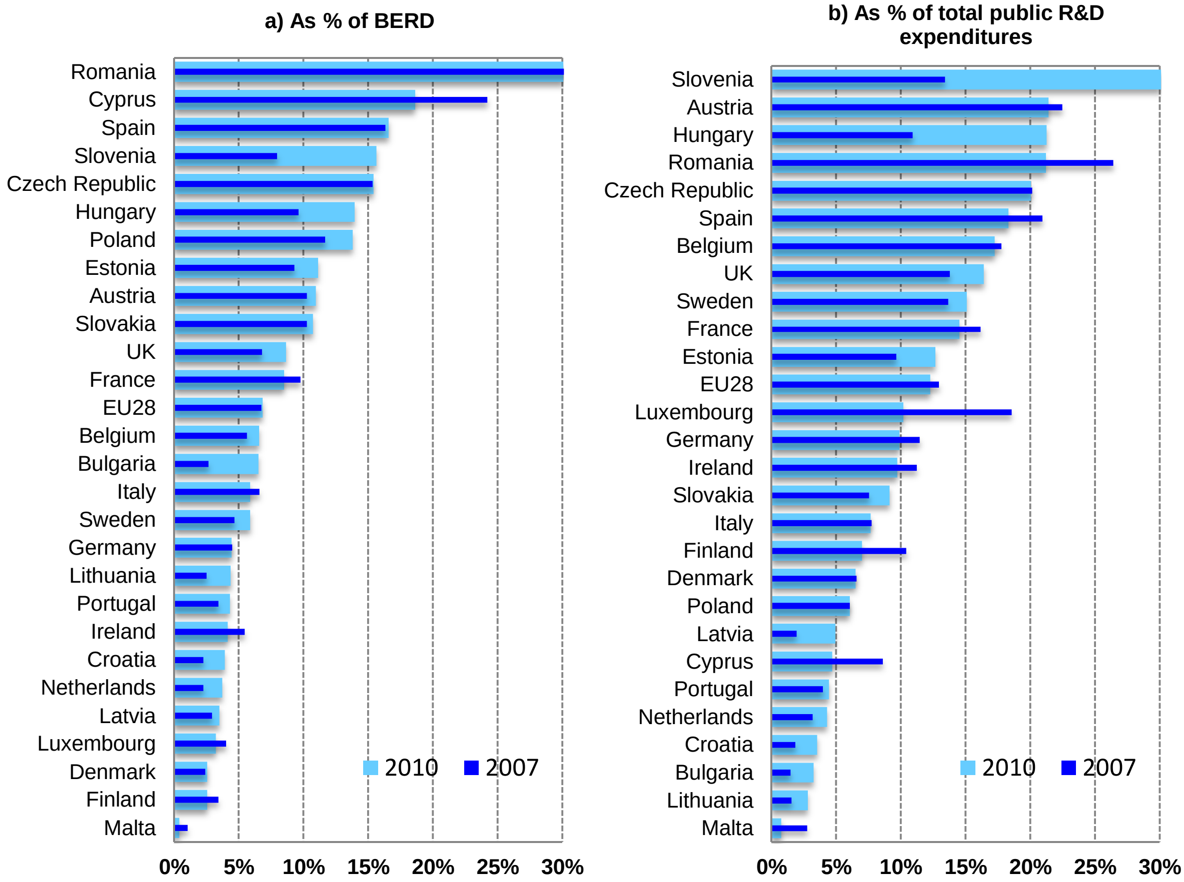
In 2010 the spending from domestic public sources for financing R&D in the business sector in the EU28 countries totaled EUR 10.5 billion. Almost one-quarter (22.3%) of this amount originated in France and one-fifth in Germany. On one hand, the Czech Republic directed twice as much funds in absolute terms from public domestic sources to business R&D than Poland or Hungary, on the other hand, only a third of Austria's amount.

Chart A.29: Expenditures for R&D performed in the business sector (%)



Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

Chart A.30: R&D expenditures in the business sector funded from domestic public sources in EU countries (%)



Source: OECD MSTI 2013/1, Eurostat September 2013 and CZSO's own calculations

A.2 Direct R&D support from the state budget

The total direct R & D support from public sources includes all funds provided from the public budgets to support R&D, including funds for R&D going abroad. According to valid international methodology R&D support with the use of repayable loans, pre-financing of EU programs backed by revenues from the European Union and the promotion of innovation are excluded from the public sources for R&D support.

The source of data for this chapter is the annual statistical exercise GBAORD (State budget appropriations or outlays on R&D), which is organized in the EU as compulsory surveys on the basis of the Commission Regulation (EC) No 753/2004 and of the methodology referred to in the Frascati Manual (OECD, 2002) with a goal to identify the core R&D area, where the state support for R&D is directed according to the socio-economic objectives (NABS classification). In the Czech Republic the GBAORD statistics is provided by CZSO in cooperation with the Research, development and innovation council through the R&D information system (IS R&D&I)[20].

All data on the total direct R&D support from the state budget, if not stated otherwise, is based on information included in the final account of the Czech state budget for R&D (R&D Chapter) provided by the Ministry of Finance of the Czech Republic. These are actual R&D expenditures of the state budget in a given year that were really used and not planned (approved).

Since the statistical exercise GBAORD is based on the analysis and identification of all funds directed to public R&D from public budgets obtained from administrative sources, it differs from data received directly from the recipients of the support (Chapter A.1). The international comparability of data from the statistical exercise GBAORD is generally lower in most countries than data obtained directly from the entities performing R&D.

Table A.7: Total expenditures of the state budget of the Czech Republic to support R&D (CZK billion)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Approved expenses	12,6	12,5	13,9	14,7	16,5	18,2	21,5	23,0	24,8	25,4	25,9	26,6
Approved expenses*	.	.	.	.	.	.	25,1	23,1	32,4	29,4	28,9	38,7
Actual expenses	**12,6**	**12,3**	**13,4**	**14,2**	**16,4**	**18,3**	**20,5**	**20,5**	**23,0**	**22,6**	**25,8**	**26,2**
Actual expenses*	.	.	.	.	.	.	20,5	20,5	24,1	24,9	37,5	39,1

Note: including expenses for pre-financing of EU programs, backed by revenue from the EU.*
Source: Ministry of Finance of the Czech Republic; state final account of the Czech Republic, chapter R&D

Total direct R&D support from the state budget – basic indicators

In the Czech Republic the state budget, after the investment from private business sources, represents the second most important source of business R&D funding. In 2012 the share of public resources to the total expenditure on R & D carried out in the Czech Republic, approximately 42%. The share of public sources achieved its maximum value in 2009 (almost 48%), since then the percentage of public sources in the total R&D expenditure is slightly decreasing.

In 2012, the direct R&D support from the state budget increased by CZK 0.4 billion, compared to 2011, to a total of CZK 26.2 billion, which amounts to approximately 2.27% of the total expenditure in the state budget and 0.68% of GDP. The direct R&D support from the state budget has reached the highest level in the reporting period since 2001. In the total expenditures of the public budget, which in addition to the state budget, includes the territorial budgets and which is used for international comparison, the state R&D spending in 2011 amounted to 1.53%.

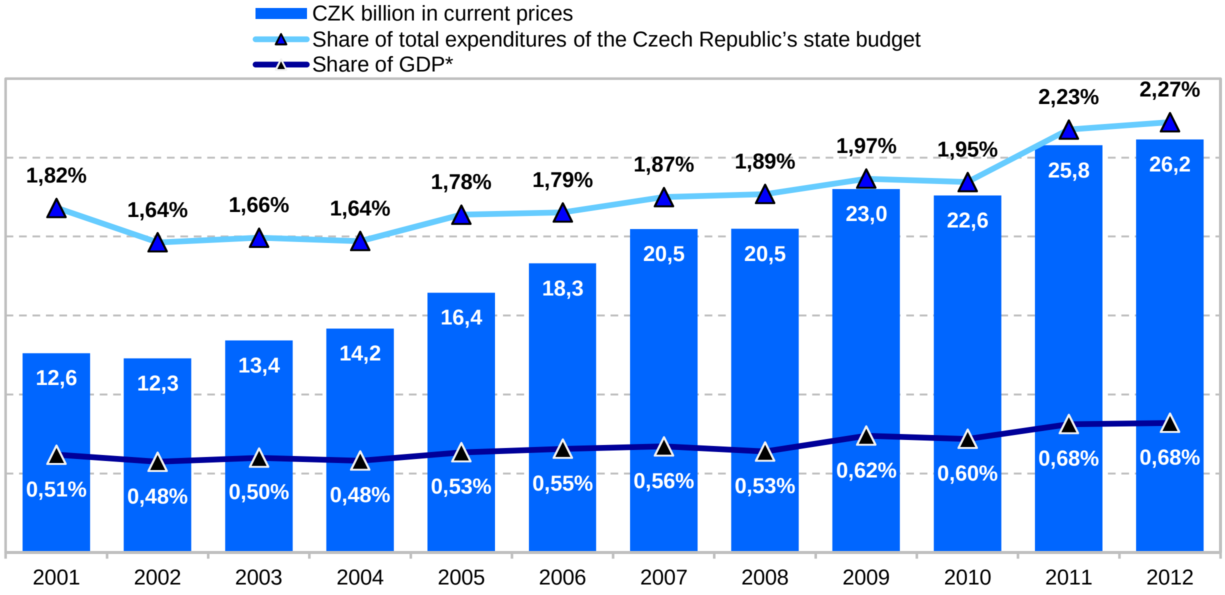
The State budget expenditures on R&D, after a fairly significant decline in 1992 and 1993, continuously grow in current and constant prices (with the exception of 2002, 2008 and 2010). There are, however, noticeable differences in the increase of expenditures for different years. A significant increase in 2011 was largely due to co-financing of EU projects from the structural funds from the Czech state budget. The increase between 2011 and 2012 is not as significant.

The R&D expenditures from the state budget at current prices in 2012 were more than two times higher than ten years ago (in 2002, the R&D expenditures amounted to CZK 12.3 billion). During this ten-year

[20] www.isvav.cz/

period, the governmental, higher education, business and the private non-profit sector drew a total of CZK 213 billion from the state budget, in the last five years (2008-2012) it was CZK 118 billion.

Chart A.31: Total expenditures of the Czech state budget for direct support of R&D (CZK billion, %)



*Note: * In the same year an extraordinary revision of the national accounts was completed, which had an impact on the recalculation of the GDP in the Czech Republic from 1995 to 2010.*
Source: The Czech Statistical Office 2013 according to data from the state final account of the Czech Republic, Chapter R&D (MF CR)

Table A.8: Year-to-year changes in total expenditures of the Czech Republic's budget for direct support of R&D

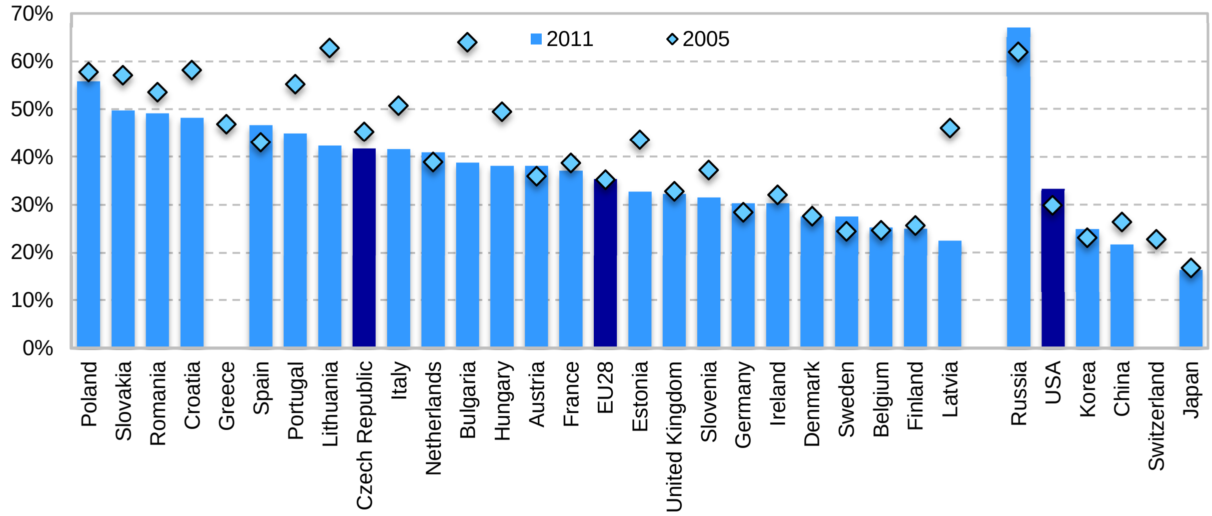
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
CZK billion (current prices)	**0,7**	**-0,3**	**1,1**	**0,7**	**2,3**	**1,9**	**2,2**	**0,0**	**2,5**	**-0,4**	**3,2**	**0,4**
% at current prices	6,0	-2,6	9,4	5,6	16,0	11,3	11,8	0,1	12,3	-1,8	14,1	1,5
% in constant prices in 2005	1,3	-5,2	8,4	1,5	16,4	10,8	8,2	-1,8	9,8	-0,2	15,1	0,0

Source: The Czech Statistical Office 2013 according to data from the state final account of the Czech Republic, Chapter R&D (MF CR)

International comparison

The Czech Republic is among countries with a higher percentage of public sources in R&D funding. The share of public sources on the total R&D expenditures (GERD) in 2011 was almost 42%, which is approximately six percentage points more than the average of the EU28 countries where the public sources in 2010 accounted for approximately 35% of the total R&D expenditures. However, the share of the public sources in funding R&D in the Czech Republic has been gradually declining in recent years.

Chart A.32: Share of public sources on funding R&D performed in the relevant country (% GERD)



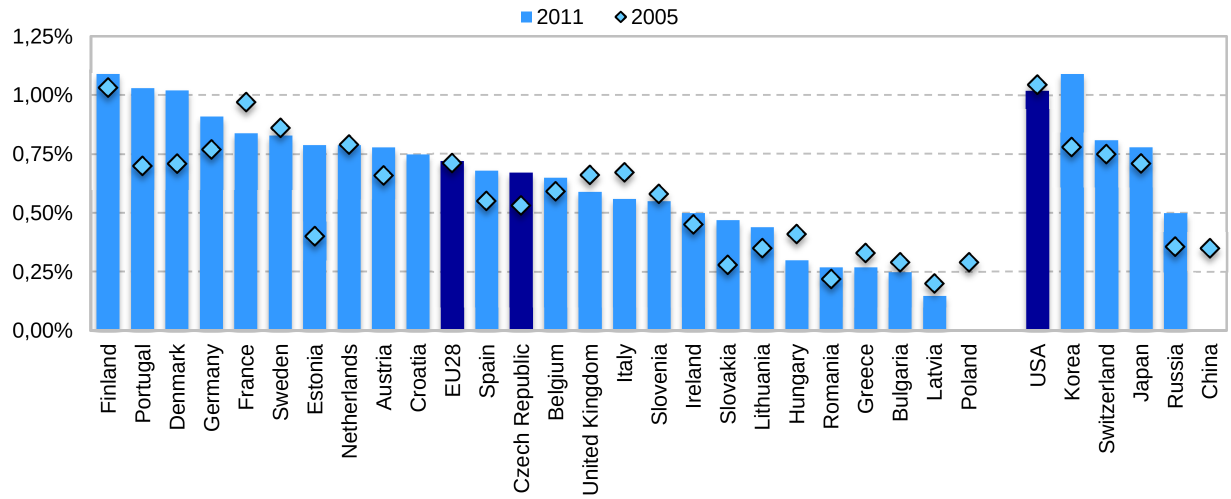
Note: EU28, France, Italy, Germany, Portugal, Spain: 2010, Belgium, Netherlands: 2009; Switzerland: 2004. The current data for Greece and Switzerland are not available.
Source: Source: OECD (MSTI 2013/1), Eurostat (August 2013) and CZSO's own calculations

Among the EU countries with a higher percentage of public sources are especially southern and new member states, such as Spain, Portugal, Italy, Romania, Slovakia and particularly Poland, where in 2011, the share of public sources in R&D funding exceeded 55%. A higher proportion of public resources in the R&D funding was recorded only in Russia, where public sources contributed approximately two-thirds of the total R&D expenditures in 2011. In contrast, a relatively low share of public sources in R&D funding can be observed in the Scandinavian countries (particularly in Finland), and in Belgium, Ireland and Germany. A low share of public sources in R&D funding can be also found in some Asian OECD countries, China and Switzerland.

Public R&D expenditures in the EU28 average in 2010 (latest available data) reached the level of 0.72% of GDP. The highest share of public R&D expenditures relative to GDP in the framework of the EU28 can be found especially in the Scandinavian countries, Germany, and surprisingly also in Portugal. Public R&D expenditures exceeded 1% of GDP in Finland, Portugal, and Denmark, as well as in Korea and in the United States. A high proportion of public expenditures relative to GDP can be also observed in Japan and Switzerland, despite the fact that the share of public sources in the total R&D expenditures in these countries is relatively low.

The Czech Republic, with a share of public expenditure relative to GDP at 0.67% (2011 data) is slightly below the European average. Even though the Czech Republic in this indicator exceeds most of the new EU member states, as well as some of the original EU countries, such as Ireland, Italy, the United Kingdom or Belgium, it still considerably lags especially behind Scandinavian countries, Germany, Portugal, and from the new EU member states also Estonia. However, public R&D expenditures as a share of GDP have been slightly growing in recent years in the Czech Republic.

Chart A.33: Intensity of public R&D expenditure (GBAORD as % of GDP)

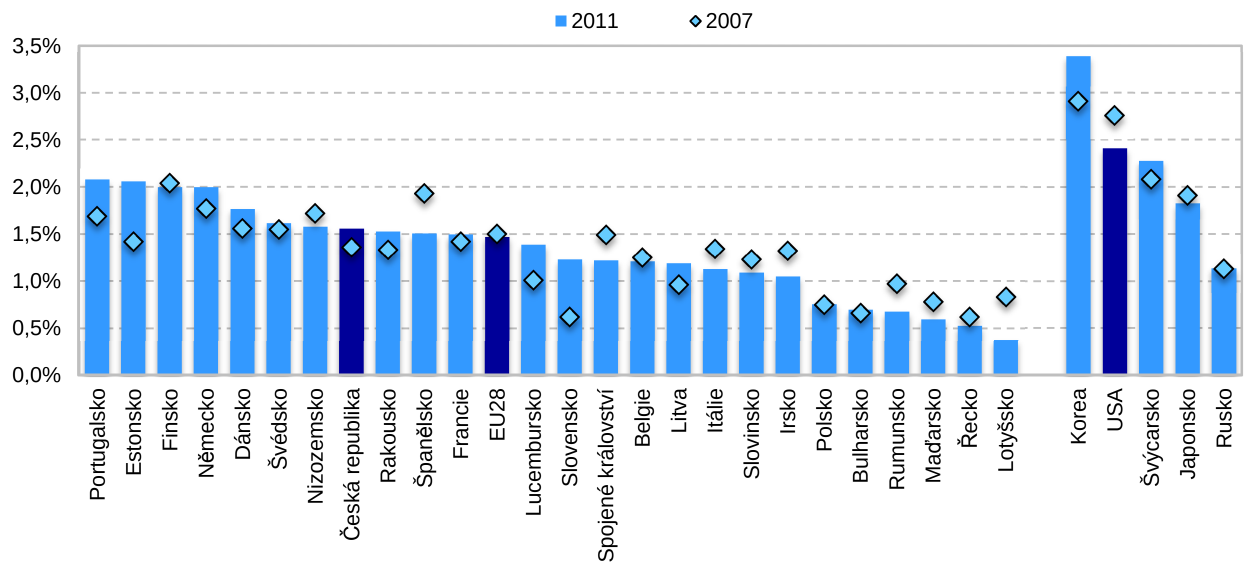


Note: United States, Korea, Switzerland and Russia: 2010
Source: OECD MSTI 2013/1, Eurostat (September 2013) and CZSO's own calculations

The total state budget appropriations and outlays for R&D (GBAORD) in 2011 in the EU28 totaled EUR 91.5 billion, which is approx. EUR 1.2 billion less than in 2010 (down by approximately 1.3%). Three countries - Germany, France and the United Kingdom - contributed to more than half of government R&D spending. In 2011 the Czech Republic increased its state budget expenditures and subsidies for R&D by approximately EUR 150 million, compared to 2010, and exceeded the threshold of EUR 1 billion, which is more than 1% of the total EU28 state budget expenditure. Despite the increase in the state budget expenditures on R&D, they do not reach even half the value of public R&D expenditures in Denmark or Austria, which are the smaller countries than the Czech Republic according to the number of inhabitants.

The share of GBAORD in total public spending amounted on the EU28 average to 1.47% in 2011. Of the EU28 countries this share was the highest in Portugal, Estonia, Finland and Germany, where the state budget R&D expenditures exceeded (or achieved) 2% of the total public expenditures. The highest proportion of public R&D expenditures in total public expenditures among the monitored countries was reported in Korea (3.4% in 2010) and in the United States (2.4% in 2010). In the Czech Republic the state budget R&D expenditures exceeded 1.5% of the public budgets in 2011, which is more than the EU28 average. The Czech Republic exceeded all the new EU member states (with the exception of Estonia), as well as countries, such as Ireland, Italy and the United Kingdom. The Czech Republic reached the level of Austria, Spain and France in 2011.

Chart A.34: State budget expenditures and subsidies for R&D (% of total public expenditures)



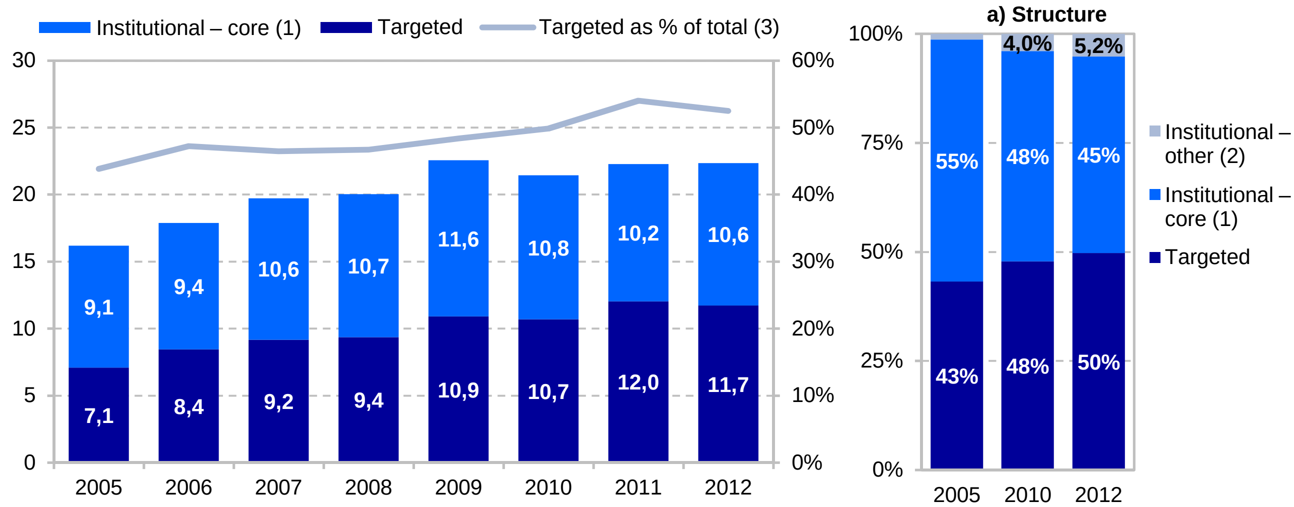
Note: Korea, United States and Japan: 2010, Poland: 2009, Switzerland and Russia: 2008

Source: OECD MSTI 2013/1, Eurostat (September 2013) and CZSO's own calculations

R&D support from the state budget by type of funding, providers and recipients

The state budget R&D expenditures in the Czech Republic have been growing in recent years, while there is a shift in the proportion of targeted and institutional support earmarked directly for R&D activities of R&D entities. In 2005, the level of institutional support was nearly CZK 2 billion higher than the targeted support, in the past two years (i.e. in 2011 and 2012) the targeted support exceeded the institutional support for R&D. The highest difference occurred in 2011, when the targeted support for R&D in absolute terms exceeded institutional support by CZK 1.8 billion. However, the difference between targeted and institutional support was narrowed down in 2012.

Chart A.35: The Czech state budget R&D expenditures according to the form of funding (CZK billion, %)



(1) Includes support of research intentions, specific research at universities, infrastructure of the Academy of Sciences and as of 2010, also the long-term support of activities for the development of research organizations.
(2) Includes the costs of the R&D support system, in particular, to ensure public competitions and evaluation of projects, awards, international fees, etc. and the costs associated with the activities of the RVVI, GACR, TACR and AS CR.
(3) Does not include the co-financing of projects from the EU and other institutional support - see aforementioned note (2)
Source: The Czech Statistical Office 2012 according to data from the state final account of the Czech Republic (MF CR) and IS R&D&I (RVVI)

The most important provider of public support for R&D in the Czech Republic since 1999 is the Ministry of education, youth and sports (MoEYS). In 2012 approximately CZK 10.2 billion from its budget chapter was distributed to R&D support, which represents 39% of the total direct R&D support from the state budget. The amount of resources provided by MoEYS to support R&D from 2000 to 2011 increased almost three times, in 2012, however, the financial resources provided by MoEYS to support R&D decreased, in comparison to 2011, approximately by CZK 0.4 billion.

The second most important provider of public support for R&D is the Academy of Sciences of the Czech Republic (AS CR). The AS CR's share of the total R&D public support in the Czech Republic, however, has been sharply declining in recent years (in 2005 the AS CR's share of the overall R&D public support was 27%, its share dropped to 18% in 2012).

MoEYS and AS CR are also the largest providers of R&D institutional support in the Czech Republic. In 2012 MoEYS and AS CR together accounted for 89% of the R&D institutional funding. MoEYS (approximately CZK 7.7 billion, i.e., 56% of the total institutional funding) supports primarily public universities, and AS CR (approximately CZK 4.5 billion. CZK, 33% of the total institutional support) its individual institutes. In case of MoEYS, the amount of institutional funding in 2012, as compared to 2011, increased by approximately CZK 0.85 billion, for AS CR the amount of institutional funding remained virtually unchanged.

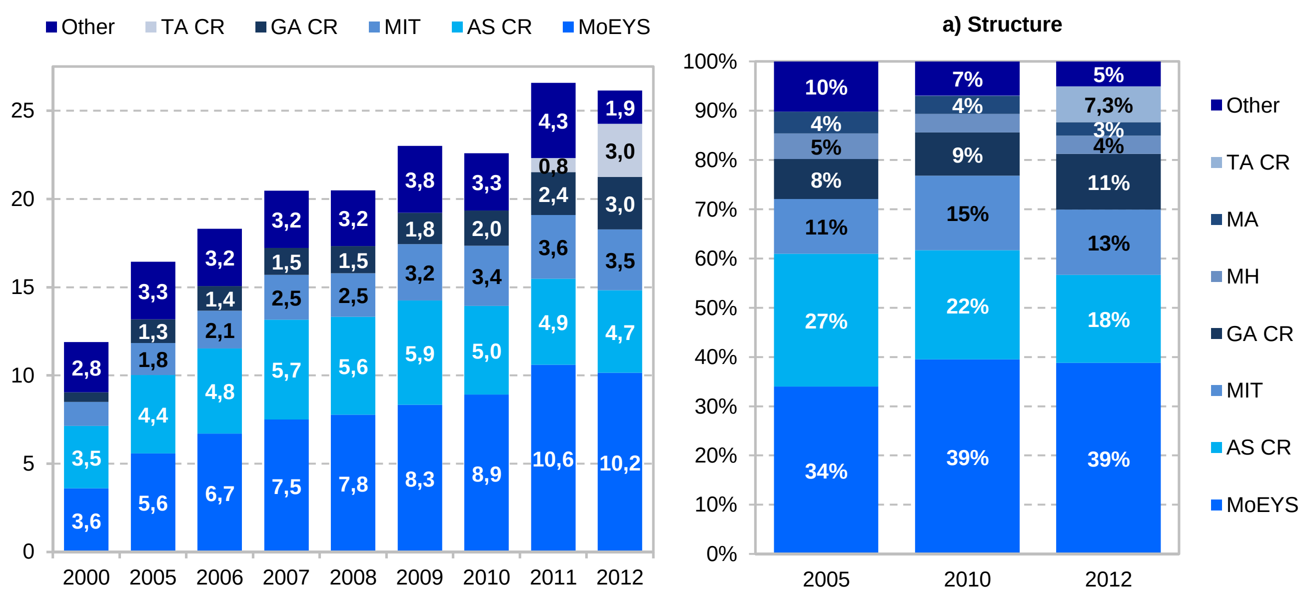
In 2012, in addition to MoEYS and AS CR, there was institutional funding for departmental institutes (which mostly function as public research institutions) and other research organizations provided by the Ministry of Agriculture (MoA, CZK 321 million), Ministry of the Interior (MoI, CZK 47 million), Ministry of Defense (MoD, CZK 89 million), Ministry of Health (MoH, CZK 391 million), Ministry of Culture (MoC, CZK 67 million) and MIT (CZK 444 million).

In 2012 the targeted (project) support for R&D in the Czech Republic was financed by 12 budget chapters, which is five budget chapters less than in 2011 (the reduction of the number of budget chapters is in accordance with the reform of research, development and innovation system in the Czech Republic approved by the government resolution of No. 287 dated March 26, 2008). Ministry of Industry and Trade (MIT), which supported applied research and experimental development through the TIP program, remained the most important provider of R&D support in 2012. MIT, which is the main provider of targeted support in the Czech Republic since 2004, appropriated a total of CZK 3 billion in 2012, i.e., approximately a quarter of total targeted R&D support in the Czech Republic. The main beneficiaries of this support are private domestic businesses.

The Czech Science Foundation (GACR), which provides grants for basic scientific research became the second most important provider of targeted support for R&D in 2012. Targeted support provided by GACR, compared to 2011, increased by more than CZK 0.5 billion to almost CZK 2.9 million, which represents approximately 23% of the targeted support allocated to R&D in 2012 in the Czech Republic.

The third most important provider of R&D targeted support was MoEYS, whose targeted support in 2012 amounted to nearly CZK 2.5 billion, which represents approximately 20% of the total R&D targeted support. It was primarily support of specific higher education research and R&D support in the so-called cross-sectional areas (international cooperation in R&D, large infrastructures for R&D). However, compared to the previous year, MoEYS recorded a decline in targeted support of CZK 1.3 billion (in 2011 MoEYS distributed CZK 3.29 billion, i.e., 26% of the targeted support).

Chart A.36: The Czech state budget R&D expenditures according to the main providers (CZK billion, %)



Source: CZSO 2013 according to data from the state final account of the Czech Republic (MF CR), IS R&D&I (RVVI secretariat) and its own calculations

In 2012 there was a significant increase in the share of targeted support provided by the Technology Agency of the Czech Republic (TACR), which distributed approximately CZK 1.9 billion this year, which represents an increase by more than CZK 1 billion compared to 2011. TACR ranked in fourth place in the volume of provided R&D support in 2012. TACR supports especially applied R&D through programs ALFA, BETA, OMEGA and the competence centers.

The other R&D targeted support providers in 2012 included MoH (approximately CZEK 570 million; 4.6% of the total targeted support), MoA (approx. CZK 400 million; 3.2%) and MoD (approximately CZK 300 million; 2.4%), which finance sectoral applied R&D. Support for the so-called cross-sectoral applied research was provided by MoC (approx. CZK 310 million; 2.5%) and MoI (approx. CZK 480 million; 3.8%). The Grant

Agency of the Academy of Sciences of CR, which attenuates its activity and since 2009 does not finance any new projects, provided targeted support in the amount of approximately CZK 160 million in 2012.

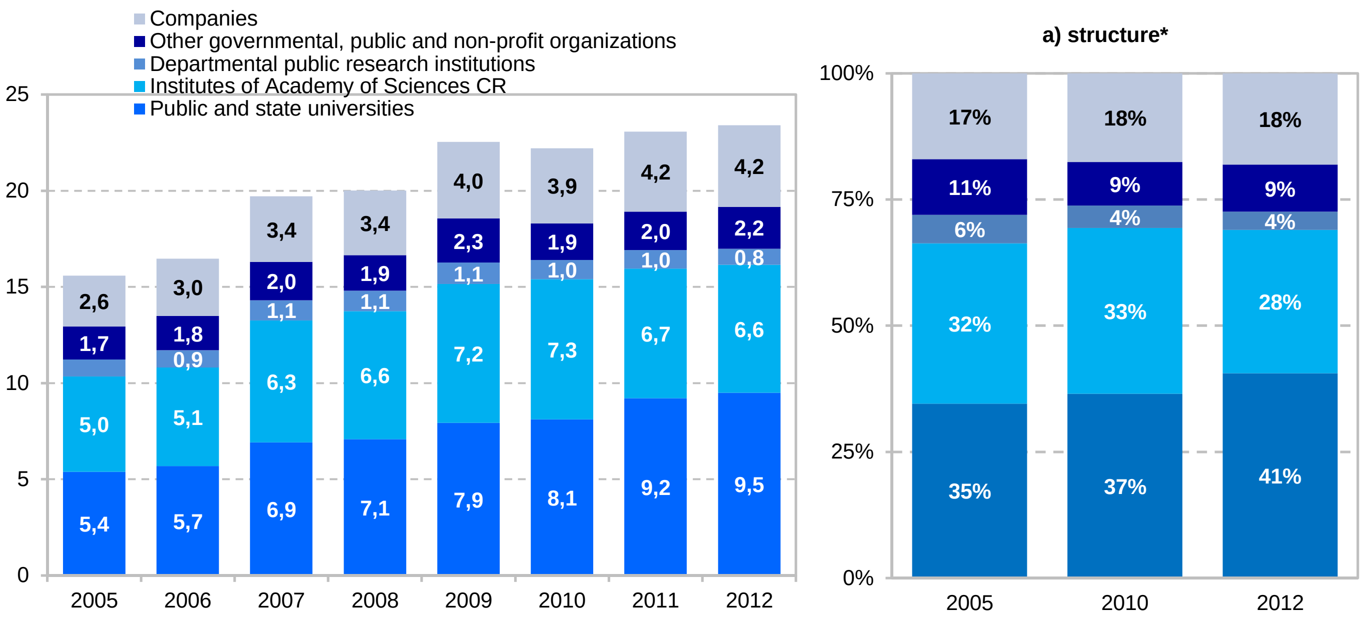
The main beneficiaries of R&D support from the state budget in the Czech Republic include public and state universities and public research institutions. Public and state universities receive a higher proportion of support since 2011. In 2012, it was approximately CZK 9.5 billion, which represents more than 40% of the total state budget expenditures on R&D (without the other institutional support). The amount of financial resources received for R&D by public universities from the state budget, increased in comparison with the previous year by approx. CZK 300 million.

The most significant recipient of public R&D support earmarked for university R&D is traditionally the Charles University in Prague, which in 2012 took advantage of approximately 29% of these funds (CZK 2.7 billion). The Czech Technical University in Prague received public support for R&D in the amount of CZK 1.3 billion (14%), and Masaryk University CZK 1 billion (11%) in 2012. These three public universities were allocated approximately 53% of the total public funding for R&D earmarked for R&D at public and state universities in 2012.

The second-largest beneficiaries of funds for R&D from the state budget are public research institutions (institutes of AS CR and departmental public research institutions), which received a total of CZK 7.5 billion in 2012, which represents 33% of the total R&D expenditures of the state budget. The most significant position among public research institutions belongs to the institutes of AS CR, which received CZK 6.6 billion in 2012. The highest amount of funds was awarded to the Institute of physics of AS CR (CZK 478 million, i.e., 7.2% of the total support provided to the institutes of AS CR). Other major recipients of support included Institute of Microbiology of the AS CR (CZK 271 million; 4.1%), Institute of Molecular Genetics of the AS CR (CZK 246 million; 3.7%), Biology Center of the AS CR (CZK 242 million; 3.6%), Institute of Physiology of the ASCR (CZK 217 million; 3.3%) and the Institute of Organic Chemistry and Biochemistry of the AS CR (CZK 202 million; 3.0%).

In the breakdown by scientific branches most of the funds were received by the life sciences and chemical sciences (CZK 2.5 billion; 37% of the total funds raised by institutes of the AS CR). Significantly fewer resources were earmarked for mathematics, physics and earth sciences (CZK 1.8 billion; 14%).

Chart A.37: The Czech state budget R&D expenditures* according to the main beneficiaries (CZK billion, %)



*Note: * Does not include the co-financing of projects from the EU and other institutional support (items related to administration of R&D, such as the costs of R&D support system to ensure public competitions and evaluation of projects, awards for R&D results, costs associated with the activities of RVVI, GACR, TACR and AS CR). The other category includes in particular the university hospitals and other public health facilities; Libraries, archives and museums, performing R&D, associations and non-profit organizations, etc.*
Source: The Czech Statistical Office 2013 according to data from the state final account of the Czech Republic (MF CR) and IS R&D&I (RVVI)

In 2012 the departmental public research institutions received CZK 840 million, which represents less than 4% of the total state budget R&D expenditure (without other institution support). The most important of these is the Crop Research Institute, which received approximately CZK 140 million in 2012 (almost 17% of the total support obtained by the departmental institutions). The amount of public support for R&D received by AS CR, and in particular the departmental research institutes, decreased in 2012 compared with 2011 (unlike universities, where the amount of support increased). In case of departmental institutes, the support decreased by almost 13%.

Businesses (private and public) received more than CZK 4 billion in 2012, i.e., 18% of the total state budget expenditure on R&D (without the other institutional support). The largest portion of this support was received by domestic private businesses (77%), a significantly smaller share of support was obtained by private foreign-controlled businesses (17%) and the smallest by public companies (6%).

The main beneficiaries of R&D targeted support from the Czech Republic's state budget are public and state universities. Their share of targeted support increased from 25.8% (CZK 1.8 billion) in 2005 to 32% (CZK 3.7 billion) in 2012. Another important group of targeted support beneficiaries includes private domestic companies, which received CZK 3.1 billion (26% of targeted support) in 2012. Overall businesses (private and public) obtained CZK 4 billion of targeted support, which exceeds the amount received by universities. Public research institutions acquired CZK 2.7 billion in 2012, i.e., 23% of targeted support provided for R&D in the Czech Republic.

In terms of public support for research and development in the business sector, there is a distinction between direct and indirect support. In addition to direct support described in this chapter, since 2005 businesses also use indirect support through the application of the deduction of deductible R&D items from the tax base in accordance with section 34 (4) of Act No. 586/1992 Coll., on income taxes. Information on indirect support is included in the following chapter.

A.3 Indirect R&D support from the Czech Republic's state budget

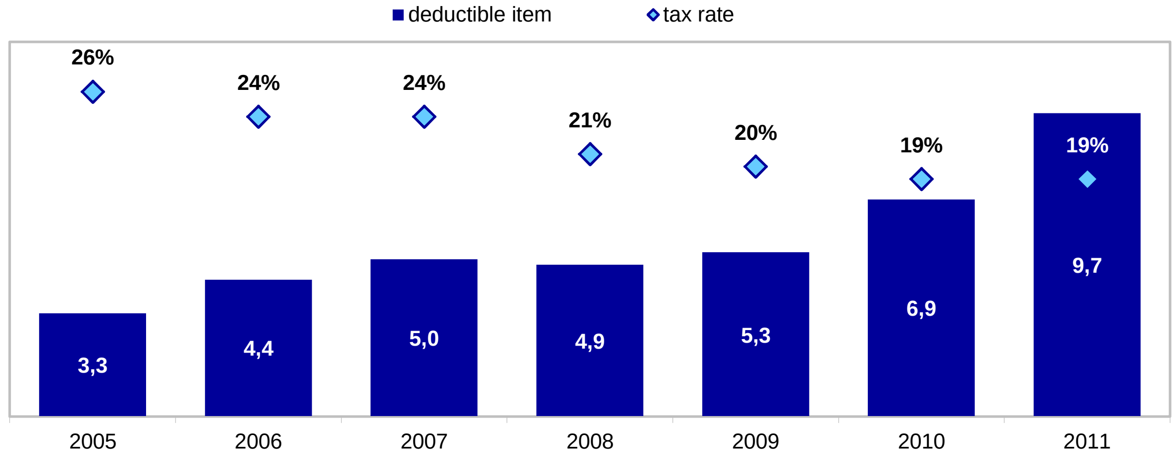
Indirect support for research and development in all developed countries is currently becoming an increasingly widespread tool to encourage investment in R&D in the private business sector. The most common forms of indirect R&D support include tax incentives and credits, accelerated depreciation of investments, reduction of social security contributions, exemption from customs duties, subsidized loans, venture capital support and discounted rental of central and regional infrastructure.

Indirect support for R&D is provided in the Czech Republic since 2005, by means of deduction of the deductible items from the tax base, which is regulated by section 34 (4,5) of Act No. 586/1992 Coll., on income taxes. Under this provision, taxpayers conducting R&D can deduct from their tax base 100% of R&D expenditures incurred while performing R&D during the taxable period. The conditions and procedure for applying the indirect support for R&D are set out in more detail in decree D-28, published by the Ministry of Finance of the Czech Republic on May 3, 2005.

Data on indirect public support for R&D are based on administrative data supplied by the Ministry of Finance of the Czech Republic on the basis of information from the individual tax offices. This data includes information about the amount of deductible items for R&D, which allows (by multiplying by the appropriate tax rate) to obtain data on the reduction of tax obligations for economic entities (indirect support for R&D).

The amount of corporate income tax rate and the sum of all deductible items for each year are shown in the following chart. It is evident from the graph that despite the gradual decline in the tax rate between 2005 and 2011, the tax deductible expenditure on research and development still grew on average by 20% a year. In 2011, companies received CZK 9.7 billion in tax deductions for R&D.

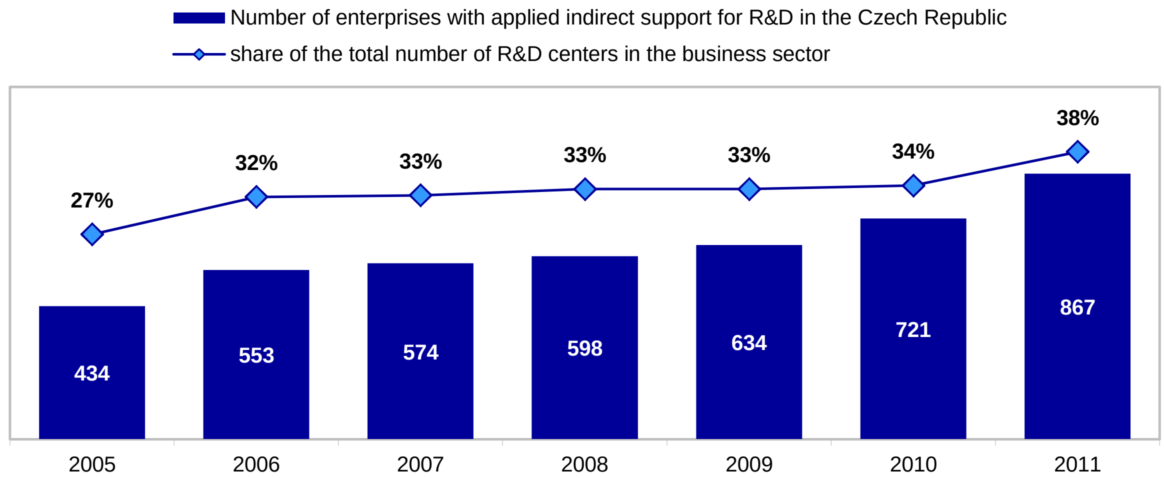
Chart A.38: Tax deductible item for R&D and the appropriate tax rate in the Czech Republic (CZK billion; %)



Source: Ministry of Finance of the CR and CZSO

In 2011, 867 companies in the Czech Republic claimed a tax deductible item for R&D, which represented 38% of all enterprises performing R&D. Compared to 2005, when the indirect support of R&D was introduced, there was both relative and absolute increase in the number of enterprises claiming this reduction of tax liability. Of the businesses that claimed the tax deduction for R&D in 2011, there were 608 private domestic companies, 253 private foreign-controlled enterprises and only 6 public companies. Of interest is the structure of companies claiming the tax deduction for R&D according to the amount of tax relief. While in 2011 three quarters of the enterprises gained indirect support of their R&D in the amount not exceeding CZK 1 million, the indirect support for R&D over CZK 10 million was received only by 19 companies.

Chart A.39: Number of enterprises with applied indirect support for R&D in the Czech Republic



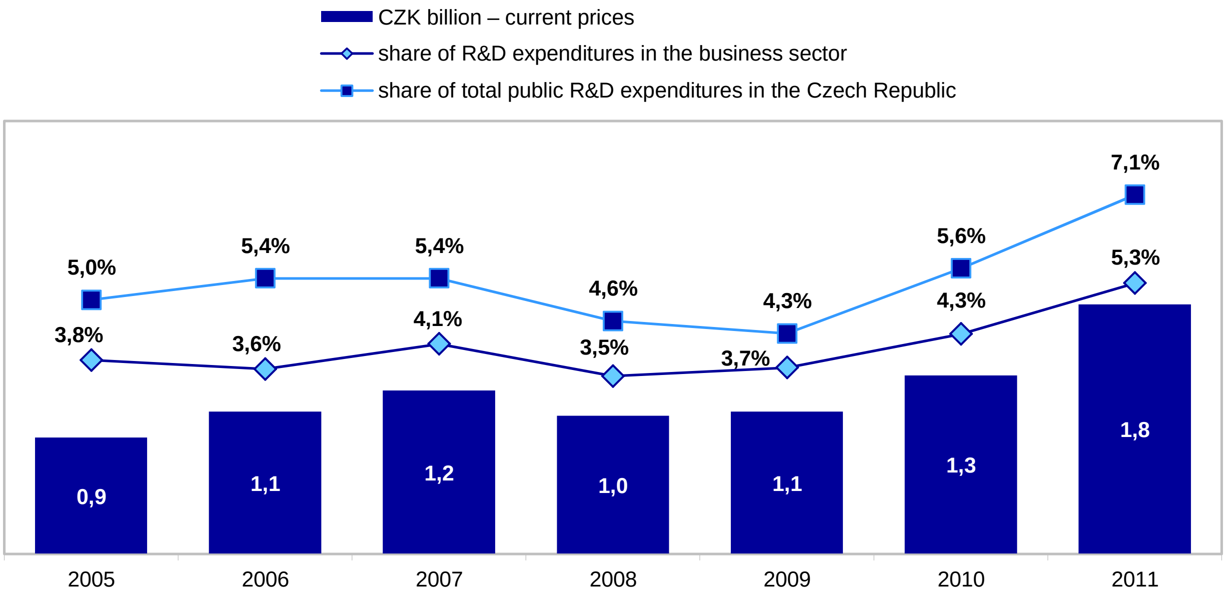
Source: Ministry of Finance of the CR and CZSO

Indirect support for R&D in 2011 reached CZK 1.8 billion, and represented 5.3% of the total expenditures in the business sector that year. If indirect support of R&D is expressed as a percentage of the total public expenditures to support R&D (i.e., total direct and indirect support), it is clear that in 2011 indirect public support for R&D amounted to 7.1% of the total R&D public support in the Czech Republic. In comparison with previous years, indirect support for R&D in 2011 was higher in absolute terms, as well as by its share of the total R&D expenditures in the business sector and its share of the total public support of R&D, which means the trend established in 2010 continues.

The largest portion of indirect support for R&D in all monitored years was claimed by private foreign-controlled businesses (foreign affiliates). In 2011 indirect support of R&D in these companies amounted to

CZK 1 300 million, which meant 70% of the total indirect R&D support. Nearly the entire remaining portion of indirect R&D support was allocated to private domestic firms, which left public companies with just CZK 10 million of indirect support for R&D. Similarly to 2009 and 2010, foreign affiliates showed a relative increase in indirect public support for R&D at the expense of private domestic businesses in 2011.

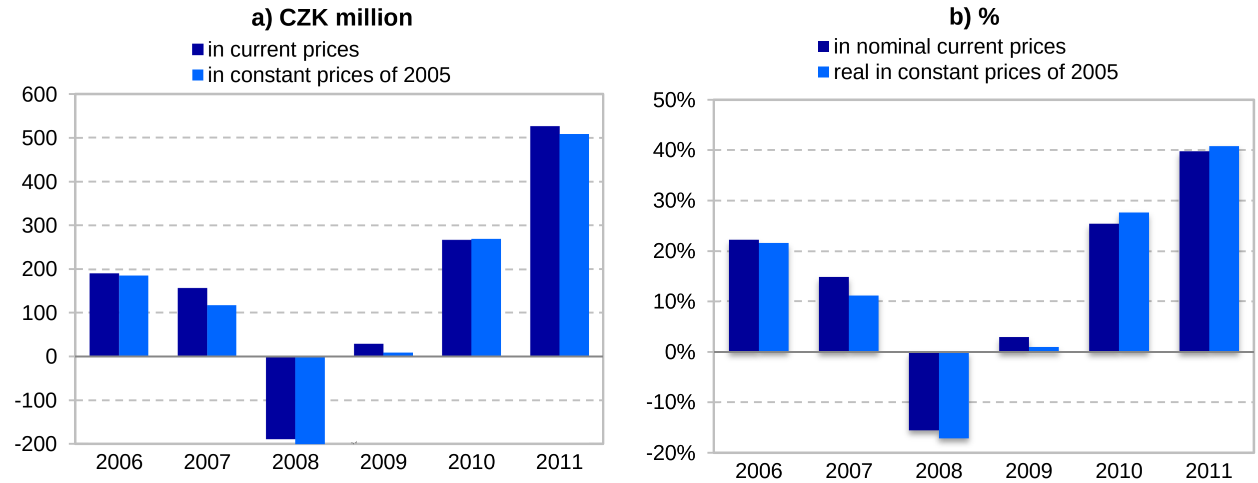
Chart A.40: Indirect R&D support in the Czech Republic (CZK billion; %)



Source: Ministry of Finance of the CR and CZSO

Between 2005 and 2011 the indirect R&D support in the Czech Republic grew by an average real annual rate of 12.6%. Despite maintaining the tax rate at 19%, the indirect R&D support increased by CZK 526 million at current prices last year, which represented nominal growth of 40%. During the reporting period an annual decline in indirect R&D support was recorded only in 2008, by less than one-fifth. This decline was due to a decrease in tax rates by 3 percentage points, as well as by the reduction of the deductible for R&D from the tax base.

Chart A.41: Annual change of indirect R&D support in the Czech Republic, 2006–2011



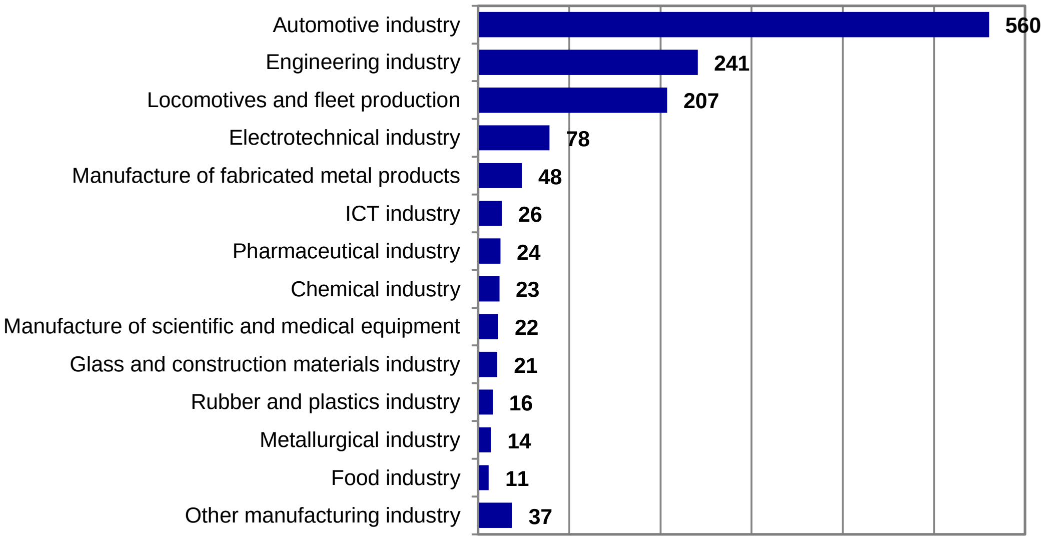
Source: Ministry of Finance of the CR and CZSO

In terms of the companies' size, businesses with more than 250 employees held a dominant position with 73% of consumed indirect R&D support in 2011. Medium-sized enterprises accounted for 19% of indirect R&D support (CZK 356 million) and small businesses for 7% (CZK 135 million).

It is not surprising that industrial companies recorded the most significant tax relief in all the years due to their spending on R&D. In 2011 indirect R&D support for industry amounted to CZK 1 354 million and for the service sector to CZK 491 million. Compared to 2007, there was a significant relative increase in indirect R&D support for services at the expense of the industrial sectors.

In terms of individual sectors of the manufacturing industry, the largest portion of indirect R&D support in 2011 was directed into the automotive sector (CZK 560 million, 42% of indirect R&D support in the manufacturing industry). The second and third place, in terms of the amount of indirect R&D support in 2011, was held by engineering (CZK 241 million) and the sector focused on the production of locomotives and rolling stock (CZK 207 million).

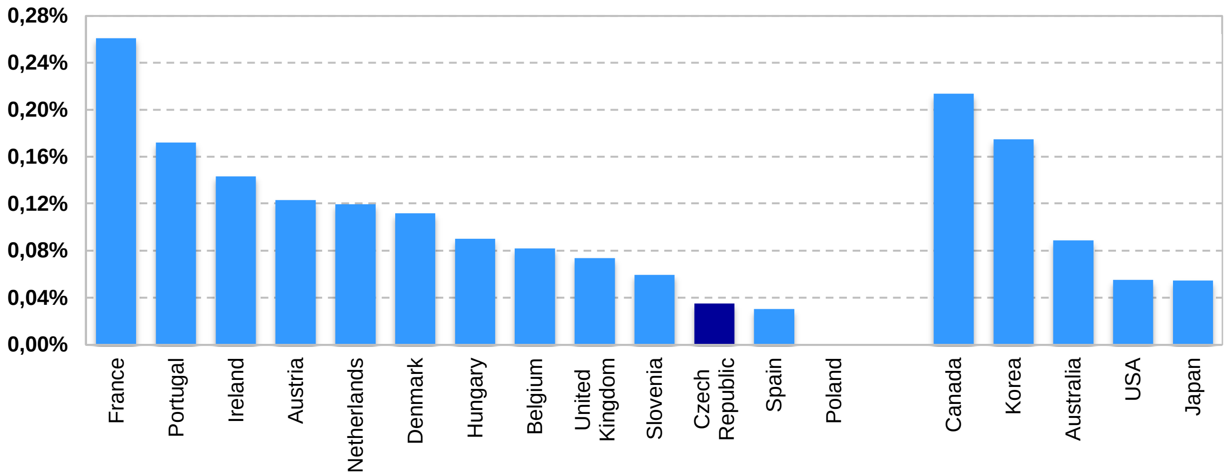
Chart A.42: Indirect R&D support in the manufacturing industry in the Czech Republic by sector (CZK million), 2011



Source: Ministry of Finance of the CR and CZSO

International comparison of indirect public R&D support is not a simple task, since not all countries currently use indirect public R&D support and statistical data on indirect R&D support is not available for countries. The existing data, however, shows that the indirect R&D support as a percentage of GDP in 2010 was the highest in France (0.26% of GDP), Canada (0.21% of GDP), Portugal (0.17%) and Korea (0.17%). The Czech Republic, with its share of 0.03% of GDP, ranked among countries with the relatively lowest indirect R&D support. The comparison of indirect and direct public R&D support in the business sector is also interesting. It shows that indirect R&D support exceeds direct R&D support in such countries as Canada, Portugal, the Netherlands, Ireland, Hungary, Denmark, France and Japan.

Chart A.43: Indirect R&D support as % of GDP, 2010 or the last available year



Source: OECD

B Human resources for research and development

Availability of high-quality human resources plays a significant role in facilitating economic and technological development. Securing adequate human resource base for the activities associated with research, development and innovation depends on the situation on the labor market, as well as the trends in education, particularly at universities.

The objective of this part of the analysis, which is divided into three main chapters, is to provide information about the development of the number and structure of workers in R&D, skilled human resources and students of higher education in the Czech Republic and to outline their specific characteristics and major trends in the international context.

Main trends

- In 2012, there were 86.9 thousand full-time and part-time employees in R&D in the Czech Republic and their number has increased more than 1.5 times since 2001. When converted to full-time equivalency dedicated to R&D, there are 60.2 thousand workers employed in research. More than half of the workers in R&D are employed long-term in the business sector.
- It is possible to describe researchers as the most important group of R&D workers, without whom there would certainly be no new knowledge. Researchers have various representation in R&D of the different sectors. The smallest number of researchers is among the business R&D employees (48%), the governmental R&D employs 53% and in case of universities researchers represent the dominant group of employees (70%).
- There is high representation of persons with tertiary education (higher education and higher vocational education) among the R&D staff, where only 28% of the R&D employees achieved a lower education level. The persons with higher education degrees are represented to the greatest extent in the higher education sector, which is, of course, determined by the main functions of universities, which are education and science.
- A significant proportion of R&D staff is focused on R&D in technical and natural sciences. These two areas employ 77% of them, with a greater portion involved in technical sciences. Technical sciences completely dominate among the business R&D staff with 70% of employees. In contrast, more than half of the staff in the governmental sector R&D is focused on natural sciences, with only 8% in technical sciences.
- The number of people who have completed tertiary education in the Czech Republic continues to increase every year. There were nearly 1.350 million such people in the age group over 25 years in the Czech Republic in 2012, which amounted to 17.3% of this demographic group. At the beginning of the reporting period, in 2000, approximately 714 thousand people completed tertiary education, which accounted for 10% of the population.
- Over the years the number of University students continues to rise, their number since 2001 almost doubled, to nearly 400 000 students in 2012. Young people, however, are moving away from the study of technical disciplines and even in the case of natural and medical sciences their numbers do not increase significantly. By contrast, great interest by the students in the study of social sciences, business and law and humanities was recorded in recent years.

Chapter B.1 Employees in R&D contains basic information about the total number of employees in R&D and their structure according to individual available characteristics, as well as about the number and structure of researchers and R&D employees in the individual sectors (business, governmental, university). In addition to the data for the Czech Republic, the chapter also includes basic indicators in international comparison.

Chapter B.2. Salaries of specialists in the field of science and technology contains information about the average gross monthly salary of persons employed in this group. There is information on the total salaries, as well as salaries by gender, age and achieved education. All this information is compared with the gross average monthly salary in the Czech Republic.

Chapter B.3 Higher education contains information on the number and structure of persons who have completed tertiary education and also basic information about students in higher education, both on the development of their numbers, as well as on their distribution among different study programs and fields. Special emphasis is placed on students in the fields of natural and technical sciences in all higher education study programs, and especially in the doctoral program. This chapter also sets the Czech Republic in the context of international comparison.

B.1 Employees in research and development

The source of data for Chapter B.1 is the Annual statistical survey on research and development (VTR 5-01), which collects information from all entities that perform R&D in the Czech Republic. The objective of this survey is to obtain detailed information on human and financial resources for R&D activities. The survey fully complies with the EU and OECD principles in the Frascati manual and the relevant EU regulations and, therefore the results for the Czech Republic are fully internationally comparable. For more information on the survey VTR 5-01 see methodological annex of this analysis or http://czso.cz/csu/redakce.nsf/i/statistika_vyzkumu_a_vyvoje.

The number of employees in research and development is measured using two basic indicators, which are the number of physical persons (HC) and the number of full-time equivalent persons dedicated to research and development activities (FTE):

- Number of R&D employees as of December 31 in physical persons (Headcount HC) provides evidence about the number of people engaged full-time or part-time in research and development activities, employed under contract at the end of the relevant year in monitored entities.
- Number of FTE employees in R&D provides evidence about the average number of FTE registered R&D employees dedicated to research and development activities in the reporting year. One FTE is equal to one year of work of an employee who is 100% dedicated to R&D activities.
- Unless otherwise stated, further on this chapter contains data on the number of FTE employees in R&D.

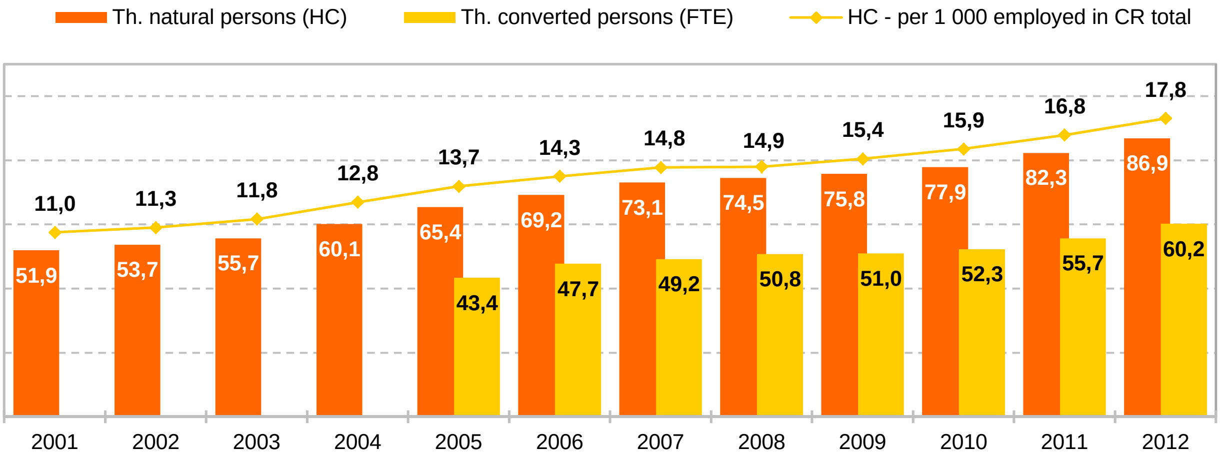
Total number of employees in research and development

Research and development employed 86.9 thousand full-time or part-time employees in the Czech Republic at the end of 2012 (HC). Since 2001, when there were nearly 52 thousand natural persons (HC), their number increased more than 1.6 times. The ratio indicator also showed continuous growth during the reporting period. In 2001 there were 11 natural persons in R&D for each 1 000 employees in the Czech Republic, while in 2012 the ratio increased to 17.8 R&D workers.

A large number of people working in R&D, especially researchers, have a work load simultaneously in multiple subjects, particularly in the higher education, and partially in the governmental sector. For this reason the HC indicator does not reflect the actual number of people working in R&D in the Czech Republic and the referenced number of R&D employees (HC) is therefore overestimated. After converting to a full-time equivalency dedicated to research and development activities (FTE) the number of R&D employees reaches 60.2 thousand this year.

In the long term one-third of R&D employees are women, both in the case of natural persons, as well as in the case full-time equivalency conversion.

Chart B.1: Employees in research and development



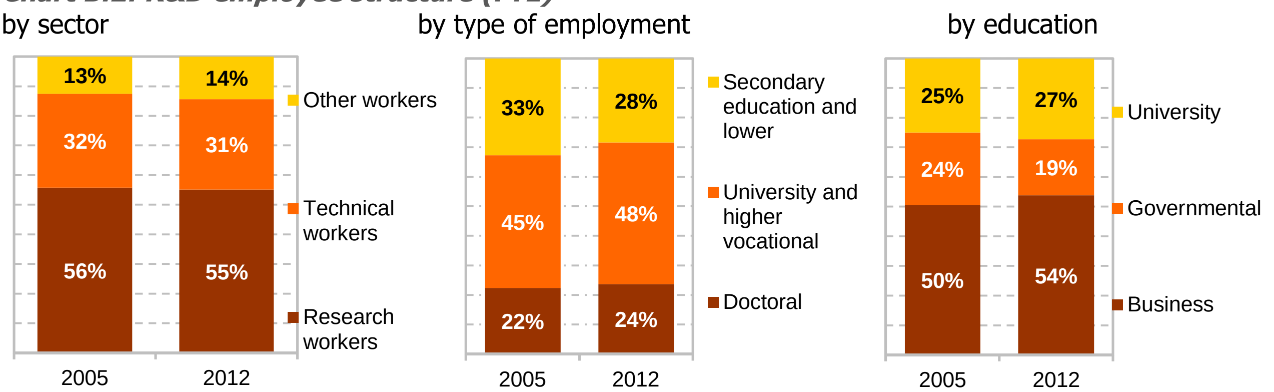
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

In 2012, as well as in previous years, most R&D employees worked in the business sector, specifically 32.2 thousand FTE workers, who accounted for 54% of all employees involved in R&D. In the same year more than 16 000 (27% of all of R&D employees) FTE workers were involved in research and development in higher education and the governmental sector R&D accounted for 11 000 FTE workers (19% of all R&D employees). Compared to 2005 the number of people employed in research and development in the business sector increased from 22 000 to 32 000 FTE workers and significant growth during this short period occurred also in the higher education R&D sector, which employed less than 11 000 FTE workers in 2005. The situation in the governmental sector can be described as stagnating.

In line with expectations, researchers dominate among the research and development staff. In 2012 they accounted for more than 33 000 FTE workers and among all R&D personnel represented, on average, more than half (55%). The second largest group of R&D employees are technicians (18 000, 31% of R&D employees) and the remaining approximately 8 500 R&D staff are among the other workers.

Since 2005, there is a moderate shift in the educational structure of R&D employees with a growing share of R&D employees with completed tertiary education (higher vocational, Bachelor's, Master's, doctoral). While in 2005 there were 67% of R&D employees who had completed tertiary education, by 2012 this percentage rose to 72%. More than 14 000 R&D employees in 2012 completed a doctoral study program.

Chart B.2: R&D employee structure (FTE)

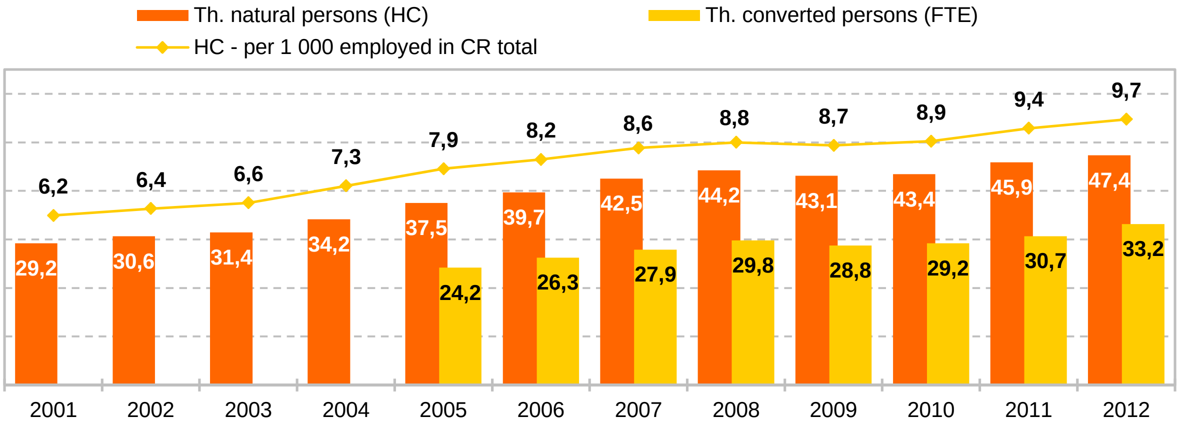


Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

Researchers

As mentioned above, researchers constitute a substantial portion of R&D employees, they account for 55% (FTE) of all R&D employees. There was 47 000 researchers in physical persons (HC) in the Czech Republic in 2012. After the FTE conversion the total was 33 000 researchers. Until 2008 the number of researchers was increasing continuously, between 2008 and 2009, however, their number declined. This decline in the number of researchers was substantially affected by the governmental sector, namely the institutes of the Academy of Sciences of the Czech Republic, where due to methodological reasons some researchers were reclassified as technical personnel. Between 2009 and 2010 a moderate increase in the number of researches was recorded again and their number has been rising significantly since 2010.

Chart B.3: Researchers



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

The distribution of researchers among the various sectors is very different depending on the unit of measure that is used. In terms of physical persons (HC) most researchers worked in the higher education sector in 2012, it was almost 21 000 people (44%), there were approximately 18 000 (39%) researchers in the business sector in the same year and nearly 8 000 (17%) in the governmental sector. On the contrary, the largest part of researchers expressed in FTE (number converted to full-time equivalent) in 2012 worked in the business sector (approx. 15 000 persons; 47%). Researchers in the higher education sector accounted for 35% (11 500) of the total and those in the governmental sector for 18% (6 000). This comparison shows that researchers in the higher education sector work more often on partial workloads.

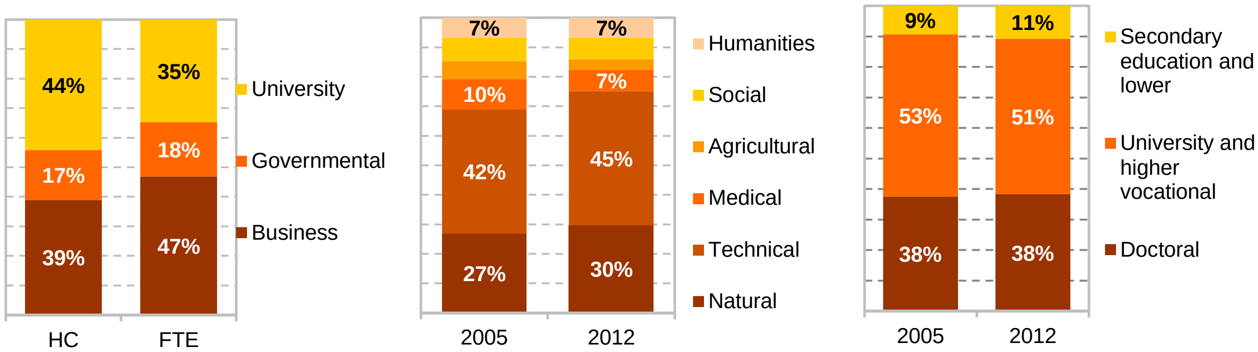
A significant proportion of researchers is dedicated to R&D in technical and natural sciences. These two areas employ 75% of them, with a majority involved in technical sciences. Medical sciences account for 7% of the total number or researchers, social sciences and humanities each account for 7% of all researchers. Agricultural sciences employ a mere 4% of all researchers.

Researchers achieve higher education than other R&D personnel. Almost 90% of researchers in the Czech Republic in 2012 completed one of the levels of tertiary education. In the case of all R&D employees, the share of workers with such level of education was 72%.

Information about the age of researchers is available for 2011. Nearly a third of them are between 25 and 34 years, 26% are in the 35-44-year category and the percentage decreases for the older age groups. The researchers' age structure in the individual sectors, however, is completely different. To be precise, a significant difference exists between the public and the business sector, which can be described as significantly younger. Data for researchers broken down by age is available in the table annex.

Chart B.4: Structure of researchers

by sector (2012) by scientific areas (FTE) by education (FTE)

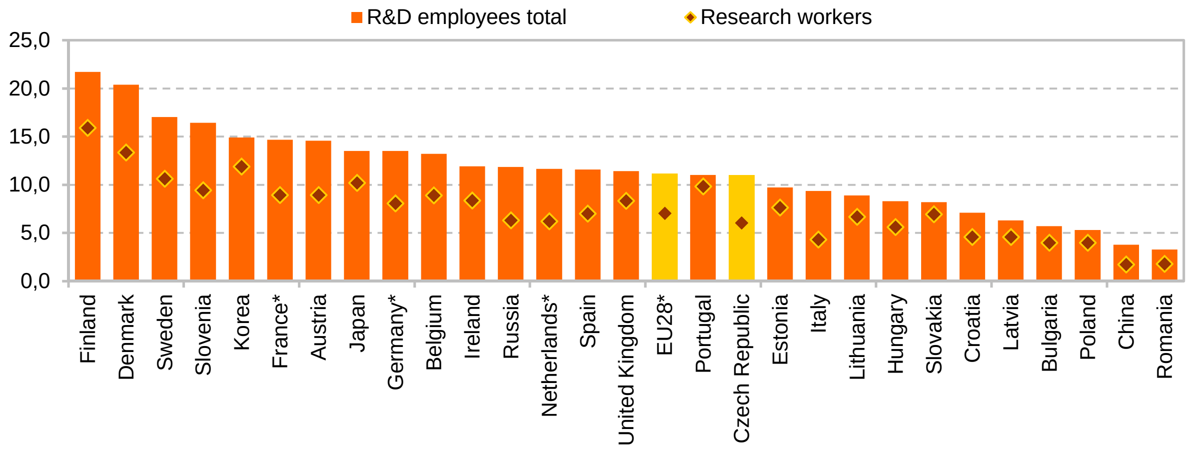


Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

International comparison

In 2011, the Czech Republic with 11 FTE workers in R&D for 1 000 employees was just below the European average, which in that year was 11.2 workers. A similar proportion of R&D workers in all employees, to that in the Czech Republic, can be found in Portugal or the United Kingdom. The highest values were recorded in Finland, where this indicator exceeded 21 R&D employees per 1 000 total employed, and in Denmark which came very close to this figure. On the contrary, the smallest representation of R&D workers among all the employed people can be found in China (3.8) and in Romania (3.3). To better grasp the absolute values of the number of R&D employees, let us mention that R&D employed 2.9 million people in China in 2011 and 2.6 million people in the EU28, which is almost three times smaller in terms of population.

Chart B.5: Research and development employees (FTE), 2011 (per 1 000 persons employed)

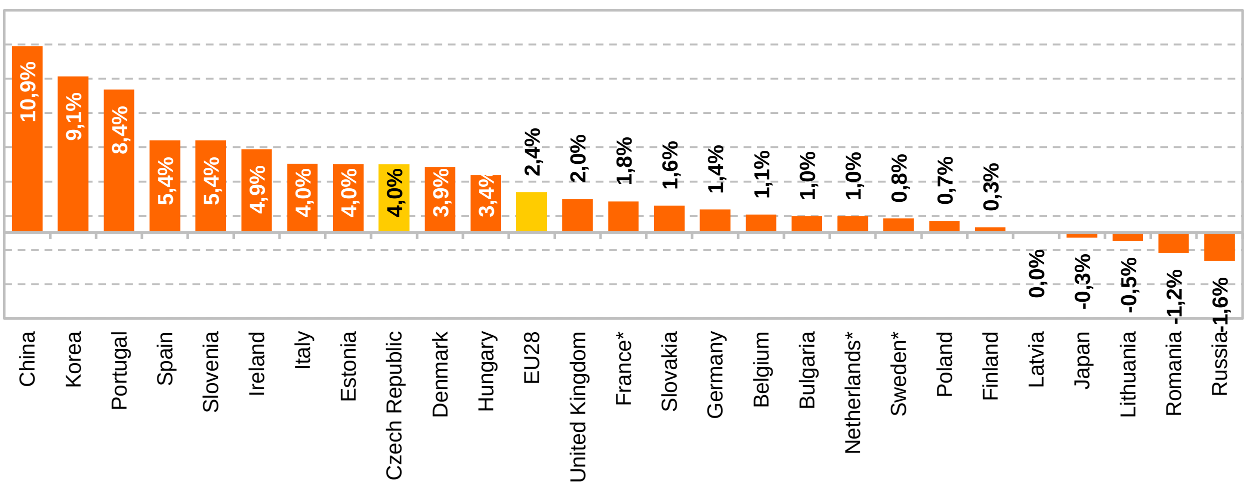


*Note: * data for 2010*
Source: OECD MSTI 2013/1, Eurostat 2013

In terms of the number of researchers, the Czech Republic was also below the European average. There were 6 FTE researchers per 1 000 persons employed in the Czech Republic in 2011, while the EU28 average was 7 researchers per 1 000 persons employed. More than 10 researchers per 1 000 employees is found in Japan, Sweden, Korea, Denmark and Finland.

The most significant growth in the number of R&D employees among the monitored countries occurred in China, Portugal and Korea. Throughout the EU28, the number of R&D workers in the reporting period increased year-on-year on average by 2.4%. Only a minimal increase was recorded, for example, by Poland and in the case of Latvia, Japan, Lithuania, Romania and Russia, the number of R&D employees on average decreased year-on-year.

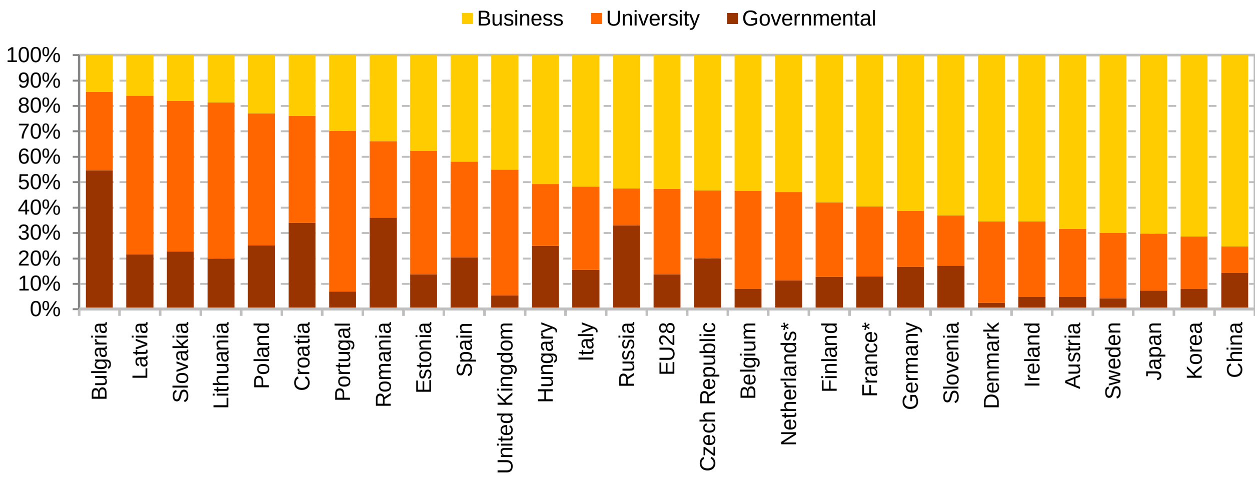
Chart B.6: Average annual increase in the number of R&D employees (FTE), 2000–2011 (%)



Note: The average year-to-year increase in the number of employees in the Czech Republic is calculated using the number of employees as physical persons (HC), since in 2005 there was a change in the methodology of calculating FTE in the Czech Republic, and for this reason the average year-to-year increase in the number of employees expressed in FTE would be significantly overestimated.
**France, Netherlands 2000 - 2010; Sweden 2001 - 2011*
Source: OECD MSTI 2013/1, Eurostat 2013

The public sector employs more than two-thirds of R&D employees in Lithuania, Slovakia, Bulgaria, Poland, Latvia, Romania, Portugal and Croatia, while in Bulgaria, 55% of them are employed in the governmental sector. Together with Italy, Hungary and Russia, the Czech Republic belongs among countries with an almost balanced ratio of employees in public and private R&D. The same applies for the average of the entire EU28. On the contrary, Austria, Sweden, Japan, China, and Korea have a dominant business sector, which employs approximately 70% of all R&D workers.

Chart B.7: Employees in research and development, by sectors of activity, 2011

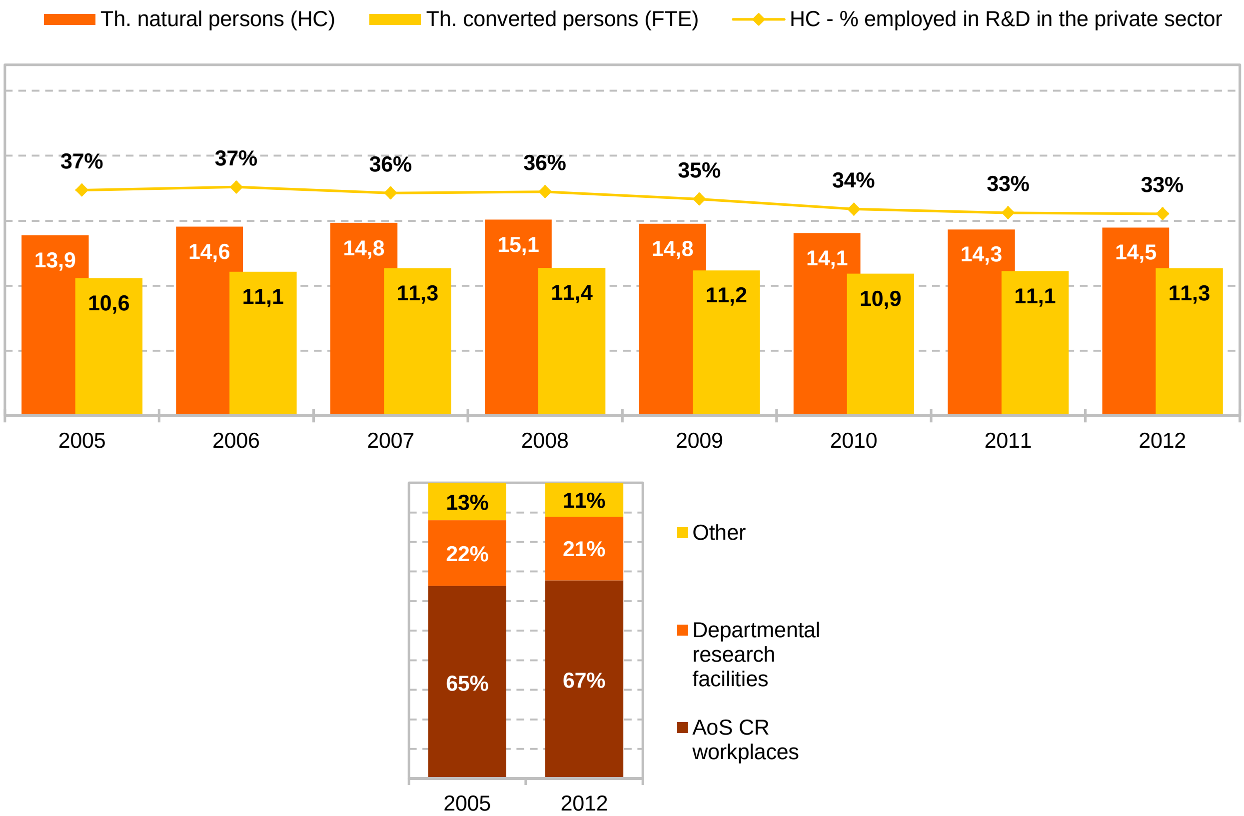


*Note: * data for 2010*
Source: OECD MSTI 2013/1, Eurostat 2013

Employees in governmental sector R&D

Between 2001 and 2005, the number of people working in research and development of the governmental sector was about 13 500 physical persons (HC). Since 2005 a moderate increase was recorded, which stopped in 2008 and reached the level of 15 100 persons working in the governmental R&D. Since then we were recording a decline and currently stagnation. In the last reporting year, in 2012, the governmental R&D employed 14 500 physical persons. In R&D of the entire public sector (governmental and higher education sector), there has been a continuous decline in the proportion of the R&D employees of the governmental sector during the reporting period. In 2001, the governmental sector employees accounted for 44% and in 2012 just 33% of all public R&D employees. If we convert physical persons employed in the governmental R&D to full-time equivalencies, the number of R&D employees will fall to 11 000 (FTE). The number of R&D employees in another public sector – in higher education - followed a completely different trajectory. There was a steady growth in both absolute and relative numbers of staff. More on the employees in higher education R&D in chapter B.1.3.

Chart B.8: Employees of the governmental sector research and development



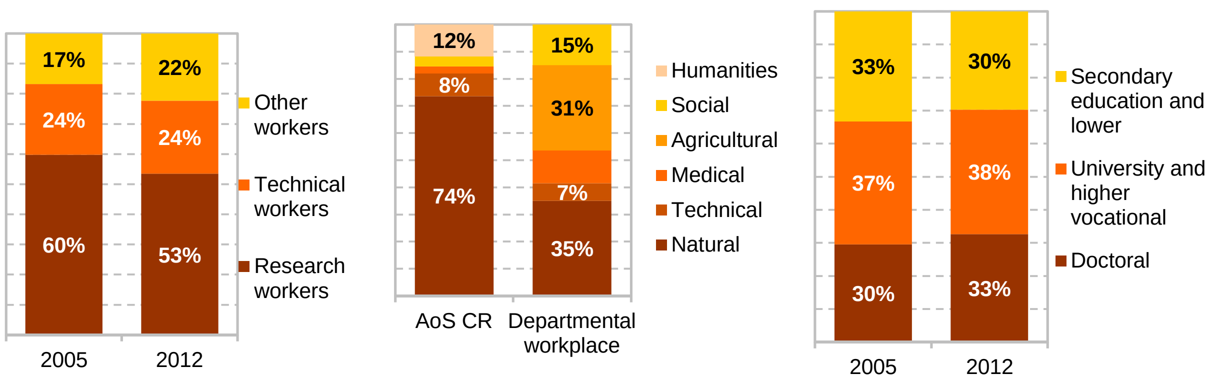
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

As already mentioned, the highest numbers of R&D staff are researchers and the governmental sector is no exception. In 2012, there were 6 000 researchers, more than 2 700 FTE technical staff and 2 500 "other" staff in the governmental R&D.

During the entire reporting period more than half of the governmental R&D staff were employed in the institutes of the Academy of Sciences of the Czech Republic, in 2012 it was already two-thirds, precisely 7 600 FTE workers. In the same year the departmental research centers employed 2 500 FTE workers and additional 1 200 worked in other research centers in the governmental sector.

Chart B.9: Structure of employees in the governmental sector R&D (FTE), 2012

by type of employment by education by scientific areas



Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

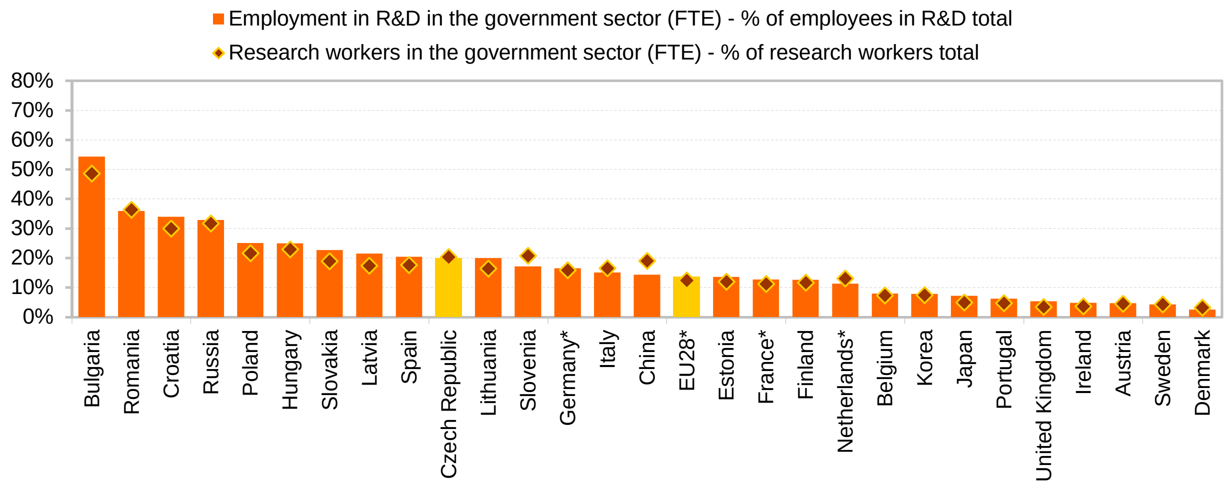
Most R&D employees in the governmental sector are dedicated to natural sciences, which in 2012 employed 60% of them, specifically it was more than 6 700 FTE workers. In the same year 8% of the governmental R&D employees were focused on technical sciences and 14% on humanities. Medical, agricultural and social sciences in the governmental sector were the focus of approx. 2 100 people. Previous data relates to the governmental sector as a whole, however, if we focus in more detail on the different types of research institutes, we find substantial differences among various scientific areas. The institutes of the Academy of Sciences of the Czech Republic were dominated in terms of the number of employees by natural sciences, with 5 600 workers employed in the AS CR's research and development. Technical sciences here employed approx. 600 and humanities less than 900 workers. The R&D institutes of AS CR have no representation of agricultural science, which, on the contrary, is strongly represented in the departmental research institutes, where nearly 700 R&D employees performed R&D in this scientific area. The departmental R&D also has strong representation of natural science with 850 R&D employees and social sciences (360). Departmental R&D institutes, as opposed to the institutes of the AS CR, has no representation of humanities.

Majority of employees in the governmental sector R&D hold one of the degrees of tertiary education, there were 8 000 such employees in 2012. There were 3 700 employees with doctoral education and 4 300 employees with higher vocational or higher education in this sector's R&D.

International comparison

Among the monitored countries in 2011 employees of the government R&D sector formed the highest proportion of all R&D employees in Bulgaria, where their share exceeded 50%. High levels were recorded in Russia, Romania and Croatia as well, where the share, however, was not as significant, as it was around 30%. In general, however, it can be stated that there remains high proportion of employees in the governmental sector R&D in the total number of R&D employees in post-Communist countries. In the European Union the average of governmental R&D employees is 14% of all R&D employees. A very small proportion of the governmental sector in R&D employees can be observed in Austria (5%), Sweden (4%) and Denmark (3%).

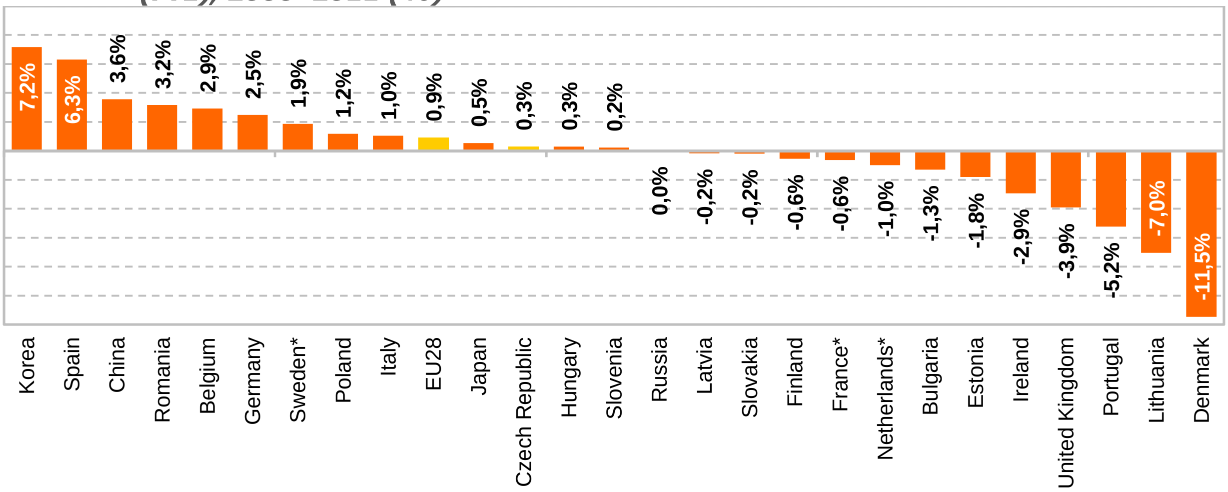
Chart B.10: Governmental sector R&D employees (FTE), 2011



*Note: * data for 2010*
Source: OECD MSTI 2013/1, Eurostat 2013

Between 2000 and 2011, the highest average annual increase in the number of employees of the governmental sector R&D among the monitored countries was recorded in Korea and Spain. In the Czech Republic the number of employees in the governmental sector R&D grew on average by 0.3% during the reporting period. i.e., slightly more slowly than in the EU28, where the value of this indicator equaled 0.9%. A large number of European countries, by contrast, recorded a decrease. The fastest decline in the number of employees of the governmental sector R&D during the reporting period occurred in Denmark, year-to-year on average by 11.5%.

Chart B.11: Average year-to-year change in the number of governmental sector R&D employees (FTE), 2000–2011 (%)

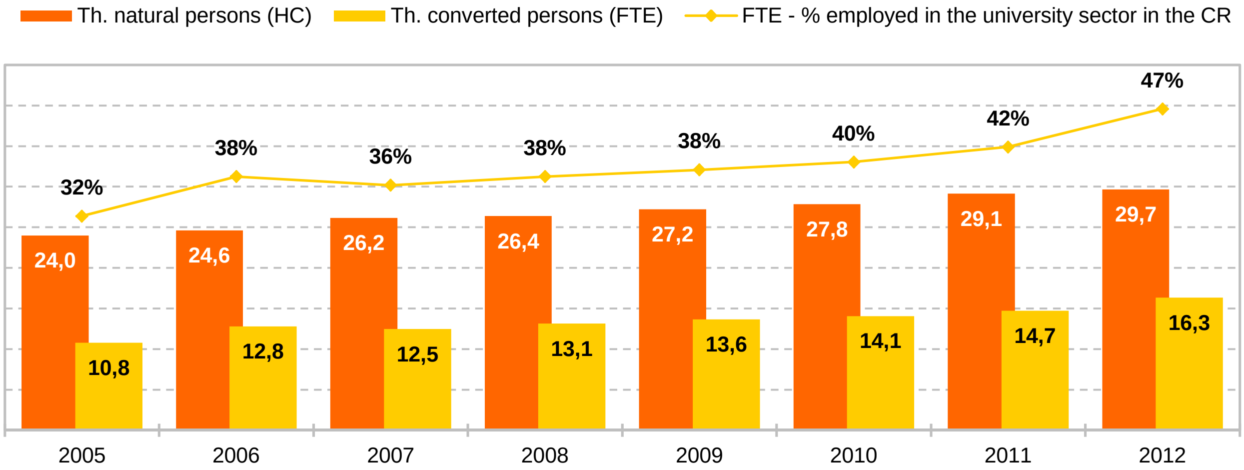


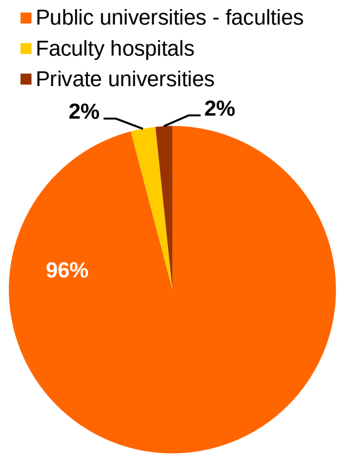
Note: The average year-to-year increase in the number of employees in the Czech Republic is calculated using the number of employees as physical persons (HC), since in 2005 there was a change in the methodology of calculating FTE in the Czech Republic, and for this reason the average year-to-year increase in the number of employees expressed in FTE would be significantly overestimated.
**France, Netherlands 2000 - 2010; Sweden 2001 - 2011*
Source: OECD MSTI 2013/1, Eurostat 2013

Employees in the higher education sector R&D

In 2012, nearly 30 000 physical persons (HC) worked in higher education R&D and since 2001 there has been a significant increase in the number of individuals employed in higher education R&D by more than 10 000 people. Conversion of higher education R&D staff to full-time equivalency decreases their number by almost half. R&D employees in the higher education sector are engaged in research and development activities on average 50% of their working time. In comparison with other sectors of R&D performance, the higher education sector is specific for a high number of workers under contracts of services or agreements to perform work. To a large extent these are workers who, in addition to research, are also involved in teaching activities. In 2012 higher education research employed 16 000 FTE workers. The R&D workers amounted to 47% of all employees of this sector.

Chart B.12: Employees in the higher education sector R&D





Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

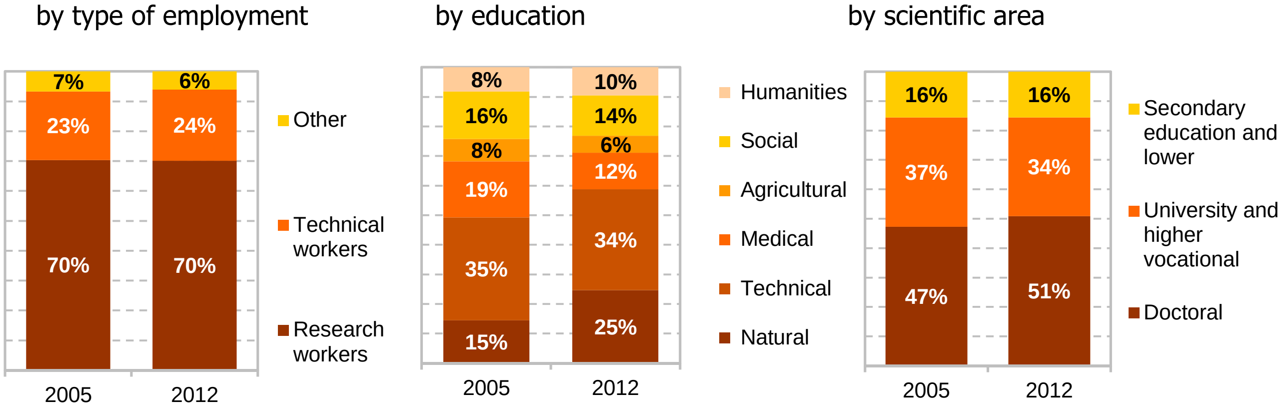
As mentioned above, the proportion of men and women among the employees of the governmental R&D is almost equal, the higher education R&D also does not show a significantly lower representation of women, in 2012 women accounted for 39% of the employees of the higher education R&D.

The higher education sector is one, where researchers represent the highest proportion of R&D workers, in 2012 it was 70%, i.e., more than 11 000 FTE employees. Approx. 3 900 R&D staff were classified as technical workers and nearly 1 000 FTE workers were in the category "other" in this year. Over the years, the distribution of R&D staff into individual categories of employment in the higher education sector remains virtually unchanged.

While in the governmental sector more than half of the R&D employees are focused on research in natural sciences, in higher education R&D employees are more evenly distributed among all disciplines. Natural sciences, compared to the governmental sector, do not dominate here. In higher education research most people are employed in technical sciences, precisely 5 600 FTE workers, natural sciences employed approx. 4 000 people, and medical sciences 2 000 employees of the higher education R&D. However, there is a change in the structure of R&D employees by scientific areas in the higher education sector, where there is significant growth in the proportion of R&D employees in natural sciences at the expense of the other scientific areas. There is also an important trend of weakening technical sciences in public research, experiencing relative and in recent years also the absolute decline in R&D employees in technical sciences in the public sector.

Higher education R&D staff achieved, in comparison with other sectors, on average a higher level of education. In 2012, 85% of the R&D employees in the higher education sector achieved one of the forms of tertiary education, with more than half (51%) of R&D employees who completed doctoral education and 34% employees with higher (Bachelor's or Master's) or higher vocational education.

Chart B.13: Employee structure in higher education sector R&D (FTE)



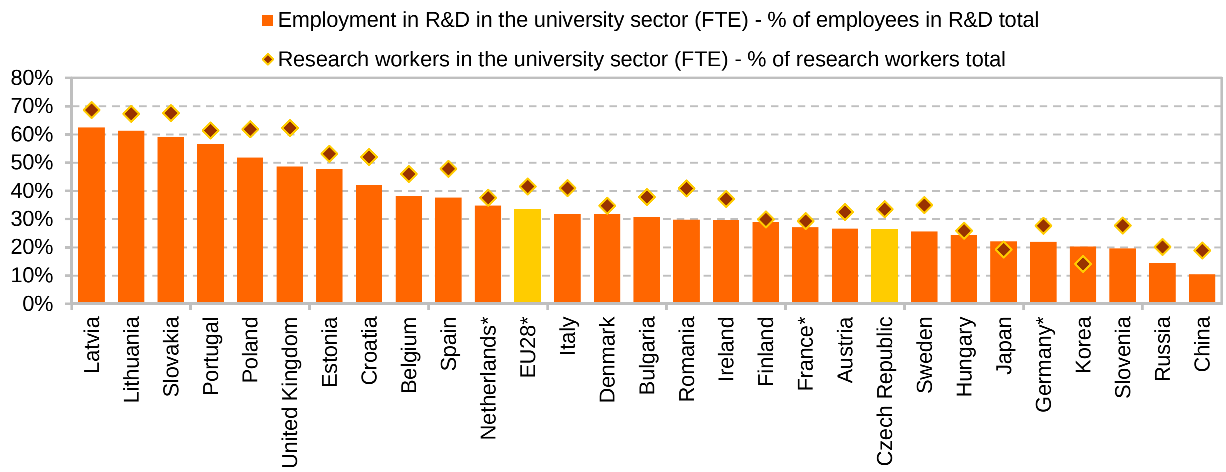
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

International comparison

Employees in higher education R&D had the highest proportion among all R&D employees in Lithuania, Latvia, Portugal and Slovakia, where the proportion was around 60%. On average across the EU28, 33% of R&D employees worked in the higher education sector and the smallest representation was recorded for R&D employees in the higher education sector in Slovenia (20%), Russia (14%) and China (10%).

Among researchers there is higher representation of the higher education sector workers than among the R&D staff. On average in the EU28, researchers from the higher education sector accounted for 42% of all researchers, in the Czech Republic the figure was 34%.

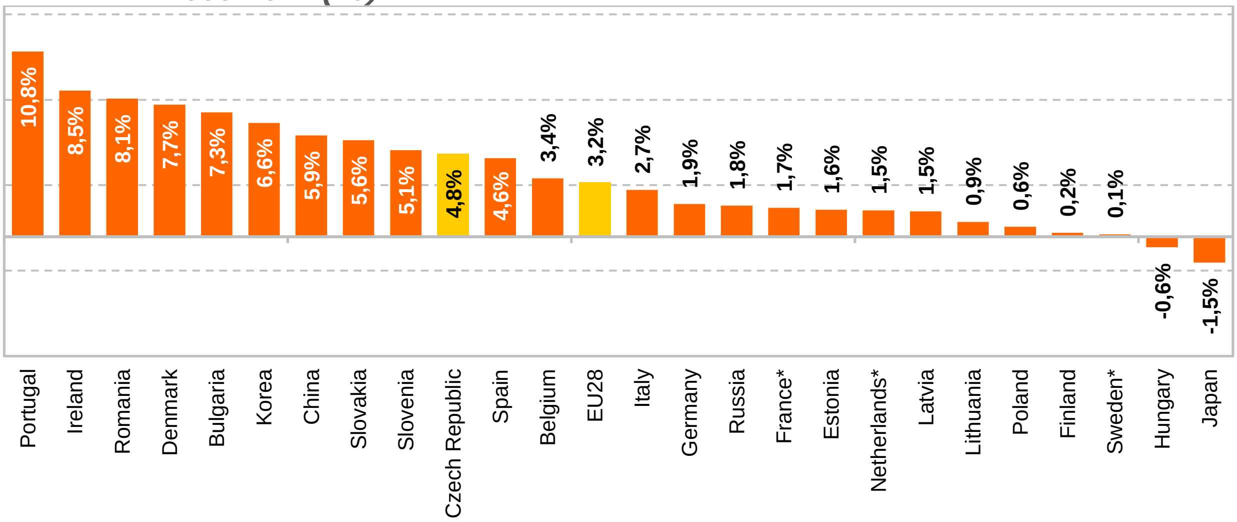
Chart B.14: Higher education sector R&D employees (FTE), 2011



*Note: * data for 2010*
Source: OECD MSTI 2013/1, Eurostat 2013

With the exception of Japan and Hungary, the number of R&D employees in higher education sector in all monitored countries increased year-to-year between 2000 and 2011. During the reporting period the highest average annual increase in the number of R&D employees of this sector was recorded in Portugal, Ireland and Romania. Throughout the European Union the number of R&D workers in the higher education sector grew by an average of 3.2% per year.

Chart B.15: Average year-to-year change in the higher education sector R&D employees (FTE), 2000-2011 (%)



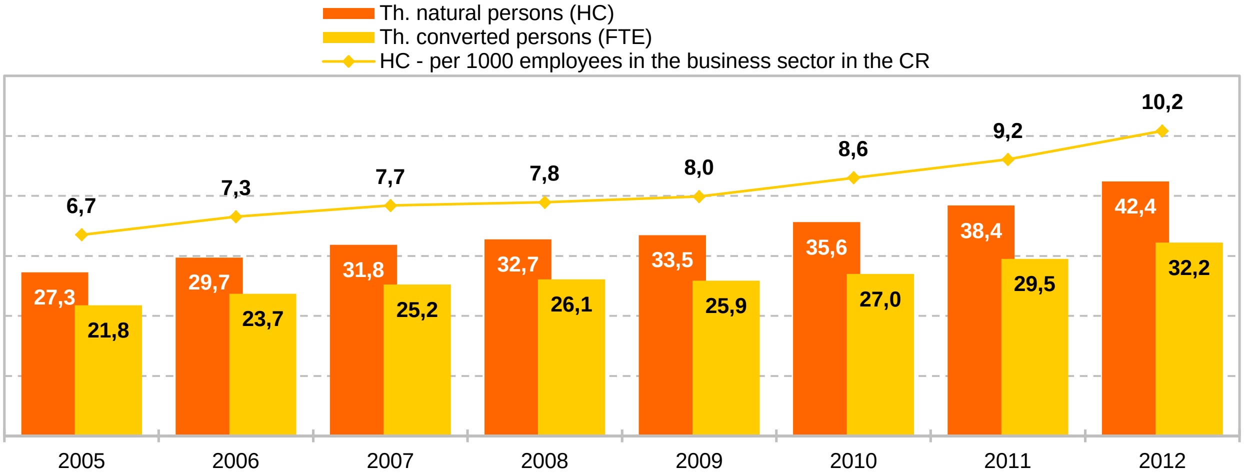
Note: The average year-to-year increase in the number of employees in the Czech Republic is calculated using the number of employees as physical persons (HC), since in 2005 there was a change in the methodology of calculating FTE in the Czech Republic, and for this reason the average year-to-year increase in the number of employees expressed in FTE would be significantly overestimated.
**France, Netherlands 2000 - 2010; Sweden 2001 - 2011*
Source: OECD MSTI 2013/1, Eurostat 2013

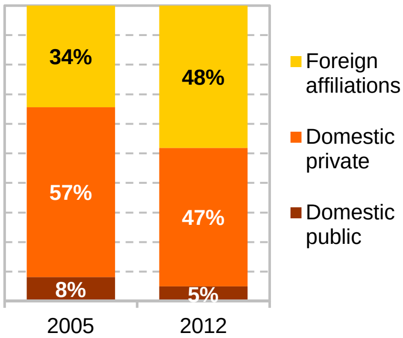
Business sector R&D employees

In 2012 there were more than 42 000 physical persons (HC) in the business sector R&D and since 2001 their number increased by approx. 22 000 persons. When converted to full-time equivalency, there were 32 000 FTE workers. In terms of physical persons (HC) there were 10.2 R&D workers per 1 000 employees of the business sector in 2012. The increase of the number of R&D employees in this sector occurred in absolute numbers, as well as in relative terms. In 2001 there were 5.3 R&D workers per 1 000 employees of the business sector.

As opposed to the governmental and the higher education sector, the representation of women among the employees of business R&D is very small. In 2012 women accounted for only 19% of the R&D staff in the business sector and such trend was recorded in the past as well.

Chart B.16: Business sector employees in R&D





Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

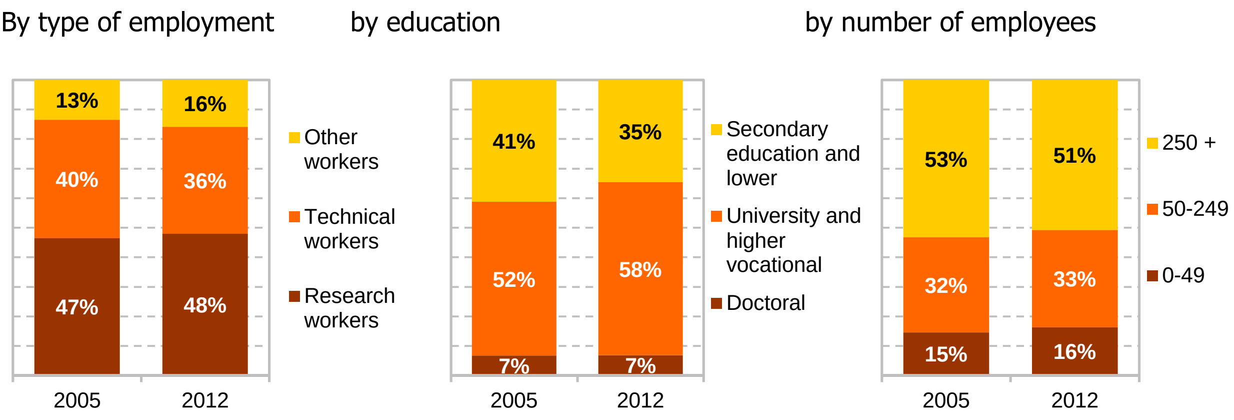
Of the total number of full-time equivalent R&D employees in the business sector in 2012, 48% were researchers, 36% were technical and 16% were other workers. In comparison with the governmental and the higher education sectors there is a completely different employee structure is the business sector, with less researchers and more technical staff.

While in the governmental sector 70% of employees completed one of the levels of tertiary education and in the higher education sector it is even 84%, in the business sector it is only 65% of the R&D staff. Very low, compared to the above mentioned sectors, is the representation of people with doctoral degrees, with only 7%.

The dominant share of R&D workers is employed in large and medium-sized enterprises. Half of the business sector employees in R&D in 2012 worked in companies with more than 250 employees. There were nearly 11 thousand business sector R&D workers in companies with 50 to 249 employees and 5 thousand R&D workers in companies with less than 49 employees.

In 2012 approximately 15 thousand business sector R&D employees worked in domestic private companies and nearly the same number was employed in foreign affiliates. Public companies employed 1.6 thousand persons in R&D. Since 2005, there has been a significant increase in the absolute number of R&D employees in foreign-controlled companies, which is reflected in the change in the structure of R&D employees according to the ownership of companies, where they are employed.

Chart B.17: Structure of business sector employees in R&D (FTE)



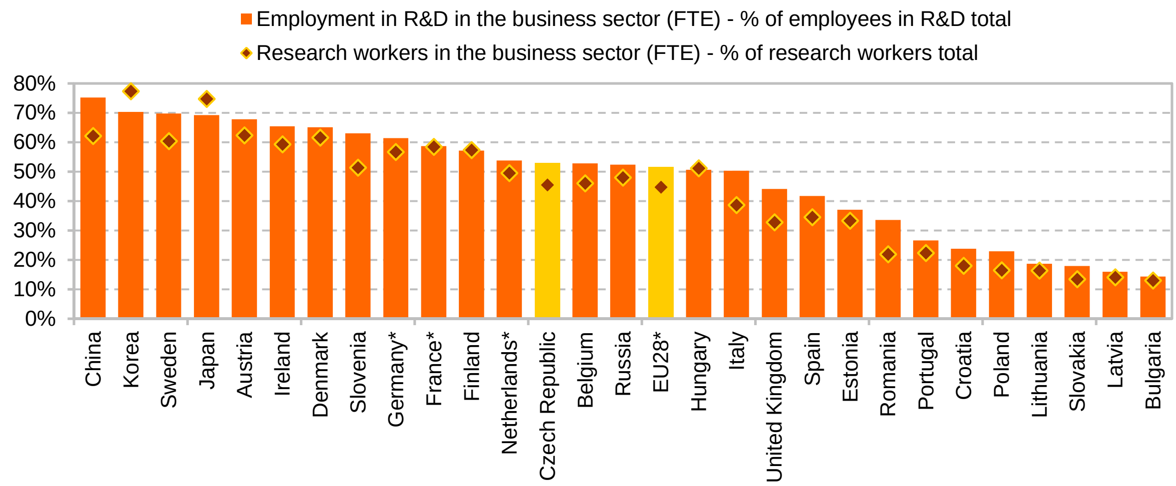
Source: The Czech Statistical Office 2013, Annual statistical survey on research and development (VTR 5-01)

In terms of economic activities the largest part of R&D employees in 2012 was employed in the manufacturing industry (17 thousand, i.e., 53%), primarily in the automotive sector (3.7 thousand, 11.5% of R&D employees in the business sector) and in the engineering sector (3.4 thousand, 10.5% of R&D employees in the business sector). The service sector employed 14,000 people in R&D, of which 4.8 thousand worked directly in research and development.

International comparison

The highest proportion of business sector R&D employees in all R&D employees in 2011 was recorded in Sweden, China, Korea and Japan, where the figure was around 70%. The Czech Republic's representation of the business sector in all R&D employees was almost identical to that of Belgium, Russia or the average of the EU28, where the business sector employed approximately 52% of all the R&D workers. Very small proportion of the business sector R&D workers can be found in Slovakia, Latvia and Bulgaria, where the figure is less than 20%.

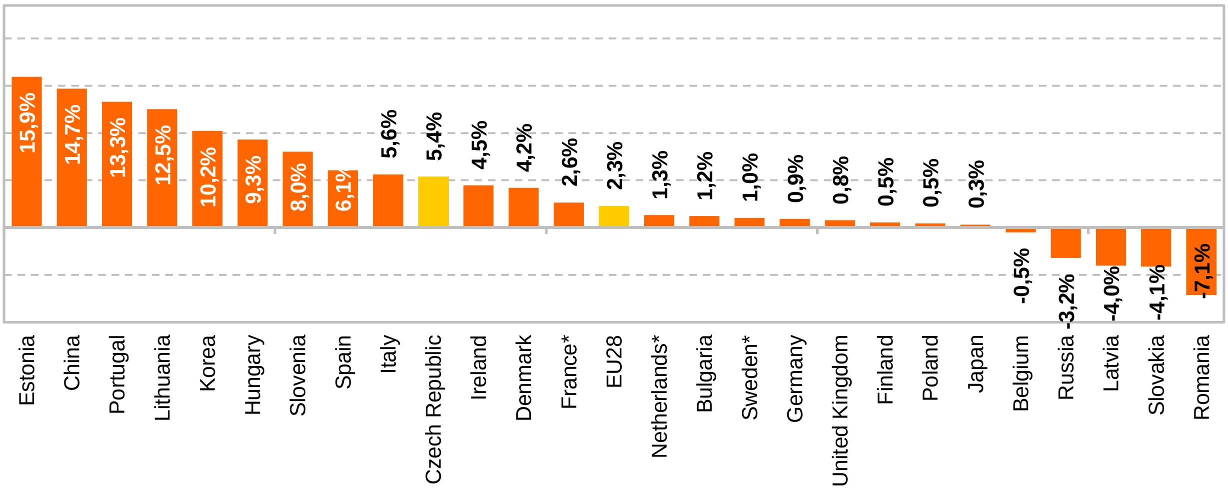
Chart B.18: Business sector employees in R&D (FTE), 2011



** data for 2010*
Source: OECD MSTI 2013/1, Eurostat 2013

The number of the business sector employees in R&D grew the fastest in Estonia, where the average annual increase in their number between 2000 and 2011 was around 16%. The growth can also be called significant in the case of China, Portugal, Lithuania and Korea. Throughout the EU28, the number of the business sector employees in R&D in the same period increased year on year on average by 2.3%. On the contrary, a decline in the number of the business sector employees in R&D was recorded in Latvia, Russia, Slovakia and Romania.

Chart B.19: Average year-to-year change in the business sector employees in R&D (FTE), 2000 - 2011 (%)



Note: The average year-to-year increase in the number of employees in the Czech Republic is calculated using the number of employees as physical persons (HC), since in 2005 there was a change in the methodology of calculating FTE in the Czech Republic, and for this reason the average year-to-year increase in the number of employees expressed in FTE would be significantly overestimated.
**France, Netherlands 2000 - 2010; Sweden 2001 - 2011*
Source: OECD MSTI 2013/1, Eurostat 2013

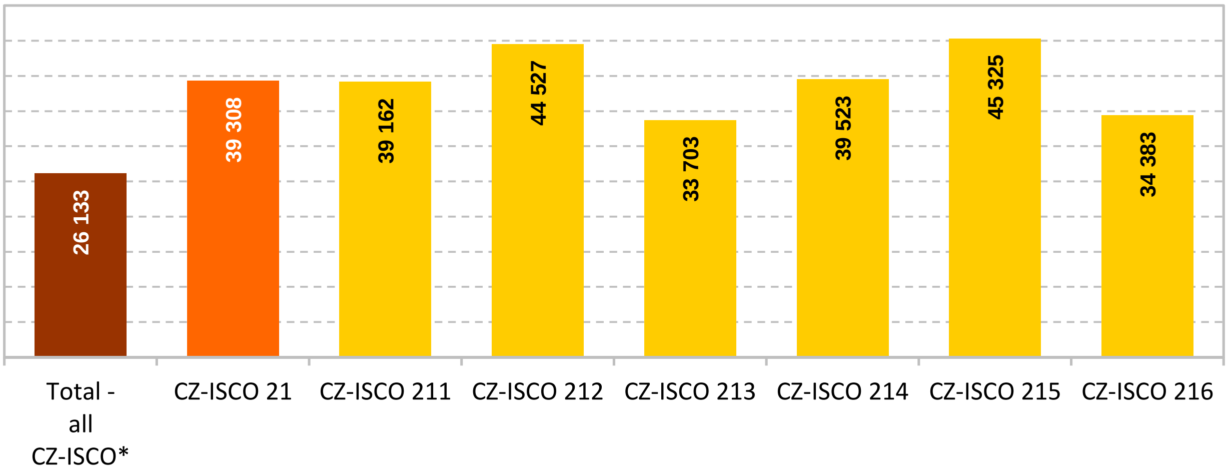
B.2 Wages of science and technology specialists

The data for this section come from the results of employee structural wage statistics published by the Czech Statistical Office in collaboration with the Ministry of Labour and Social Affairs. More information can be found at: http://www.czso.cz/csu/redakce.nsf/i/lidske_zdroje_ve_vede_a_technologiich.

R&D employees, due to their general higher level of qualifications, can be expected to earn above-average wages. Information about the salaries of research and development employees is not available; however, we do know how salaries are distributed amongst the various employment groups (CZ-ISCO). Employees that most closely fit the definition of Scientists are science and technology specialists (CZ-ISCO 21). In 2012, employees in this group earned an average gross monthly wage of 39 308 CZK, which in comparison with the average gross monthly wage in the Czech Republic in that year, which slightly exceeds 26 thousand CZK*, is 150 % of the wage of the average Czech employee.

Science and technology specialists are employed in a variety of professions with varying wage scales. On the one hand, there are specialists in the field of electrical engineering, electronics and electronic communications with an average gross monthly wage of 45 thousand crowns, while on the other there are specialists in biological and related disciplines who earn less than 34 thousand crowns on average.

Chart B.20: Average gross monthly wage in the Czech Republic* (in CZK), 2012

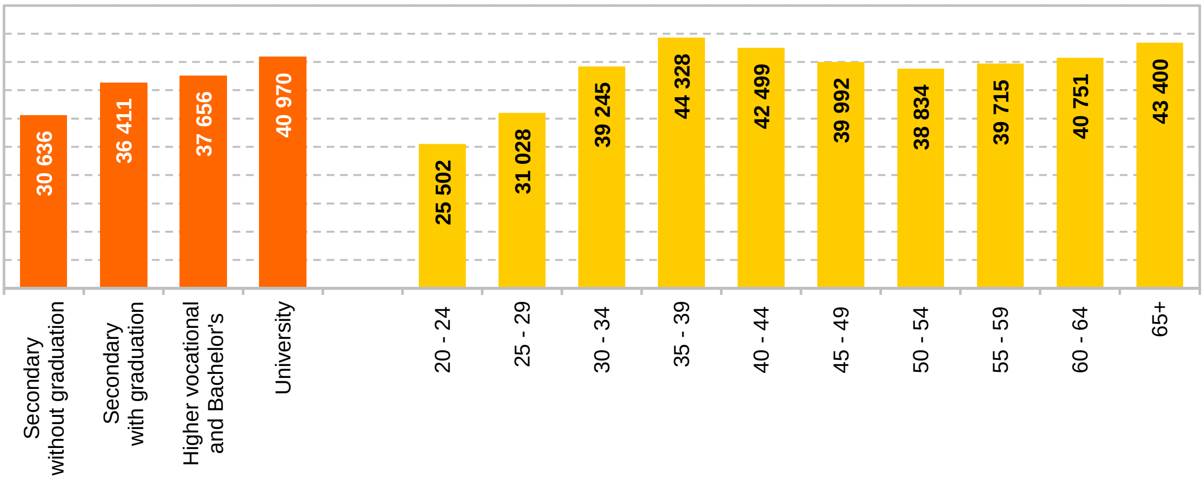


CZ-ISCO 21 - Science and technology specialists; CZ-ISCO 211 - Specialists in the fields of physics, chemistry and related disciplines; CZ-ISCO 212 - Specialists in the field of mathematics, statistics and insurance mathematics; CZ-ISCO 213 - Specialists in biological and related disciplines; CZ-ISCO 214 - Specialists in production, construction and related disciplines; CZ-ISCO 215 - Specialists in the field of electrical engineering, electronics and electronic communications; CZ-ISCO 216 - Architects, town planning specialists, designers and related workers.
** The average gross monthly wage in the Czech Republic given in this analysis differs slightly from the average gross monthly wage in the Czech Republic as published in other materials, due to the use of analytical (uncomputed) data relating to the survey sample (approx. 1.7 million employees).*
Source: Structural Wage Statistics 2012

The distribution of wages of science and technology specialists into the various age groups mirrors the overall distribution of wages in the Czech Republic. This means that wages do not increase proportionately with age, but peak in the 35–39 age group, and start to fall in higher age groups. In general, lower wages are earned by employees in the lowest age groups, i.e. those at the start of their career, and then rise sharply, peaking, as already stated, at the age of 35–39 let. In this age group the average gross monthly wage of science and technology specialists is almost 45 thousand crowns. After reaching the age of sixty, the average gross monthly wage of these specialists again rises to more than 43 thousand crowns for those over the age of 65 let. This is probably due to the fact that employees in higher, better paid positions stay in their jobs for longer (they postpone retirement).

As the level of education achieved by scientists and engineers rises, so do their wages. This is true of all jobs, and science and technology specialists are no exception. The difference between the wages of these specialists with secondary education with graduation and higher vocational and Bachelor's education is just a few hundred crowns (36.4 thousand crowns for secondary education with graduation; 37.7 thousand crowns for higher vocational). However, there is a significant rise in wages in the case of S&T specialists with a university education; such specialists earn on average almost 41 thousand crowns.

Chart B.21: Average gross monthly wage of science and technology specialists by education and age (in CZK), 2012



Source: Structural Wage Statistics 2012

There are differences between men and women in the average gross monthly wage of science and technology specialists, as is the case with wages in general in the Czech Republic. In 2012 the average wage for men in these positions exceeded 41 thousand crown, while with women it was almost 34 thousand. The average wage of women employed as science and technology specialists is thus 82 % of the wages paid to men. In the case of the overall gross monthly wage in the Czech Republic, the difference between men and women is slightly higher; in this case the average wage of women was 78 % of the average wage of men.

There are also significant differences in wages amongst science and technology specialists based on whether a particular specialist is employed in the business or non-business sector. In the business sector, the wages of these specialists are considerably higher than in the non-business sector. The difference in the average wage of those employed as S&T specialists in the two sectors was more than 11 000 crowns in 2012, which in other words means that an S&T specialist employed in the public sector earned a mere 73 % of the wage of an S&T specialist employed in the business sector.

In relation to these two sectors, it is also worth noting the differences between the average wages of men and women. In the public sector female S&T specialists earn 94 % of the wage of male S&T specialists, and in the business sector the figure is 84 %. These differences in men and women's wages in these sectors are caused by tabular wages in the public sector, which do not allow for greater differences between men and women.

B.3 University education

Data relating to people who have completed university education are sourced from the Labour Force Sample Survey, with the basic units surveyed being individuals and households. The data shown are annual averages and if the value is less than 3 000 people, they are considered to be less reliable.

Data on students and university graduates were taken from the data sources of the Ministry of Education, Youth and Sports (MoEYS). Specific data come from the SIMS database – Student Information Management System. Classification into study disciplines is based on study programme codes, which in some cases does not reflect how the various study disciplines pertain to the main discipline groups. Due to the difficulty of classifying various student into discipline groups, where they are classified into disciplines, qualified estimates are given (MoEYS).

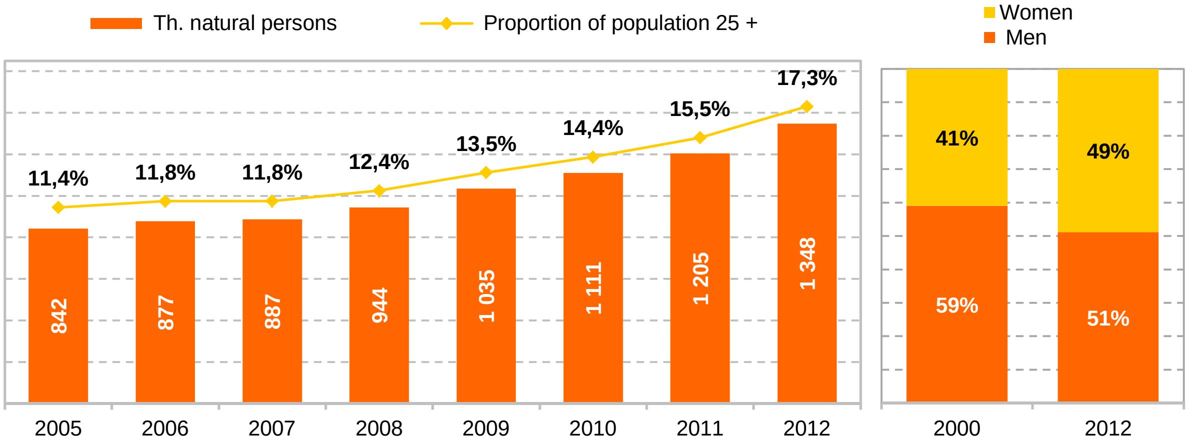
Detailed information (data, definitions and methodology) about these two statistics can be found at http://www.czso.cz/csu/redakce.nsf/i/lidske_zdroje_pro_vedu_a_technologie .

As stated above, 72 % of research and development employees have a university education, and with researchers the figure is as high as 89 %. Obviously, not all those with a university education can be expected to work in research and development, but they are a potential resource for that field and play a major part in generating new skills and technology. This section will focus on the current number of people who have completed university education, as well as university students and graduates. It will then take a more detailed look at the natural and technical sciences, which can be seen as key areas for research and development, which is also proven by the fact that in 2012 75 % of research and development employees worked in these fields of science.

People who have completed university education

The number of people who have completed university education is increasing every year. In 2012 there were almost 1 million 348 thousand university-educated people in the population over the age of 25 in the Czech Republic, which made up 17.3 % of the population of that age (this age category was chosen as it consists of people who are expected to have completed their studies). At the beginning of the period in question, in 2000, approximately 714 thousand people had completed university education, making up 10 % of the population. In 2000 there were considerably more university-educated men than women than there are today. In 2000 the ratio of men to women was 59 % to 41 %; in 2012 the ratio of the two genders had evened out somewhat, with 51 men and 49 women out of every 100 people with a university education.

Chart B.22: People who have completed university education aged 25 and above

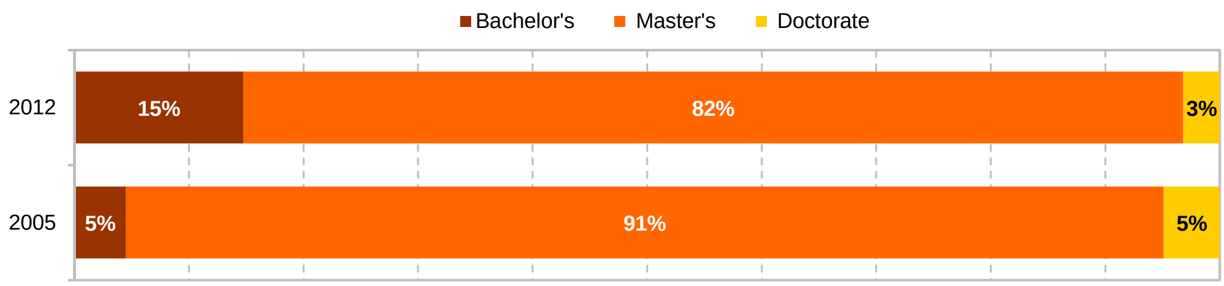


Source: Czech Statistical Office2013, Labour Force Sample Survey

Most of the university-educated population is made up of people studying long term in Master's programmes. In 2012 these made up 82 %, people with a Bachelor's education comprised 15 %, and the remaining 3 % of the university-educated population had earned a doctorate. Over the years, there has been a shift in the structure of people with tertiary education towards a Bachelor's degree. This shift is caused by a change in the composition of the study programmes available, as ten years ago it was only possible to do a Bachelor's study program in exceptional cases, and most university studies involved a Master's programme, usually lasting for five years.

The proportion of the population with university education are those educated in the fields of the social sciences, business and law (26 %) and the technical sciences, manufacturing and construction (21 %); 17 % of university-educated people have a teaching education and 9 % have an education in the natural sciences.

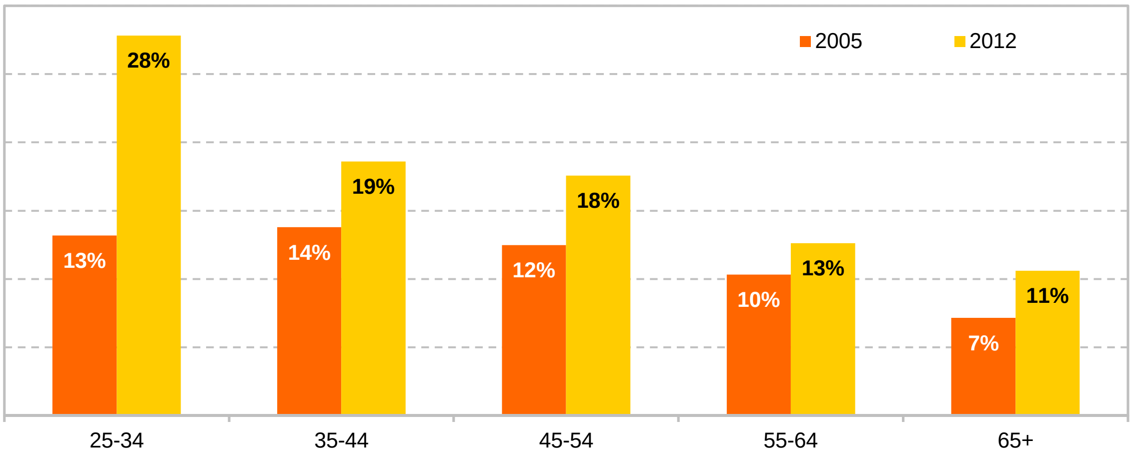
Chart B.23: People with university education by study programme



Source: Czech Statistical Office 2013, Labour Force Sample Survey

In 2012 the highest proportion of the population with a university education was in the 25–34 age group, which made up 28 % of the university-educated population, a rise of 15 percentage points against 2005. There was also a rise in the proportion of the population with a university education in the other age groups. Approx. 19 % of people aged 35–54 completed a university education in 2012, 11 % of whom were of post-productive age.

Chart B.24: People with university education by age, (% of people in given age group)



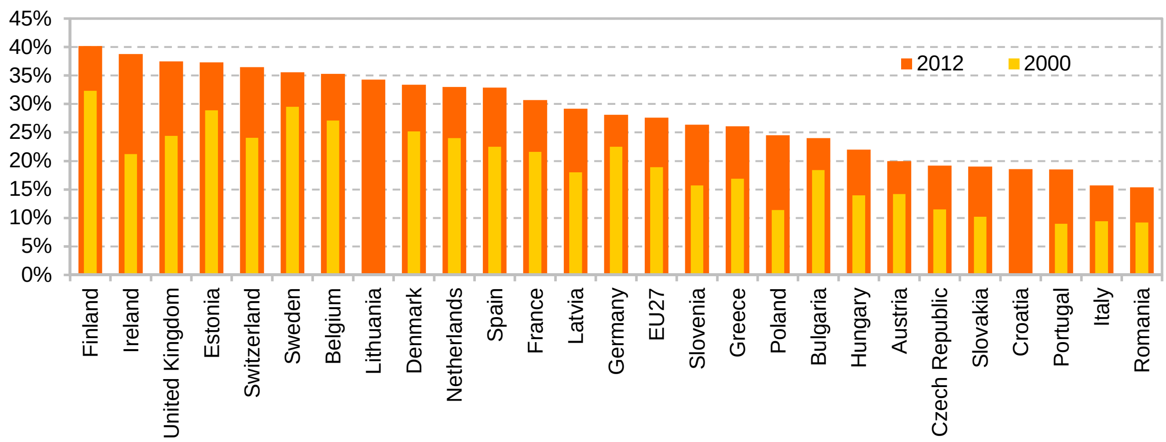
Source: Czech Statistical Office 2013, Labour Force Sample Survey

International comparison

In terms of its proportion of people who have completed tertiary education, the Czech Republic has long been far below the European average. In 2012 19.2 % of people in the Czech Republic had completed tertiary education, while the EU27 average in the same year was 27.6 %, with the highest proportions in Finland, Ireland, the United Kingdom and Estonia, where more than 37 % of the population had completed tertiary education. Since 2000 this proportion has been on the increase in all the countries monitored. The most considerably increase in the countries in question was seen in Ireland, where the proportion of the population with tertiary education increased by almost 18 percentage points.

Although the Czech Republic is a country with one of the lowest proportions of people with tertiary education in the population, if we focus on people with at least secondary school education, the situation is completely different. In 2012 92 % of people in the Czech Republic had at least secondary education with graduation. The proportion was similar in Lithuania and Slovakia. On average 74 % of the population in EU27 achieved least secondary school education. Countries with the lowest proportion of people with at least secondary education were Spain (54 %), Italy (57 %) and Portugal (38 %), while the last two, Italy and Portugal, also have a very low proportion of people who have completed tertiary education (approx. 17 %).

Chart B.25: People who have completed tertiary education aged 25–64 (% of the population aged 25–64)



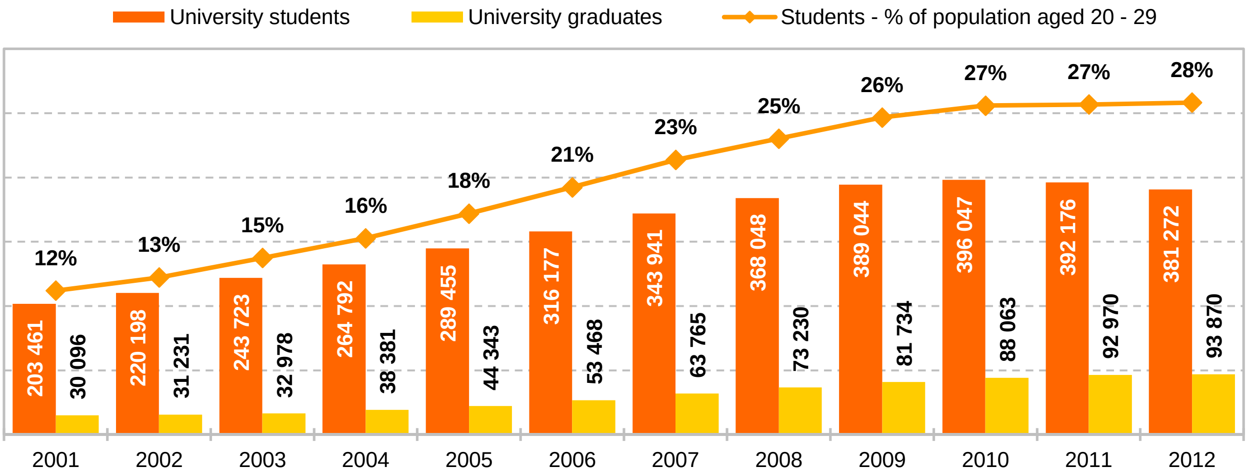
Source: Eurostat 2013

Students and university graduates

During the last ten years the number of university students (Bachelor's, Master's and doctorates) in the Czech Republic has been rising steadily, and since 2001 the number has almost doubled to as many as 400 thousand students in 2010. Since then, the number has fallen slightly. There has been a sharp rise not only as regards absolute figures, but also the ratio indicator, which is the proportion of university students in the population within the 20–29 age range. While in 2001 12 % of this group of the population studied at university, by 2012 more than 28 % of the people in this group were university students. The number of women students rose more than the total number of students. There were 90 thousand of women students at the beginning of the period in question, in 2001, and in 2012 there were more than 214 thousand, making up 56 % of all university students. Since 2001, when women made up 48 % of students, the proportion of women amongst university students has increased considerably.

While the number of students at university almost doubled between 2001–2012, the number of graduates during the same period increased more than threefold. In 2001 more than 30 thousand students graduated from university in the Czech Republic and in 2012 the figure was almost 94 thousand. This significant increase in the number of graduates may partly be down to the fact that since 2001 Master's degrees have been divided up into two parts and most Bachelor's graduates go on to do a follow-up Master's programme. Women made up more than 50 % of university graduates for the whole of the period in question, with women comprising 51 % of all graduates in 2001 and 11 years later, in 2012, the proportion was 61 %. The fact that there has long been a higher proportion of women amongst university graduates than amongst students implies that they are more successful when completing their university studies.

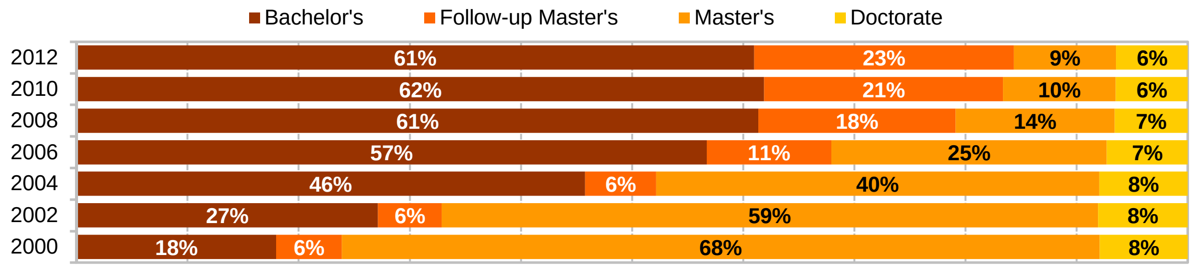
Chart B.26: Students and university graduates in the Czech Republic



Source: Ministry of Education, Youth and Sports 2013

In 2001 a strictly three-step university study structure was introduced, with the former typically 4-6-year university courses changed to what are usually three-year Bachelor's study programmes and Master's programmes. There are two types of Master's study programmes, these being the follow-up Master's, which allows Bachelor's graduates to continue their studies (usually two years), and the so-called long Master's programmes, which could not be split into two levels (e.g. to study medicine, veterinary medicine or architecture). The introduction of the three-step model is clearly illustrated in the following graph, which shows how the proportion of students shifted over the years from long Master's programmes to Bachelor's programmes, consequently follow-up Master's programmes.

Chart B.27: Structure of university students by type of study programme

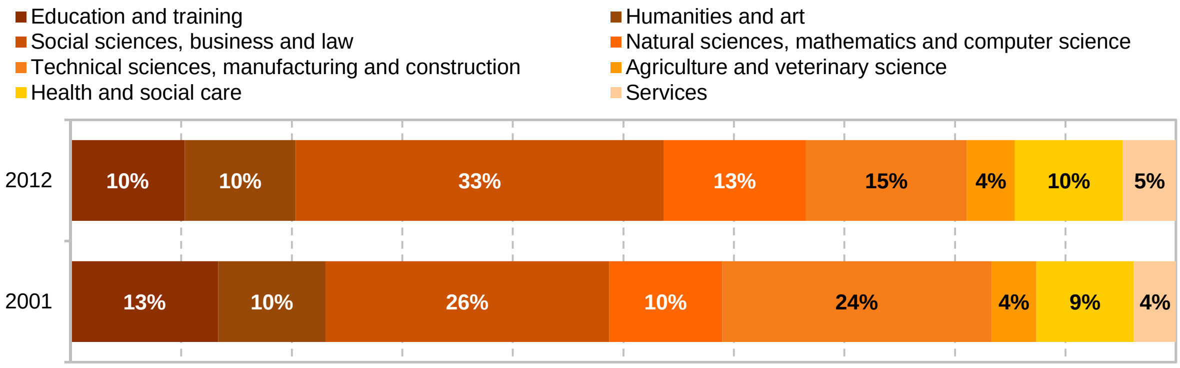


Source: Ministry of Education, Youth and Sports 2013

In 2012 61 % of university students were doing a Bachelor's programme, 23 % were studying a follow-up Master's programme, and only 9 % of university students were doing a long Master's study programme.

For a long time now, the most popular disciplines amongst university students are the social sciences, business and law, which in 2012 were studied by approx. 128 thousand people, making up 33 % of the total number of students. These are also disciplines in which there has been the sharpest rise in interest since 2001. Compared to 2001, there are now approx. 140 % more people studying these disciplines, and there has been a similar surge in interest in the natural sciences. In contrast, there has been a negligible rise in the number of students of the technical sciences, which during the period in question rose by a mere 11 %, and the structure even saw a decline by 9 percentage points. Between 2010 and 2012 there has also been a drop in the number of students of the technical sciences. Moreover, there has been a year-on-year decline in other disciplines, too. Nevertheless, the drop is sharpest in the technical sciences. In all the years most university students studied the social sciences, as mentioned above, although in 2001 these students only made up 26 % of the total. In contrast, students of the second most studied discipline, the technical sciences, made up 24 % of all students in 2001, yet in 2012 the figure was a mere 15 % (56 thousand). Due to the structure of the Czech economy, the relative decline in interest in technical disciplines is a worrying signal as regards our future ability to meet the business sector's demand for highly qualified manpower.

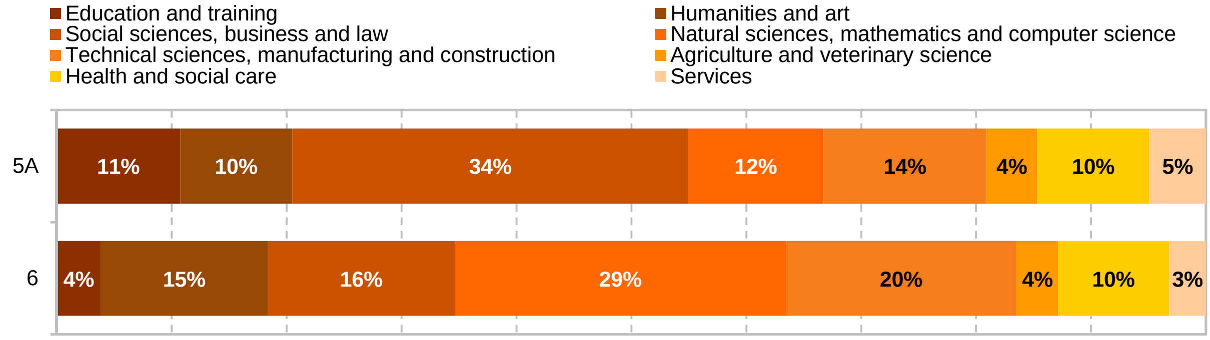
Chart B.28: Structure of university students by discipline



Source: Ministry of Education, Youth and Sports 2013

As mentioned above, in 2012 doctoral students made up 6.5 % of all university students. Compared to 5A students, i.e. Master's and Bachelor's students, these students were distributed amongst the various disciplines in a very different way. Level 5A was considerably dominated by the social sciences, business and law, which in 2012 were studied by 34 % of all Master's and Bachelor's students. Well behind in second place were the technical sciences, manufacturing and construction, which in that year were studied by 14 % of Bachelor's and Master's students. In contrast, the technical sciences, manufacturing and construction together the natural sciences, mathematics and computer science were the most popular disciplines for doctoral students, with doctoral students making up 29% (7 thousand) of students of the natural sciences and 20 % (5 thousand) of technical sciences students in 2012. The fields most frequently studied by 5A students are the social sciences; in the case of doctoral students, business and law was third with 16 %.

Chart B.29: Structure of university students by discipline and level of education, 2012

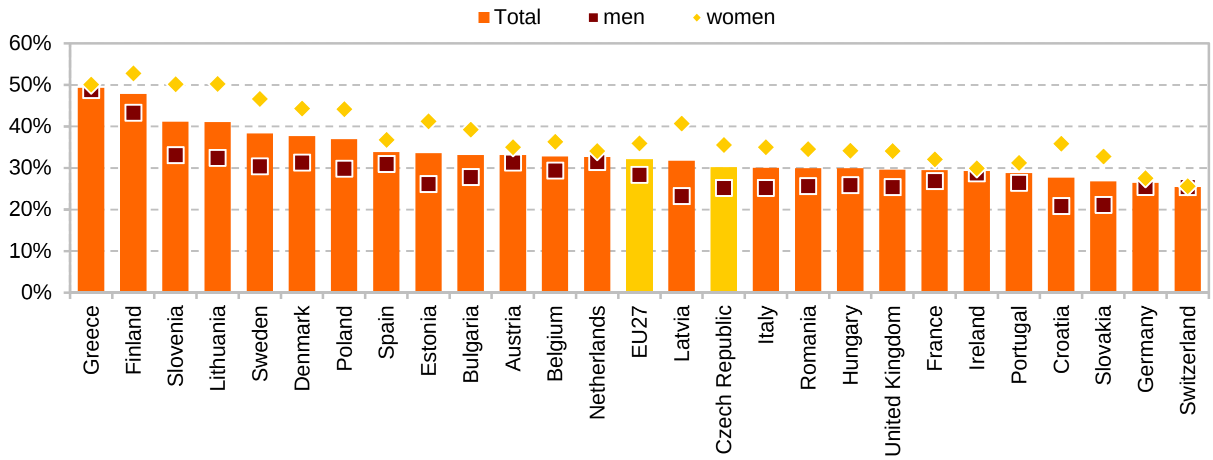


Source: Ministry of Education, Youth and Sports 2013

International comparison

For reasons of availability, data from international comparisons include data for tertiary education students, i.e. not only university students, but also students at higher vocational schools. The highest proportion of tertiary education students in the 20–29 age range was in 2010 Greece (49 %), Finland (48 %), Lithuania (41 %) and also Slovenia (41 %). The Czech Republic, with 30 %, was below the EU27 average, which is 32 %. In general, in the countries in question there are more students in tertiary studies in the female population in the 20–29 age group than there are in the male population of the same age. In Latvia, 41 % of women are university students, while for men the figure is a mere 23 %. The only exception is Switzerland, where the proportion of male and female students in tertiary studies is the same.

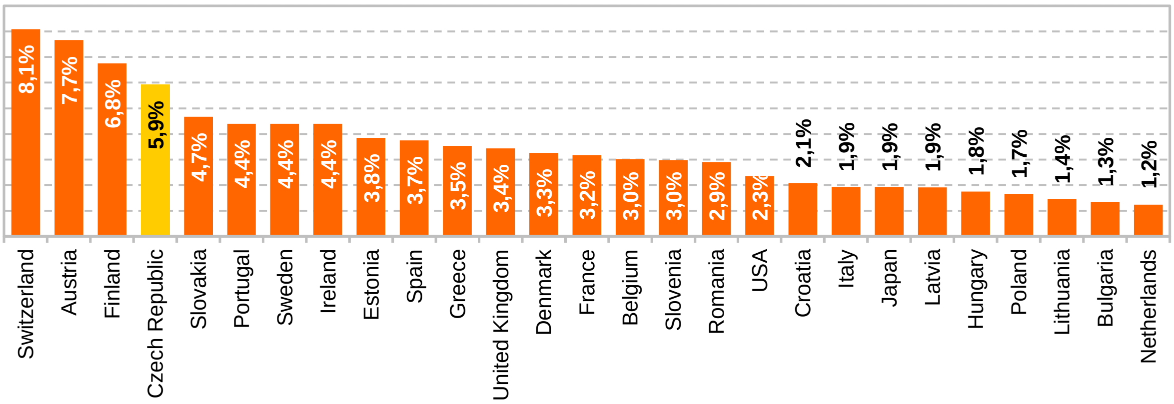
Chart B.30: Tertiary education students, 2010 (% of population aged 20–29)



Source: Eurostat 2013

In 2010 doctoral students made up 6 % of all tertiary education students in the Czech Republic, putting the Czech Republic near the top out of all the countries in question. The only countries which exceeded this figure are Switzerland, Austria and Finland. In contrast, doctoral students made up a small proportion of all tertiary education students Lithuania, the Netherlands and Bulgaria, where the proportion is less than 1.5 %.

Chart B.31: Students of doctoral study programmes, 2010 (% students in tertiary studies)



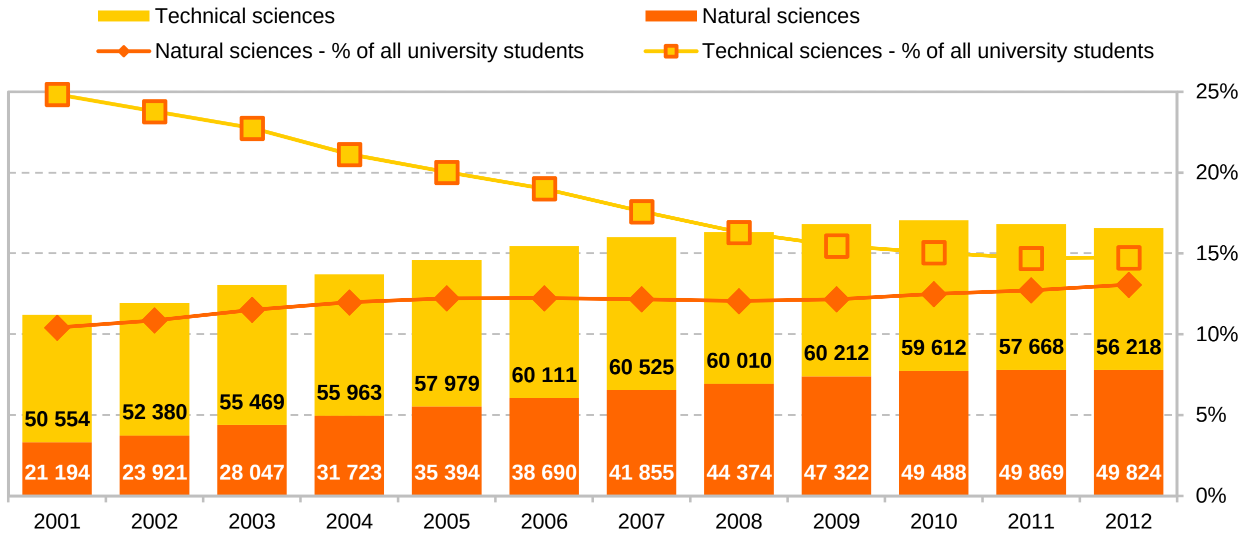
Source: Eurostat 2013

Students and university graduates in the fields of the natural and technical sciences

The narrowest basis when measuring human resources consists of university-educated people in the fields of the natural and technical sciences, and so closer attention must be focused on students of these disciplines.

In 2012 approx. 106 thousand students studied the technical and natural sciences at university in the Czech Republic. Since 2001, when these disciplines were studied by 72 thousand university students, the number has been rising steadily. However, for the whole of the period in question the natural sciences have been growing at a much faster pace. In recent years the number of students of the technical sciences has been stagnating. Since 2001, when the natural sciences were studied by 21 thousand students, the number has increased by 135 % to 50 thousand. In contrast, the number of students of the technical sciences during the same period rose by a mere 11 % from approx. 51 thousand in 2001 to 56 thousand in 2012. In the case of students of the technical sciences, between 2009 and 2012 the number declined by almost 4 thousand students.

Chart B.32: University students studying the natural and technical sciences

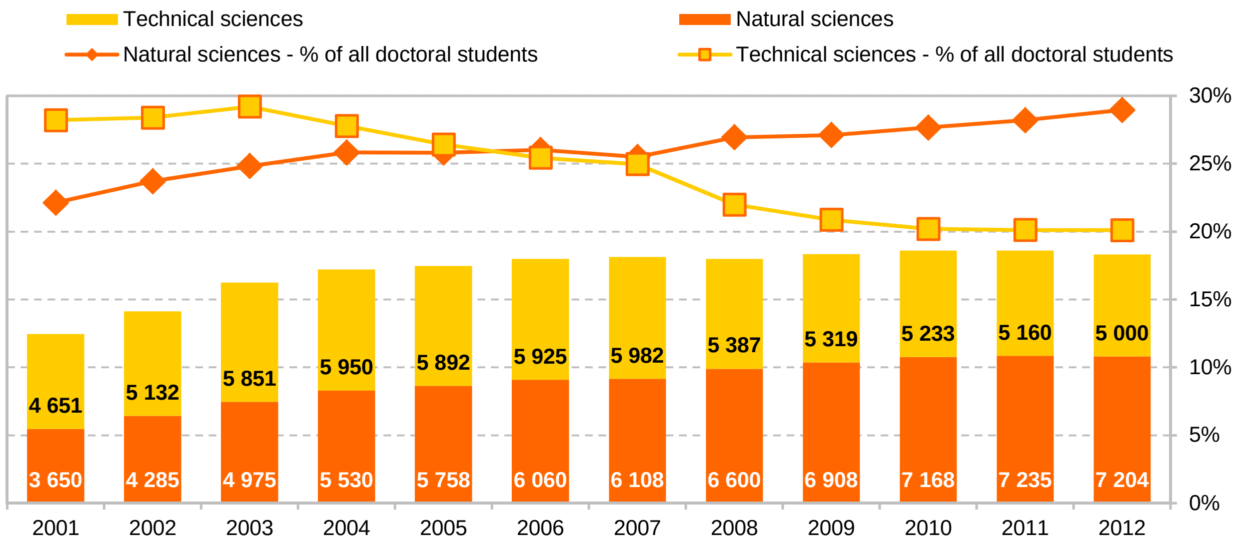


Source: Ministry of Education, Youth and Sports 2013

In 2012 there were almost 50 thousand students studying the natural sciences, mathematics and computer science at university, with men making up the majority, at 63 %. 13 % of those studying these disciplines in 2012 were also foreigners. Amongst university students studying the natural sciences, mathematics and computer science, for a long time now the greatest interest has been in computer science, which in 2012 was studied by 44 % of natural science students. The physical sciences were studied by 26 % and the life sciences were studied by 21 % of all natural science students. In contrast, mathematics and statistics, with 9 %, are natural science disciplines least popular amongst university students,

In 2012 more than 56 thousand people studied the technical sciences at university, with men making up the clear majority, at 73 %. Foreign students in technical disciplines comprised 8 %. University students studying the technical sciences, manufacturing and construction have long shown the greatest interest in technology, which in 2012 was studied by 54 % of students of the technical sciences; architecture and construction were studied by 33 % of students of the technical sciences, with manufacturing and processing making up the remaining 13 %.

Chart B.33: Students of doctoral study programmes in the fields of the natural and technical sciences



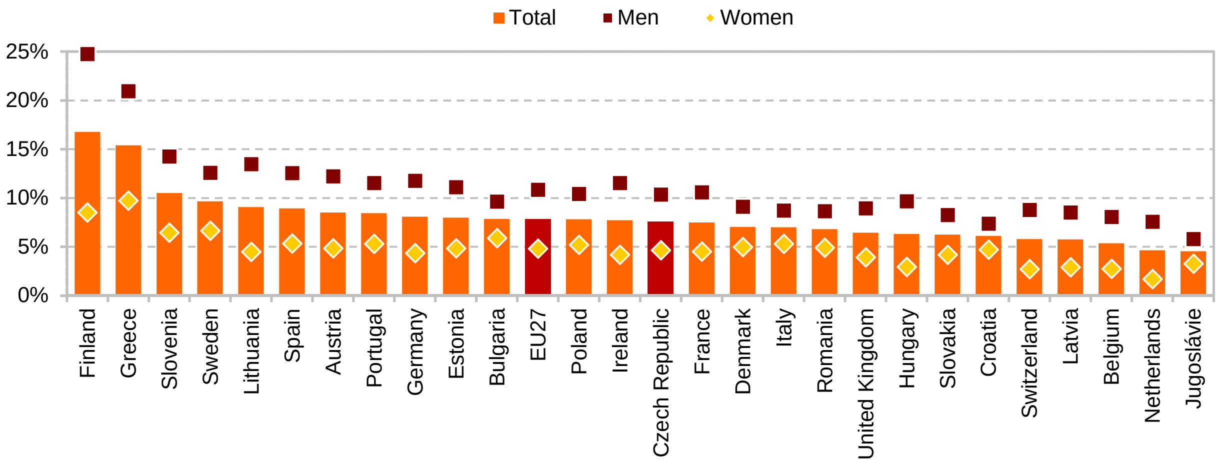
Source: Ministry of Education, Youth and Sports 2013

In 2012 more than 12 thousand people studied for a doctorate in the natural and technical sciences, making up 49 % of all doctorate students. Women made up 44 % of doctorate students in the natural sciences, and 23 % of technical science students. Therefore, the proportion of women doing doctorate courses in the natural sciences is higher than in with all the other study programmes in this field (see above).

International comparison

In Finland 17 % of the population aged 20–29 studied tertiary education in the fields of the natural and technical sciences in 2010, while in comparison with the other countries in question Finland showed the highest results for this indicator. A relatively high proportion of the population aged 20–29 comprised students of these disciplines in Greece (15 %), Slovenia (11 %) and Sweden (10 %), too. On average, 8 % of the population aged 20–29 in the EU27 countries studied the natural and technical sciences. As mentioned above, the proportion of students in tertiary studies is higher for women than it is for men. However, this is not true for the technical and natural sciences. In all the countries monitored, there were more male students of these disciplines than there were female students. The most significant difference between the sexes was in Finland, where 25 % of men studied the natural and technical sciences, while for women the figure was a mere 9 %.

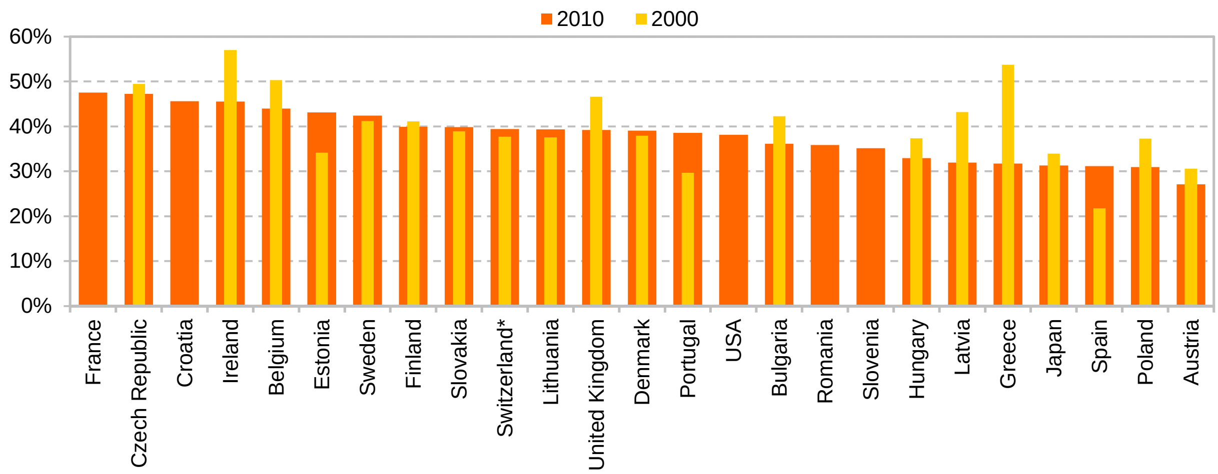
Chart B.34: Students of tertiary degrees in the natural and technical sciences, 2010 (% of population aged 20–29)



Source: Eurostat 2013

In 2010 the highest proportion of students of doctoral study programmes comprises students of the natural and technical sciences in the Czech Republic (47 %), France (48 %) and also in Ireland (46 %). In contrast, doctoral students made up only a small proportion of the natural and technical sciences in Austria (27 %), Poland (31 %) and Spain (31 %).

Chart B.35: Students of doctoral study programmes in the fields of the natural and technical sciences, (% of all doctoral students)



Source: Eurostat 2013

In comparison with 2000, in the countries in question the most marked increase in this proportion was seen in Spain and Portugal, when between the years 2000 and 2010 there was an increase of nine percentage points. In contrast, the greatest decline in this indicator was seen in Greece, from 54 % in 2000 to 32 % in 2010.

C Results of research and development

This section presents summaries and scientometric analyses of results generated as part of research and development activities in the Czech Republic. The primary source of information about results generated in the Czech R&D&I system is the Research and Development Information System (R&D IS), which on the basis of the Law on the Support of Research and Development[21] is in charge of the collection, processing, provision and use of data relating to research, development and innovation supported from public funds. The bulk of the figures presented is taken from part of this system, the Results Information Register (RIV). The RIV records data about the results of research and development financed from public funds. The RIV provides data about the type of results, their authors and affiliations, bibliographic publishing data and information about how the results are connected with projects, programmes and providers of public aid in relation to which the results were created.

Overviews of the results of R&D&I are sorted according to various criteria. The aggregation of the 123 disciplines defined in the R&D IS[22] uses aggregation into 13 broader disciplines as introduced by the new assessment methodology applicable for 2013 - 2015[23]. The institutional division of results uses a sector classification system similar to the methodology used by the CSO. Selected time series are presented in order to illustrate the dynamics of the changes that occur in the national R&D&I environment.

Information about the publication of the results of Czech R&D and its renown on the international scene is sourced from the research and analytical platform Thomson Reuters (TR) Web of Knowledge and its database of professional publications, Web of Science (WoS), which contains data about professional publications and their citation rates (the databases Science Citation Index, Social Sciences Citation Index and Arts & Humanities Citation Index). For international comparison, data provided by the InCites evaluation tool were used. WoS data are sorted according to two TR methods: Categorisation into 22 broader R&D disciplines (referred to by TR as Essential Science Indicators, ESI). In this classification every periodical title is assigned to one of the disciplines. A more detailed discipline classification uses the system on 251 Web of Science Categories[24]. Unlike ESI classifications, a title may be assigned to more than one discipline. One example is the overlap of nuclear physics with multi-disciplinary physics, instruments and instrumentation and instrumentation and electrical and electronic engineering.

Data and information about patent activity are sourced from the Industrial Property Office of the Czech Republic, which provides patent protection within the Czech Republic. The Czech Statistical Office then, in collaboration with IPO CR, publishes detailed patent statistics in various classifications, according to the OECD Patent Manual. Data used for international comparison are sourced from Eurostat and the OECD. Detailed information (data, definitions, methodology) are available on the CSO website. Data on licences provided and acquired has been monitored by the CSO since 2004 by means of an annual licence survey (LIC 5-01). The aim of this survey is to determine the number of licence contracts for the provision or acquisition of the right to a form of protection of industrial property applicable in the Czech Republic and the value of received or paid license fees for the provision or acquisition of this right. Detailed information can again be found on the CSO website.

Section C is divided up into three parts. Part C.1 presents data about the results from the RIV sorted according to a series of criteria – time series, discipline and institutional classification and by type of results. Part C.2 compares publication output and selected indicators of the efficiency of Czech R&D with the group of countries, the discipline structure of publication outputs and their citation rate. Part C.3 presents information about the current state and trends in patent activity in the Czech Republic in an international comparison. It also presents data about sales of patent licences and related licensing revenue of subjects from the Czech Republic.

21 Precise name Act No. 130/2002 Coll., on the Support of Research and Development from Public Funds and on the Amendment to Some Related Acts (for the complete wording, see the Collection of Laws under No. 211/2009 Coll.)
22 Definice oborů viz http://www.vyzkum.cz/FrontClanek.aspx?idsekce=959
23 Precise name Methodology for Evaluating the Results of Research Organisations and Evaluating the Results of Completed Programmes (valid for the years 2013 and 2015) http://www.vyzkum.cz/FrontClanek.aspx?idsekce=685899
24 see http://images.webofknowledge.com/WOKRS511B5P1.01/help/WOS/hp_subject_category_terms_tasca.html

Main trends

- The total number of R & D results registered in the Results Information Register stagnated in comparison with 2011.
- The number of publications by Czech authors registered by Thomson Reuters Web of Science in 2012 stagnated and in the last five years increased by 18 %.
- The number of publications registered by Web of Science increased faster in previous years than the total number of publications reported in the R&D&I IS.
- The largest increase in the number of results recorded in the the Results Information Register between the years 2008 and 2012 was in the social sciences (shvb) social, humanities and arts sciences (shva), while there was a decline in the agricultural sciences, the mathematical sciences and the social sciences (shvc).
- The downward trend in publishing in conference proceedings in 2012 continued to intensify (14% year-on-year decline compared with 3% in 2011)
- The Czech Republic's share in global production in 2012 stagnated at 0.76 %, although from 2008 rose by 0.03 %.
- The citation rate of Czech publications from 2010 exceeds the world average.
- The fields of multidisciplinary physics, nuclear physics, nuclear science and technology achieve both an above-average citation rate (150-310% of the world average) as well as a relatively high proportion of the total global publication output.
- The most cited field in the five-year average is general medicine (almost 700% of the global average). Other branches of medicine (rheumatology, cardiovascular medicine and medical laboratory technology) are also highly cited disciplines (more than double the global average).
- The number of publications related to population and FTE researchers is at the level of the EU27 average.
- In terms of numbers of publications per million inhabitants, old EU member states achieve several times better figures than the Czech Republic.
- The number of patents granted as registered in the RIV increased approximately threefold between 2008 and 2012 and in 2012 annual growth stagnated at approximately 20%. The annual growth rate of registered utility models and industrial designs in 2012 fell to 24% in comparison with the 87% increase in 2011.
- Applicants from the Czech Republic filed a total of 867 patent applications with IPO CR in 2012, i.e. 11 % more than in the previous year and 22 % more than five years ago. A marked yoy increase was also seen in the case of patents granted.
- The most significant contribution to the overall annual growth of patent applications were domestic companies, which in 2012 filed 378 applications, i.e. a fifth more than in 2011 and the most since 1995. For a long time now, approximately two-thirds of business applications for inventions have come from domestic companies and third from the companies under foreign control.
- In the longer term, there has also been a significant increase in the patent activities of Czech public universities in particular.
- The patent activity of Czech entities abroad, however, despite the steady increase, is still significantly behind developed EU countries. While in 2012 EU27 countries filed an average of 129 applications for inventions with the EPO per million inhabitants, in the Czech Republic the figure was a mere 13 applications.
- The increase in patent activity in recent years is not accompanied by a corresponding increase in the number of licensed patents and the related increase in licensing revenues. Although in 2012 entities from the Czech Republic received almost 1.5 billion CZK from patent licences, only 8 million CZK came from new licences. In terms of licensing revenues from industrial property, in this country most come from the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the Czech Republic.
- Of a total of 2 200 patents valid as of 31. 12. 2012 in the Czech Republic pertaining to domestic entities, only one in ten was licensed in 2012.

C.1 Results recorded in the R&D&I IS Results Information Register

In 2012 there were 58.4 thousand results reported in the RIV (see table C.1). In comparison with the previous year, there was no increase in the total number of results, which since 2009 has remained at approximately 6 %. The main type of results comprises publication outputs. However, the proportion these made up of the total number of results systematically dropped from approximately 88 % in 2007 to 76 % in 2012. This is mostly caused by the significant decline in registered outputs in conference proceedings (type D). However, publishing in specialised periodicals maintained the upward trend from previous years, when the year-on-year increase in 2012 was approximately half (3 %) that seen in in 2011 and a third of in comparison with 2010. In 2012, however, there was a 12 % increase in the number of publications in impacted periodicals[25]. The several times higher growth in the number of impacted publications and the systematic increase in the citation rate of Czech publications (see section C.2) reflect the increasing quality of Czech research. The declining in the trend of publications in conference proceedings accelerated and in 2012 the year-on-year figure was 14%. One possible explanation is the conflict between the conditions governing the size of contributions in conference proceedings and the criterion stipulating the minimal length of contributions (2 pages) for inclusion in the RIV, which have applied since 2009. Another reason may be the fact that, particularly in the case of significant international conferences, conference proceedings are issued as dedicated issues of impacted periodicals.

The rise in the number of reported patents in 2012 was the same (approximately 20 %) as in the previous year. The current increase in patent activities is significantly lower than in the years 2007–2009, when year-on-year growth reached 70%. This sudden increase may be the result of the change to the assessment methodology, stimulating patent registration. The current increase in the number of patents granted indicates greater interest in the protection of intellectual property in the Czech R&D environment. The increase in the number of other results with legal protection (utility models, industrial models, type F) was comparable with the number of patents granted. Between the years 2010 and 2012 there was a significant slowdown in the production of these results (in 2011 year-on-year growth was almost 90 %). In the field of applied results, in comparison with 2011 there was an approximately 12% decline in the number of pilot operation, certified technology results (type Z) and the number of technically implemented results (prototypes, functional models, type G) stagnated. After rising sharply in 2007–2009, the numbers of type Z results fell and the number reported in 2012 was considerably lower than in 2008.

The results for software (R), after falling by approximately 50% in 2011, were the fastest increasing type of results (28 % y-o-y), although in absolute terms the number of reported results for software is around the same as in 2009. The second fastest increasing type of results, which are more application, are certified methodology, medical procedures, conservation procedures, specialised maps featuring special content (type N), the number of which in 2012 is more than double that of 2009 and 2010.

The total number of results of Czech R&DaI recorded in 2012 stagnated. However, the number of several types of results is showing a long-term increase, which reflects the systematic increase in the effectiveness of Czech R&DaI.

Table C.1: Numbers of the results of R&D&I recorded in the RIV database in the years 2007–2012

Result type	type	Year					
		2007	2008	2009	2010	2011	2012
Total number of records in the RIV		**55 469**	**53 622**	**52 535**	**55 653**	**59 231**	**58 400**
Publication output total (B + C + D + J)		**48 573**	**45 909**	**43 193**	**44 971**	**46 354**	**44 469**
Of which:							
Specialised monographs	B	1 492	1 636	1 464	1 596	1 834	1 661
Sections or chapters in specialised books	C	3 588	4 028	4 221	4 706	5 211	4 883
Articles in conference papers from events (published lecture – proceeding)	D	21 892	18 568	16 030	15 139	14 702	12 632
Articles in specialised periodicals	J	21 601	21 677	21 478	23 530	24 607	25 293

25 Impacted publications are defined as periodical titles registered by the Thomson Reuters Web of Science database (Methodology for evaluating the results of research organisations and analyis of the results of completed programmes (valid from 2013 to 2015), approved by Czech Government Resolution No. 475 of 19. 6. 2013.

Of which:							
Articles in specialised impacted periodicals	J_{imp}	8 985	9 104	9 145	10 090	10 380	11 613
Pilot operation, certified technology (used in production, etc.), variety or breed	**Z**	**305**	**452**	**573**	**462**	**459**	**403**
Patent	**P**	**55**	**85**	**144**	**162**	**198**	**240**
Other applied outputs total (F + G + N + R)		**2 410**	**2 705**	**3 860**	**4 372**	**4 976**	**5 992**
Of which:							
Legally-protected results (utility models, industrial models)	F	51	215	354	361	675	836
Technically implemented results (prototypes, functional models)	G	2 153	1 264	1 469	1 695	1 823	1 806
Certified methodology, medical procedures, conservation procedures, specialised maps featuring special content	N	117	510	949	1 036	1 648	2 280
Software	R	89	716	1 088	1 280	830	1 070
Other results total (A + E + H + M + O + V + W)		**4 126**	**4 471**	**4 765**	**5 686**	**7 244**	**7 296**
Of which:							
Audio-visual work, electronic documents	A	1 082	818	581	518	728	797
Arrangement (organisation) of exhibitions	E	107	145	177	190	161	167
Results implemented by provider (the results reflected in legislation and standards, directives and regulations of a non-legislative nature of binding within the competence of the relevant provider)	H	24	52	74	65	131	97
Arrangement (organisation) of conferences	M	586	685	542	532	573	501
Other results that cannot be classed as any of the above result types	O	1 877	2 260	2 953	3 743	4 920	5 132
Research report containing classified information	V	3	7	3	3	11	17
Arrangement (organisation) of workshops	W	447	504	435	635	720	585

Note: Results of the type prototype, methodology used, functional models were classed in category S in the RIV until 2008. This category is harmonized in all outputs with the current category G. Results of the type pilot operation, certified technology, variety or bred were listed as category T until 2006 and are harmonized with the current category Z.
Source: R&D IS, Results Information Register figures as of 31. 12. 2012.

Discipline structure of results recorded in the R&D IS Results Information Register

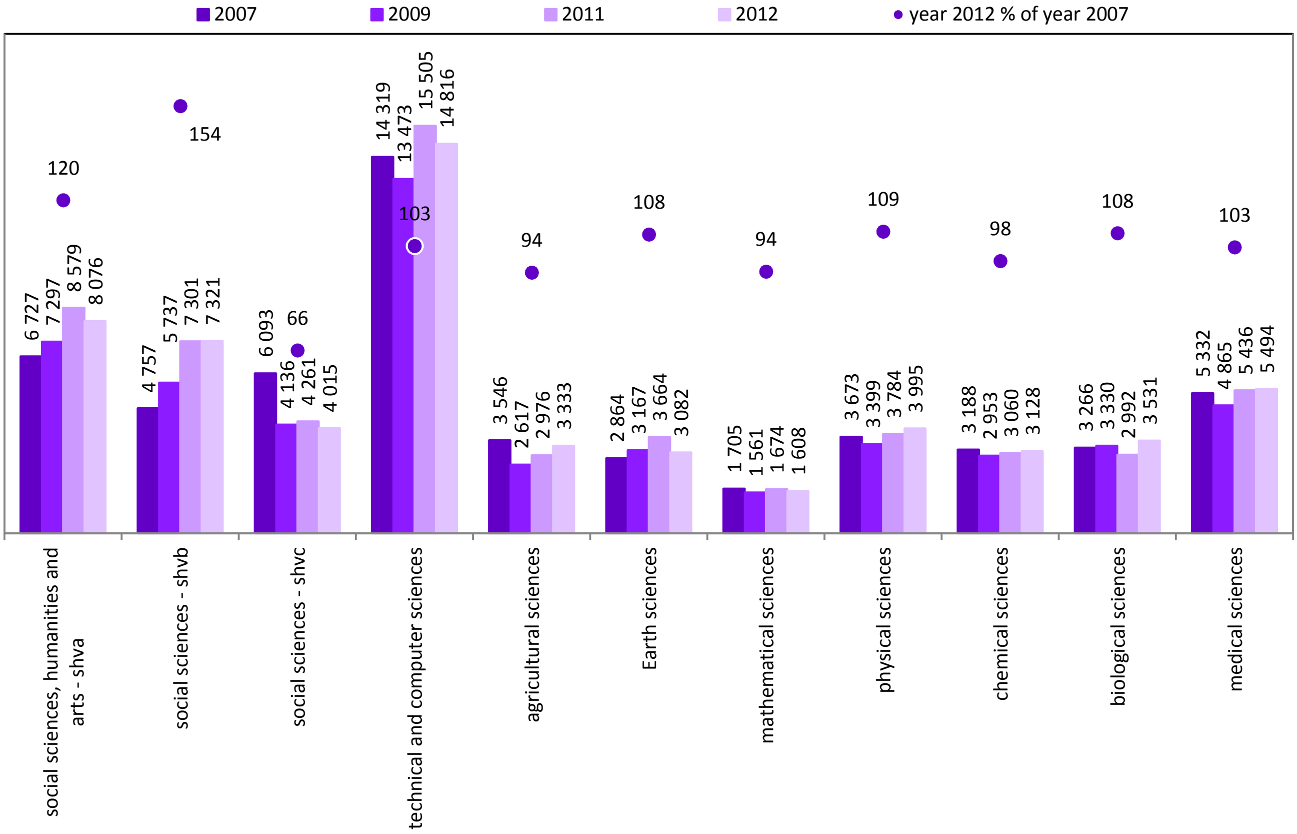
The method used to assess the results of R&D&I defines 123 scientific disciplines for the categorisation of results and research activities. The methodology adopted for the years 2013-2015 changed and extended the aggregation of these disciplines into discipline groups from ten to eleven discipline groups and has merged the technical sciences with informatics, which in previous R&D&I analyses were in one group together with the mathematical sciences. In the current methodology, the two original groups of social sciences and humanities disciplines are divided into three discipline groups. When assessing the discipline structure of the results, it is essential to take account of the fact that the discipline classifications of results are sent to the R&D IS by the creators of the results, and so may be subjectively influenced.

In absolute terms, the highest number of results are registered in the newly defined field of the technical and informatic sciences (graph C.1). Since 2007 the greatest rise in the number of results has been seen in the social sciences (shv-b), humanities and the arts (shv-a). In the other discipline groups the total numbers of results stagnated in comparison with 2007, or rose by a mere few percent.

Publication outputs (B, C, J, D) predominate in all the discipline groups. Their relative proportion does, however, vary in the various discipline groups due to different publishing practices and the dynamics of the spread of knowledge in the various fields. The discipline groups differ particularly in the extent to which they use conference and book outputs (entire professional books as well as individual chapters). With the exception of the social sciences, all the disciplines saw a decline in the number of articles in conference proceedings. In most of the disciplines this decline was offset by increases in the number of articles in specialised periodicals.

The technical and informatic sciences are the only discipline where the number of conference articles has long exceeded the number of articles in periodicals. In 2008 the ratio was approximately 3:1 and by 2012 it had fallen to 37 %:25 %. The technical and informatic sciences are the main creators of patents (type P) and software (R). The year-on-year increase in patents in 2012 in this group was 33 %.

Chart C.1: Numbers of results recorded in the RIV in broader scientific disciplines in the years 2007 - 2012 and related to 2007



Source: R&D IS, Results Information Register, figures as of 31. 12. 2012

The social sciences follow the technical and informatic sciences in the use of conference publishing. In 2012 the ratio of journal and conference publications in the social sciences (sum total of shva, shvb, shvc) was 34 %:20 %. The social sciences are characterised by their high proportion of book outputs. In the group of social sciences, the humanities and the arts (shva) and social sciences (shvc), the proportion of book publications (sum total of monographs and chapters in specialised books: type B + C) is approximately equal to the proportion of journal publications (32–35 % in 2012).

The mathematical sciences, despite a slight decline of approximately 9 percentage points over five year, maintained a high proportion of conference articles at approximately 30 % in 2012, which is the most from the physical and natural sciences.

In comparison with the other disciplines, the medical sciences have a unique output structure: 84 % of outputs (2012) are made up of articles in journals and other types of results contribute no more than a few percent. It is surprising that there are so few type N results (certified methodology, medical procedures...), which, with the exception of 2009 (14 results), numbered several results/year.

The main results in the physical sciences are articles in specialised periodicals, which made up 62 % of all results (2012). The second most significant means of sharing the results of physical research are articles in conference proceedings.

In the chemical sciences the structure of results is very similar to that of the physical disciplines. The chemical sciences saw a sharp rise in the number of patents granted, which has more than doubled since 2009. After the technical and informatic sciences, the chemical sciences are the second largest generator of patents.

The Earth sciences and agricultural sciences ate the main generators of type N results - certified methodology, medical procedures, conservation procedures, specialised maps featuring special content. In 2012 the proportion of both disciplines in the total number of results in the discipline was approximately 22 %, while in the Earth sciences there was a year-on-year decline of 25%. In the agricultural sciences, however, the number of these results saw a year-on-year increase of 98 %. During the last 5 years, the agricultural sciences saw the greatest decline in publications in conference proceedings. In 2007 the number of conference articles was practically the same as the number of publications in periodicals. In 2012 they comprised only a third of publications in periodicals.

The biological sciences show the second highest proportion of articles in specialised periodicals in relation to the overall output of this field (70 % in 2012). The number of results of this type saw a year-on-year increase of approximately 13 %. The results of type of patent granted saw the sharpest rise in previous years in the biological sciences. In 2012 the number of patents granted rose by approximately fifty perfect in comparison with 2011. In comparison with the other science groups, articles in conference proceedings are not a significant means of sharing information about results and in 2012 made up only approximately 5 % of all outputs in the discipline.

The numbers of results with application potential (types F, G, R, N) in most of the disciplines since 2007 have increased several fold. The disciplines in which this increase is the greatest are the agricultural sciences (an almost sevenfold increase since 2007) and the Earth sciences, where there was an almost threefold increase since 2007.

Institutional structure of results recorded in the R&D IS Results Information Register

The institutional structure of results reflects the classification of sectors engaged in R&D as used by the CSO. The CSO divides R&D workplaces up into four sectors: Business, governmental, university and private non-profit, which are further divided up into a total of 11 groups[26]. For the purposes of this Analysis, this classification is simplified by merging all the business subjects into a single class. In this section the creators of the results are aggregated into nine groups[27]:

- Business sector
- Governmental sector – workplaces of the Academy of Sciences of the Czech Republic
- Governmental sector - departmental research facilities
- Governmental sector - libraries, archives, museums
- Governmental sector - other
- University sector - public and state universities
- University sector - teaching hospitals
- University sector - private universities
- Private non-profit sector

As shown in the previous section, the difference in the discipline structure in itself leads to a difference in the proportion of ways of sharing the results of R&D. Therefore, when interpreting data about the results in the various groups, it is essential to take account of the differences in their discipline structures and how the various discipline groups are represented in the institutional research portfolio.

The dominant type of results in the business sector are results with application potential: Methodology, prototypes, functional models, utility/industrial models, software (F, G, H, N, R, Z). In comparison with the other sectors, the proportion of these results is highest in the business sector. Even so, important types of

26 E.g. http://www.czso.cz/csu/2011edicniplan.nsf/t/59001FFA8D/$File/96011105.pdf

27 The institutions were classified into groups using the attributes of institution types provided by RRI, the name of the institution, CSO methodology: http://www.czso.cz/csu/redakce.nsf/i/definice_vav/$File/definice.pdf and the Business Register http://registry.czso.cz/irsw/

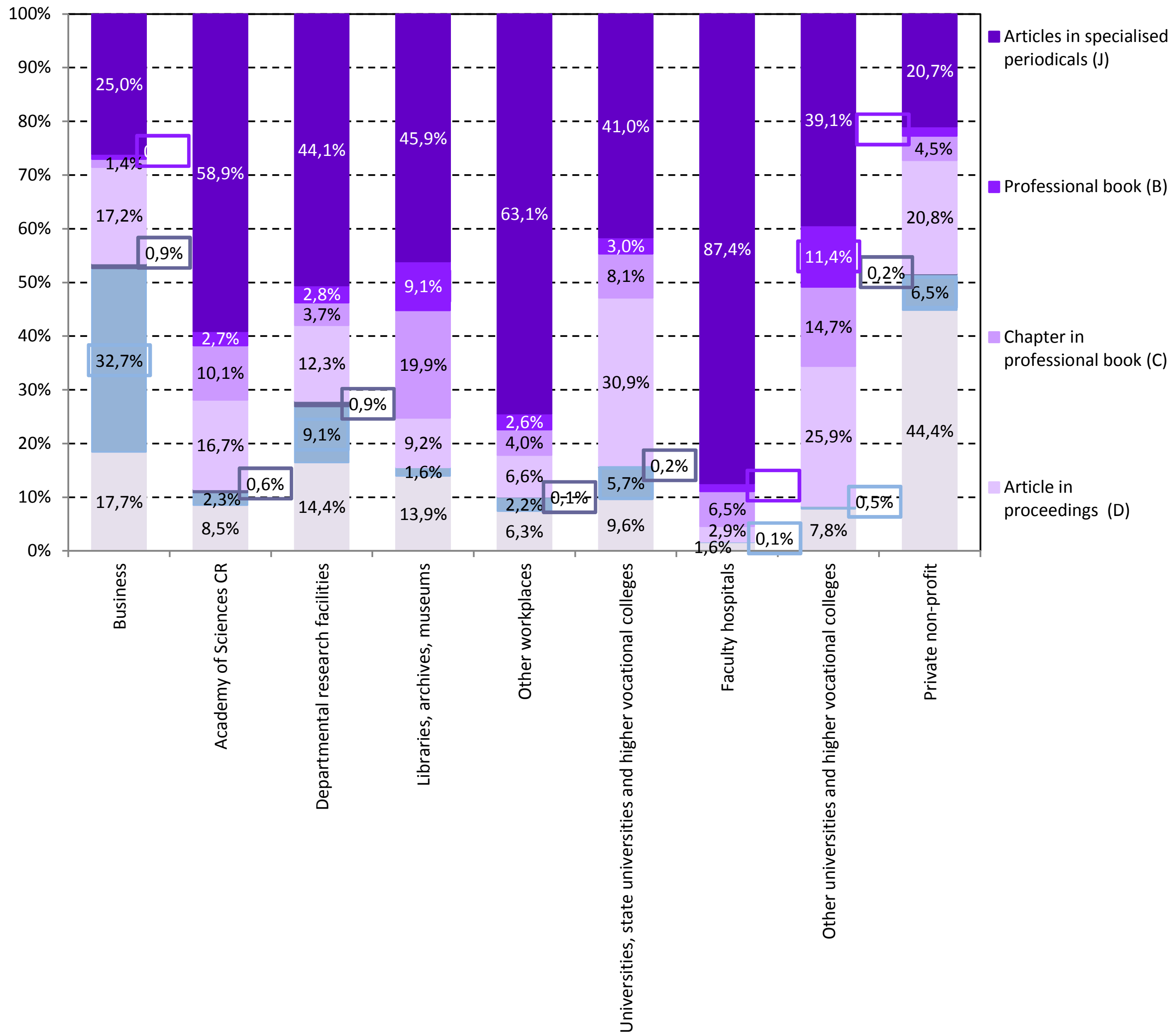
results in the business sector are articles in periodicals (J) and articles in conference proceedings (D), which together exceed the number of application outputs (Graph C.2).

The difference in the discipline structure of R&D results recorded in the RIV is highlighted by the different ways in which knowledge is shared in the various scientific disciplines.

The governmental research sector is clearly dominated by publications in specialised periodicals, while more than half of this type comes from workplaces of the Academy of Sciences of the Czech Republic and those that do not fall into the aforementioned three specific groups in the governmental sector. Compared with journal publications, there is a lower proportion of publications in conference proceedings in the governmental sector than in the business sector. The reason for this is probably the predominance of the technical sciences, in which publications in conference proceedings outweigh articles in specialised periodicals in R&D businesses. Of all the R&D sectors, libraries, archives and museums have the highest proportion of book publications (approximately 30 %).

The highest proportion of outputs in the university sector comprises publications in specialised journals, although in public and state universities (the majority of the university sector) 31 % of outputs comprised articles in conference proceedings, which is the highest proportion of all the R&D sectors. The structure of results from teaching hospitals is very different to that of the other R&D sectors. Almost 90 % of the results comprise publications in specialised journals and, wholly unlike publication outputs (J, B, C, D), comprises almost 2 % of all outputs. The structure of results from other universities, which make up a relatively small proportion of the university sector, is similar to public universities, although the proportion of book publications is approximately twice as high.

Chart C.2: Total numbers of results in categories in the years 2008 - 2012 by sector

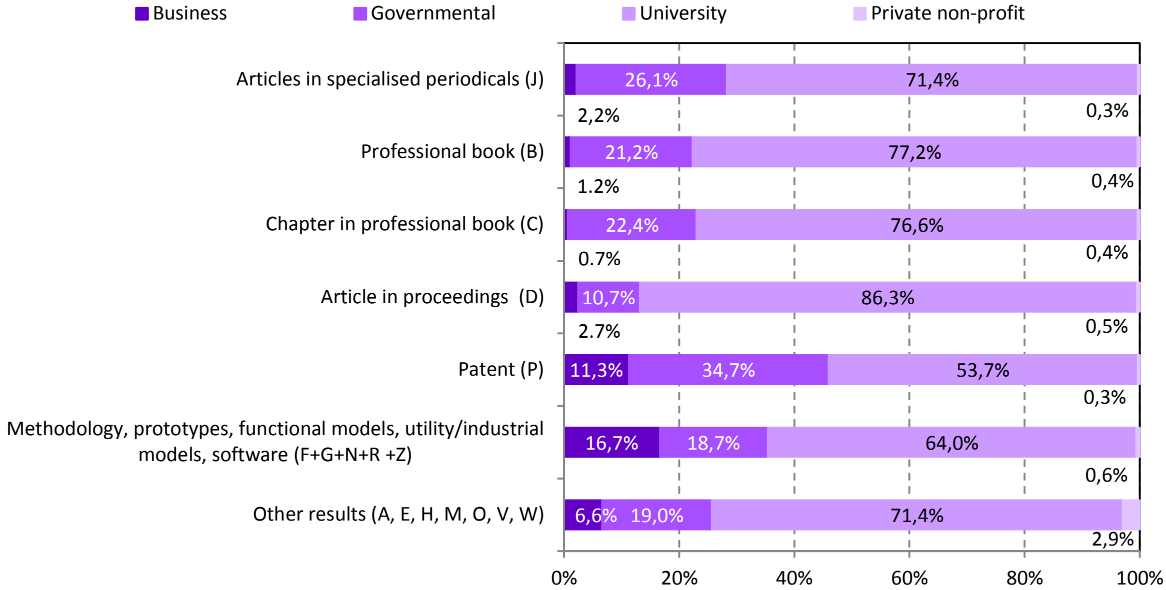


Source: R&D IS, Results Information Register figures as of 31. 12. 2012

The structure of publication outputs of the private non-profit sector is approximately the same as in the business sector. The results of the private non-profit sector are dominated by results categorised in the Other group ((A, E, H, M, O, V, W).

The proportion of the various R&D sectors in these results is shown in graph C.3. The main producer of results, in terms of the total size of the sectors, is the university sector. In publication outputs the structure of results from the university sector is comparable with that of the governmental sector, the most significant contributor to which is the Academy of Sciences of the Czech Republic. As regards results with application potential, the governmental sector contributes considerably more than its proportion of funding and human resources would imply. The governmental sector provides approximately a third of patents granted during the last five years, and the governmental sector provides approximately three times more patents than the business sector. In the group unifying other results with application potential (F, G, N, R, Z), the governmental sector's proportion is the same as that of the business sector. The governmental sector, with the dominant research capacity of the Academy of Sciences of the Czech Republic, is a major producer of knowledge and skills with application potential within the Czech R&D system.

Chart C.3: Total numbers of results in categories in the years 2008 - 2012 by main R&D sectors

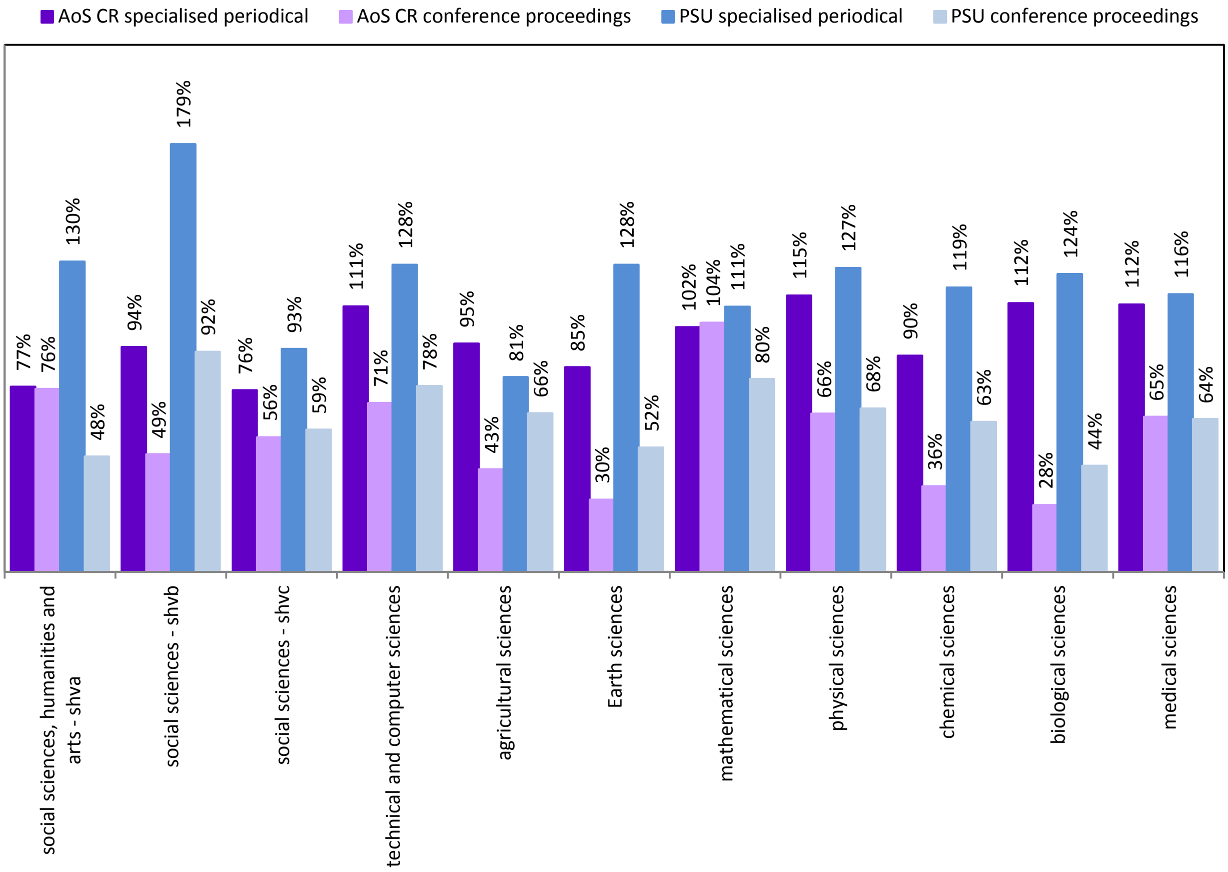


Source: R&D IS, Results Information Register figures as of 31. 12. 2012

Graph C.4 shows the sectoral dynamics of research activities in public and state universities and ASCR as reflected in the production of the prevailing results - journal articles and conference proceedings. In the group of public research institutions set up by the Academy of Sciences of the Czech Republic, during the last five years there has been a marked rise in the number of articles in specialised journals to approximately 10 % in the technical and informatic sciences, the physical sciences, biological sciences and medical sciences. There was a sharp decline in publishing in the Academy of Sciences of the Czech Republic in two areas of the social sciences and humanities (shva, shvc). The production of publications in the other disciplines stagnated and only changed by a few percent during the period in question. The greatest decline in publishing in conference proceedings was seen in the Earth sciences, biological sciences and chemistry. The exception is the mathematical sciences, where the rise in the number of publications in conference proceedings outstripped that of journal articles.

In the university sphere during the period in question there was an approximately 80 % increase in the social sciences (shvb). With the exception of the social sciences (shvc) and the agricultural sciences, the number of articles in specialised journals during the period in question increased by 10–30 %. The agricultural sciences are the only field which saw a dramatic decline, by almost 20%. The decline in the number of publications in conference proceedings was less sharp in the university sphere than it was in the Academy of Sciences of the Czech Republic.

Chart C.4: Discipline-based breakdown of results in the category publications in specialised periodicals (J) and articles in conference proceedings from events (D) generated in the Academy of Sciences of the Czech Republic and public and state universities (PSU) relative to 2008

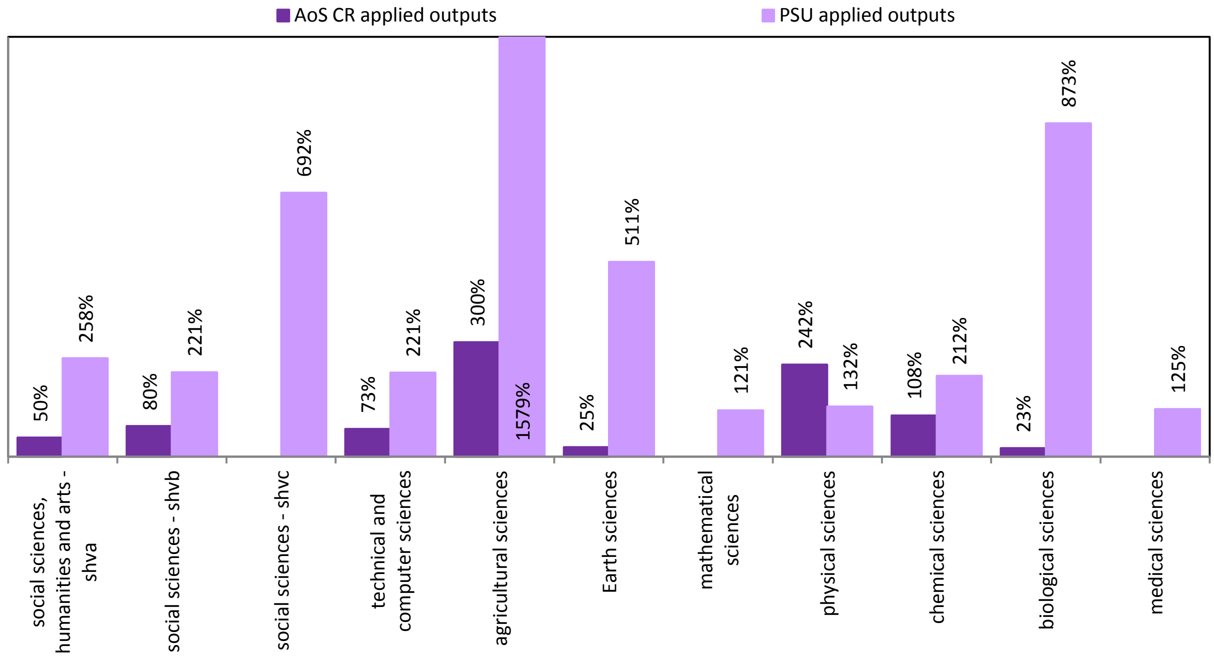


Source: R&D IS, Results Information Register figures as of 31. 12. 2012

In the group of results with application potential, there was a marked increase in results in the agricultural sciences in both the Academy of Sciences of the Czech Republic as well as in the university sphere. Another discipline which showed a sharp rise in these results in the Academy of Sciences of the Czech Republic was the physical sciences. With the exception of the chemical sciences, which saw a slight increase, in the other disciplines there was a decline in these results in the Academy of Sciences of the Czech Republic (see graph C.5).

Universities showed a considerable increase in these results in most of the disciplines. In the agricultural sciences, the figures were fifteen times higher, and eight times higher in the biological disciplines. The significant increase in results with application potential may indicate that research capacities are focusing more on applied research. However, neither the financial benefits nor how successfully new knowledge is absorbed in the business sector can be evaluated without more detailed analysis. It is also essential to bear in mind that these results are not subject to the same rigorous assessment as patent proceedings or peer reviews in the case of publications, and the increase may reflect a purposeful reaction to the methodology used to evaluate R&D in the past.

Chart C.5: Discipline-based breakdown of results of an applied nature (F, G, N, R, Z) generated in the Academy of Sciences of the Czech Republic and public and state universities (PSU) relative to 2008



Note: Sum total of categories F,G ,N, R and Z
Source: R&D IS, Results Information Register figures as of 31. 12. 2012

The numbers of patents granted to institutions of the Academy of Sciences of the Czech Republic and public universities are shown in table C.2. In most of the disciplines, both in the Academy of Sciences of the Czech Republic and at universities there was a considerable increase in the number of patents granted. With the exception of the technical and informatic sciences, for which the Academy of Sciences of the Czech Republic has very little research capacity, the numbers of patents granted are very balanced. Due to the generally lesser research capacity of the Academy of Sciences of the Czech Republic in comparison with the university system, this indicates a significantly higher level of protection of intellectual property and the greater potential of R&D to generate patentable results. However, the true impact of patent activities cannot be appraised in greater detail without a deeper and particularly financial assessment of the benefit that patents bring.

Table C.2: Numbers of patents registered at the Academy of Sciences of the Czech Republic and public and state universities (PSU) in the years 2008 – 2012, by discipline

		year				
		2008	2009	2010	2011	2012
social sciences, humanities and arts - shva	AoS CR					
	PSU					1
social sciences - shvc	AoS CR					
	PSU				1	1
technical and computer sciences	AoS CR	6	1	6	6	5
	PSU	10	33	49	70	96
agricultural sciences	AoS CR	5	2	2		
	PSU		1	4	7	3
Earth sciences	AoS CR	1	1	2		
	PSU		3	2	6	6
physical sciences	AoS CR	2	5	6	5	6
	PSU	3	5	6	10	12
chemical sciences	AoS CR	15	25	27	20	21
	PSU	2	18	25	27	28
biological sciences	AoS CR	5	10	7	4	11
	PSU	1	5	1	5	7
medical sciences	AoS CR	1	3	7	4	3
	PSU	2	4	5	3	6

Note: Disciplines in which no patent was granted are not shown – social sciences shvb and mathematical sciences
Source: R&D IS, Results Information Register, figures as of 31. 12. 2012

Breakdown of results recorded in the R&D IS Results Information Register by aid provider

Overall, the greatest the number of results were generated with aid from MoEYS, GA CR and the Academy of Sciences of the Czech Republic. After MoEYS, the most results from government authorities were seen in departments of the Ministry of Health, Ministry of Industry and Trade and Ministry of Agriculture (table C.3). With the exception of the Czech Office for Surveying, Mapping and Cadastre, the Ministry of Foreign Affairs and the Technology Agency, most are publication-type results (B, C, D, J).

In absolute terms, the most patents were issued under funding provided by MoEYS and the Academy of Sciences of the Czech Republic. The greatest number of patents relative to the total number of results were in R&D supported by the Ministry of Industry and Trade (1.0 %), the Ministry of Agriculture (0.8 %) and the Academy of Sciences of the Czech Republic (0.6 %). At the top for applied results are the Security and Information Service (40 %) and the National Security Authority (100 %). However, in the case of both these institutions, the statistics are probably distorted as some research activities are classified, and their results are not specified in the RIV. Making up the bulk of applied results are the Ministry of Transport (24 %), the Technology Agency (36 %), the Ministry of the Environment (34 %), the State Office for Nuclear Safety (32 %) and the Ministry of Industry and Trade (28 %). Compared to 2007–2011, the number of applied results generated as part of research funded by TA CR rose by 12 percentage points.

Table C.3: Total numbers of results in the years 2008 - 2012 by provider of public funds for R&D&I

Provider	Total number of records in the RIV	Publication output (B + C + D + J)	Patents (P)	Pilot operation, variety, breed (Z)	Applied outputs (F + G + N + R)	Other results (A + E + H + M + O + V + W)
Academy of Sciences of the Czech Republic	27 217	23 797	164	86	795	2 376
Security and Information Service	15	0	0	0	6	9
Czech Mining Office	63	50	0	2	3	8
Czech Office for Surveying, Mapping and Cadastre	305	81	0	71	55	98
Grant Agency of the Czech Republic	33 593	29 806	77	17	1 172	2 521
South Moravian Region	30	30	0	0	0	0
Plzeň Region	68	57	0	0	0	11
Ústí Region	31	31	0	0	0	0
Ministry of Transport	946	556	1	7	232	151
Ministry of Culture	3 621	2 949	0	21	122	529
Ministry for Regional Development	620	499	0	0	57	64
Ministry of Defence	4 172	3 312	3	4	337	516
Ministry of Industry and Trade	9 081	4 176	92	859	2 588	1 367
Ministry of Labour and Social Affairs	619	559	0	0	4	57
Ministry of Justice	112	112	0	0	0	0
Ministry of Education, Youth and Sports	170 678	137 705	413	973	12 370	19 217
Ministry of the Interior	1 752	1 202	3	6	330	211
Ministry of Health	11 155	10 831	5	14	16	289
Ministry of Agriculture	8 211	5 438	63	182	1 453	1 076
Ministry of the Environment	4 767	2 598	0	63	1 634	472
Ministry of Foreign Affairs	334	135	0	0	0	199
National Security Authority	21	0	0	0	21	0
State Office for Nuclear Safety of the Czech Republic	236	144	1	0	76	16
Technology Agency of the Czech Republic	1 786	820	8	46	635	276
Government Office of the Czech Republic	3	3	0	0	0	0

Note: Data about the Security and Information Service and the National Security Authority are distorted as many results are classified.
Source: R&D IS, Results Information Register figures as of 31. 12. 2012

C.2 Bibliometric results

The scientometric evaluation Czech publications and the standard of Czech R&D in comparison with the global average is based on the Thomson Reuters Web of Science database of professional publications and citation rates. The Web of Science currently records professional articles in approximately 17 000 periodicals, conference proceedings and specialised books. For the purposes of comparing the Czech Republic with other countries, outcomes are used from the analytical tool TR InCites [28], which provides professionally, institutionally and territorially aggregated scientometric data and benchmarks for international comparison.

The quantitative indicator for the quantitative evaluation of scientific quality, impact and the influence of Czech R&D is the relative citation index (RCI), which is generally the ratio of the citation rate of a defined set of publications (e.g. sets of individual authors, institutions and groups, or territories) and the average citation rate around the world. A relative citation index value of 1 (or 100 %) shows that the citation rate of the set in question is the same as the global average. Values of less than 1 indicate a below-average citation response and values higher than one indicate the above-average relevance or professional impact of that set of publications on the global rate. The absolute numbers of citations received by a publication are influenced by the specific citation practices of the various disciplines. Scientific disciplines also differ in terms of the speed of the response to newly published findings, the interval at which the frequency of the citation rate culminates, and the duration for which the publication is more significantly cited. For example, the average length of the list of publication citations in biochemistry is approximately twice that of mathematics[29]. The result of this is that the average number of citations per publication differs greatly from discipline to discipline. This is eliminated through the discipline-based normalization of citation indexes – by applying the citation rate to the global average in each of the various disciplines (discipline-relative standardised citation index, RCIO). Despite discipline-based normalization, the interdisciplinary comparison of citation indexes is still complicated by the uneven proportion of the various disciplines in the TR database. Although the TR currently actively indexes a total of approximately 17 000 periodicals and includes the social sciences (Social Sciences Citation Index) and arts and humanities (Arts and Humanities Citation Index) and specialised book publications (Book Citation Index, Science and Book Citation Index, Social Sciences & Humanities), the proportion of scientific disciplines in the WoS database is unequal. The coverage of disciplines falls from the biomedical science and natural sciences (approximately 80–100 % of titles) through mathematics and technical/engineering disciplines (60–80%) to the social sciences and humanities, of which WoS indexes approximately a third of titles[30]. However, the proportion of the various disciplines in the social sciences and humanities is also very inhomogeneous: For example, the economic sciences are included in the WoS at approximately the same extent as technical/engineering disciplines. At the opposite pole are disciplines such as history and literature, approximately one tenth of which are indexed by WoS.

Citation indexes are an objective indicator of the relevance of national research and the application of scientific knowledge generated in the national environment in the global context. Since these are average values, they cannot detect top research groups and individuals. The different disciplinary structure also makes it more difficult to perform an inter-institutional comparison of groups of large research institutions (Academy of Sciences of the Czech Republic, universities).

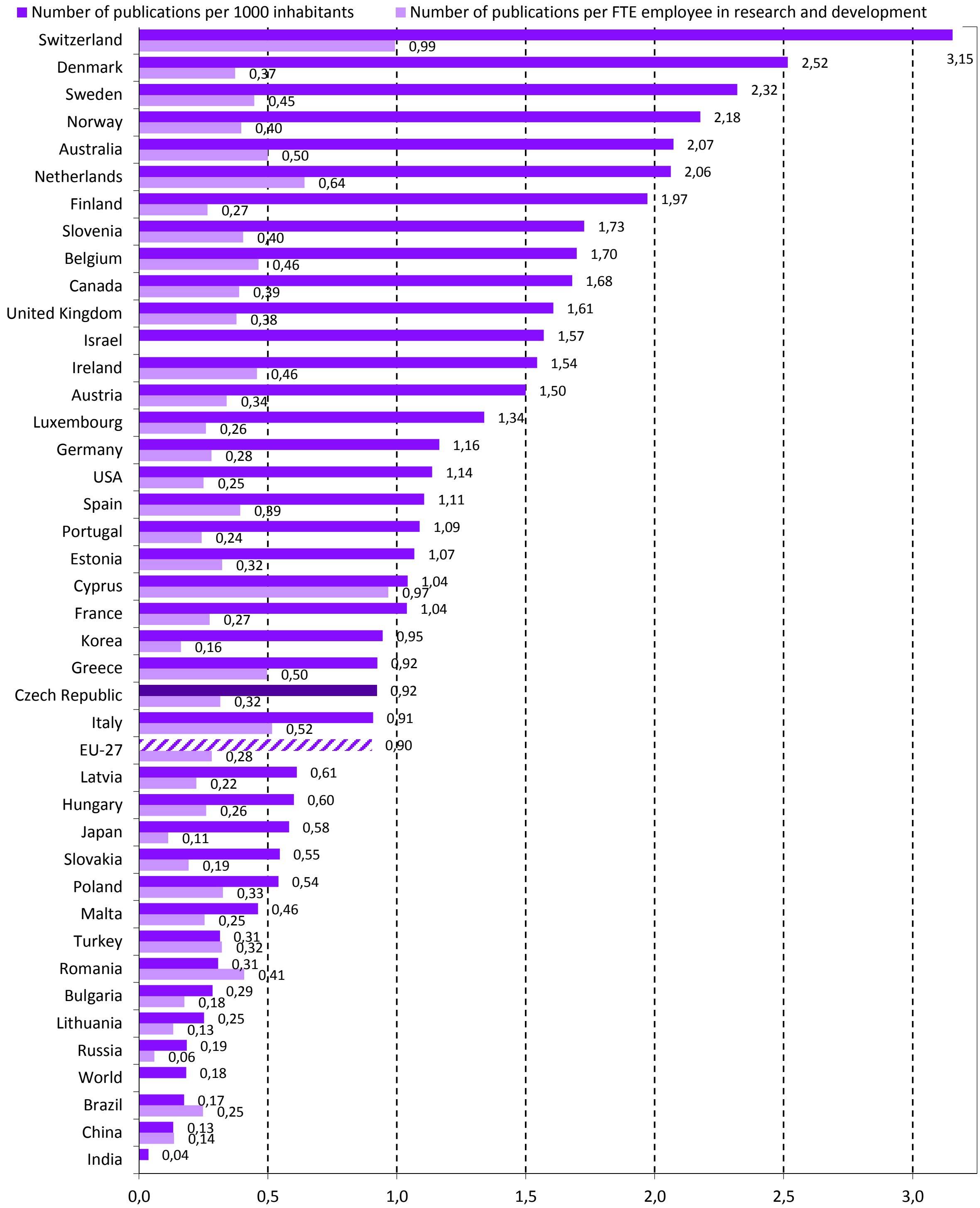
International comparison of the Czech Republic

In 2012, as regards numbers of publications relative to the number of inhabitants, the Czech Republic exceeded the EU27 average and is at the same level as countries such as Italy and Greece (graph C.6). In comparison with EU15 countries of a similar size (e.g. Belgium, Netherlands), the number of publications, at 0.92 per 1000 inhabitants, is approximately half. In comparison with the new EU countries, the CR is third, after Slovenia (1.73) and Estonia (1.07). As regards numbers of publications relative to FTE workers in R&D, which is a very rough indicator of the effectiveness of research activities, the Czech Republic is slightly above the EU27 average and is at the same level as large EU countries (France, Germany, United Kingdom). In EU

28 See TR InCites http://researchanalytics.thomsonreuters.com/incites/
29 E. Garfield,. Citation indexing : its theory and application in science, technology, and humanities. Wiley, New York 1979.
30 Garfield's analysis of the significance of periodicals, however, shows that as regards citation rate and therefore relevance to science, the core comprises around 103 periodicals; Garfield, E. Citation analysis as a tool in journal evaluation. Science, 178 (4060), 471-479 (1972), Garfield, E. Which journals attract the most frequently cited articles?. Current Contents, No. 39, 5-6. (1973)

countries of a similar size to the Czech Republic, however, the effectiveness of the research sphere as defined in this manner is 50–100 % higher.

Chart C.6: Number of publications of selected countries relative to 1000 inhabitants and number of (FTE) research and development workers in 2012



Note: FTE R&D workers in the governmental and university sector
Source: Thomson Reuters InCites, OECD

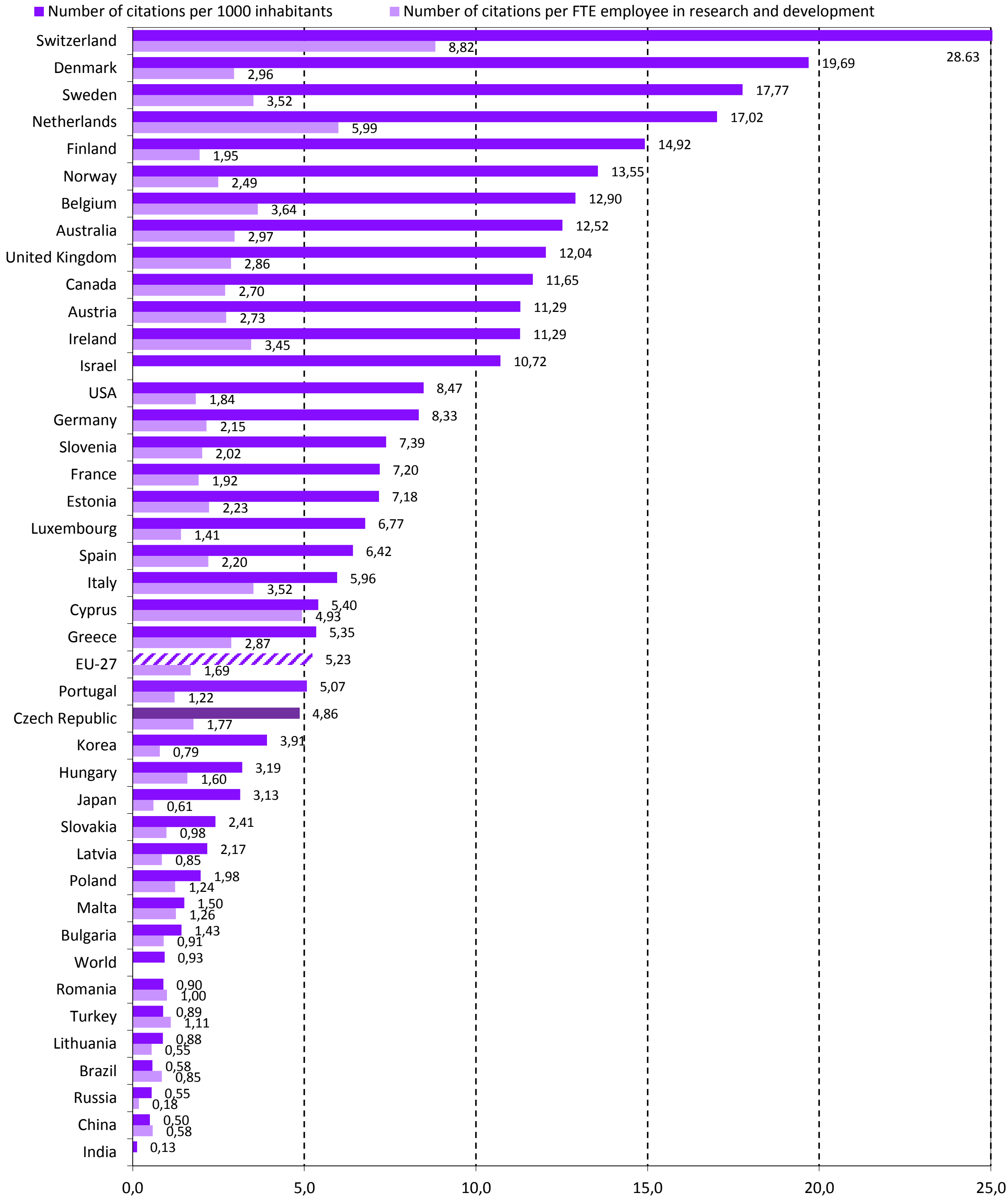
In terms of the citation rate of publications relative to the number of inhabitants (graph C.7), the Czech Republic is below the EU27 average and just behind Portugal. Since 2010, when the Czech Republic achieved 80 % of the EU-27 average in this indicator, the figure has increased to 93 %[31], although in comparison with countries with a similar population e.g. the Netherlands and Austria, the number of

31 Analysis of the state of research, development and innovation in the Czech Republic and comparison with other countries in 2012, Government Office of the Czech Republic, Council for Research, Development and Innovation, January 2013. http://www.vyzkum.cz/FrontClanek.aspx?idsekce=674510

publications per 1000 inhabitants is half or even a third. In terms of the number of citations per FTE R&D worker, the Czech Republic is approximately 5 % above the EU27 average, although in most of the old EU countries of a comparable size this indicator is 50 % or more higher.

In terms of the relative production of specialised publications the Czech Republic is slightly above the European average. The total weight of Czech R&D as assessed by the citation rate of Czech publications is still relatively low, even though the situation is improving.

Chart C.7: Citation rate of publications from 2010 relative to 1000 inhabitants and number of (FTE) research and development workers



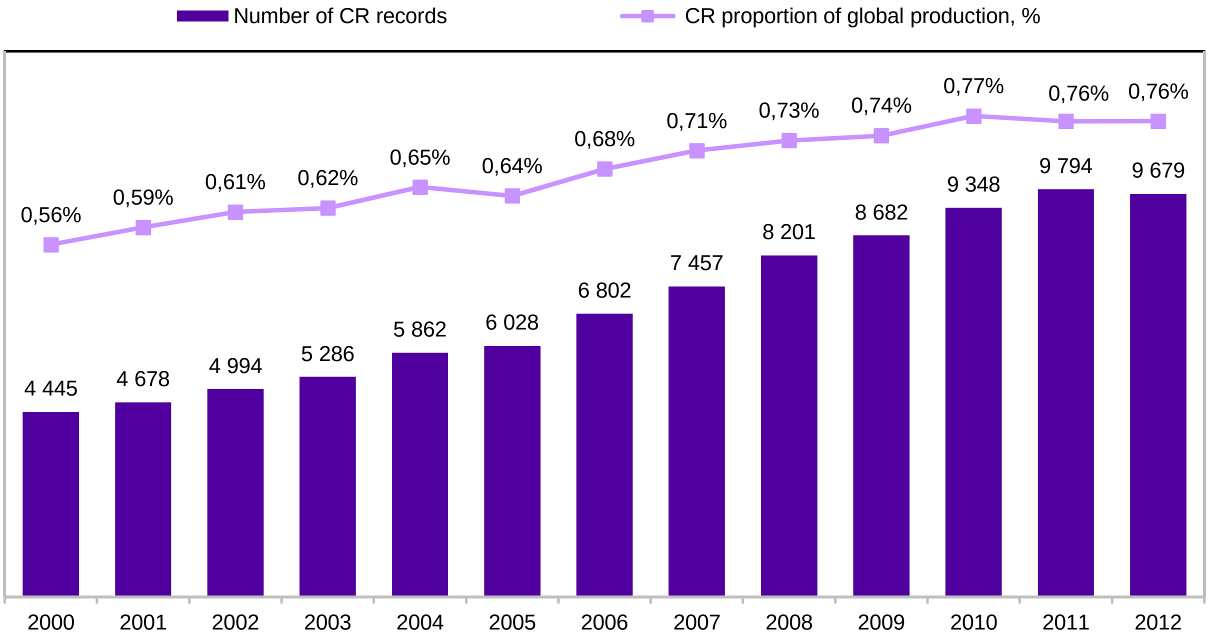
Note: FTE R&D workers in the governmental and university sector
Source: Thomson Reuters InCites, OECD

Czech Republic's share in global production of publication outputs

In 2011 the number of publications which are by at least one author from the Czech Republic[32] and which are recorded in the WoS rose to 10 114 (Graph C.8). In 2011 the year-on-year rise in the number of articles in impacted journals (J_{imp}) was 2.4 %, which is considerably less than in the previous five years, when the number of publications increased by 7–13 % per year. In year-on-year terms, the Czech Republic's share in global production fell slightly by 0.02 %, although it remained above the 2009 level.

As the total global volume of publishing has been rising sharply in recent years as the result of the boom in R&D in growing economies (BRICS countries and others), the proportion of Czech R&D in relation to the global volume is increasing in the long term.

Chart C.8: Total numbers of publications by authors from the Czech Republic in the years 2000–2011 and their proportion of total global production



Source: Thomson Reuters Web of Science, InCites

The number of references to a published work is a measure of the importance, significance and relevance of the information contained in that work for contemporary research[33]. Citations may also be interpreted as an indicator of the influence the authors have on the broader scientific scene[34]. the Absolute numbers of citations depend on the citation practices of the various disciplines. The citation rate is also influenced by the dynamics of the different disciplines. In rapidly developing disciplines, the increase in new findings leads to a higher citation rate. The citation rate of a set of works is a function of the discipline structure.

The discipline-independent citation rate may be acquired by relating the absolute number of citations to the global average in the discipline in question. Two computational methods may be used to acquire the average discipline-independent citation rate of a heterogeneous set of publications:

- proportion of the sum total of citations of the set and the sum of sectoral world averages[35]
- average of the proportion of the citation rate of the various works and the relevant average global citation rates[36] for that discipline.

32 Records in the WoS Science Citation Index, Social Sciences Citation Index and Arts & Humanities Citation Index with the attribute CZ='CZECH REPUBLIC'. In accordance with the methodology of the bibliometric part of the "International Audit of Research, Development and Innovation in the Czech Republic" performed by the Technopolis consortium (Bibliometric Analysis of the Czech Republic Research Output in an International Context - Institutional Analysis, Annex 8 to the Second Interim Report), only 'Article', 'Letter', 'Note' and 'Review' documents are included. Documents such as conference proceedings, articles, abstracts and books are not included.

33 E. Garfield, Citation Indexing. Its theory and application in science, technology, and humanities, Wiley New York 1979.

34 J. R. Cole, S. Cole, Measuring the quality of sociological research: Problems in the use of Science Citation Index, The American Sociologist 6, 23 (1971).

35 "Crown" indicator used by the Centre for Science and Technology Studies, University Leiden

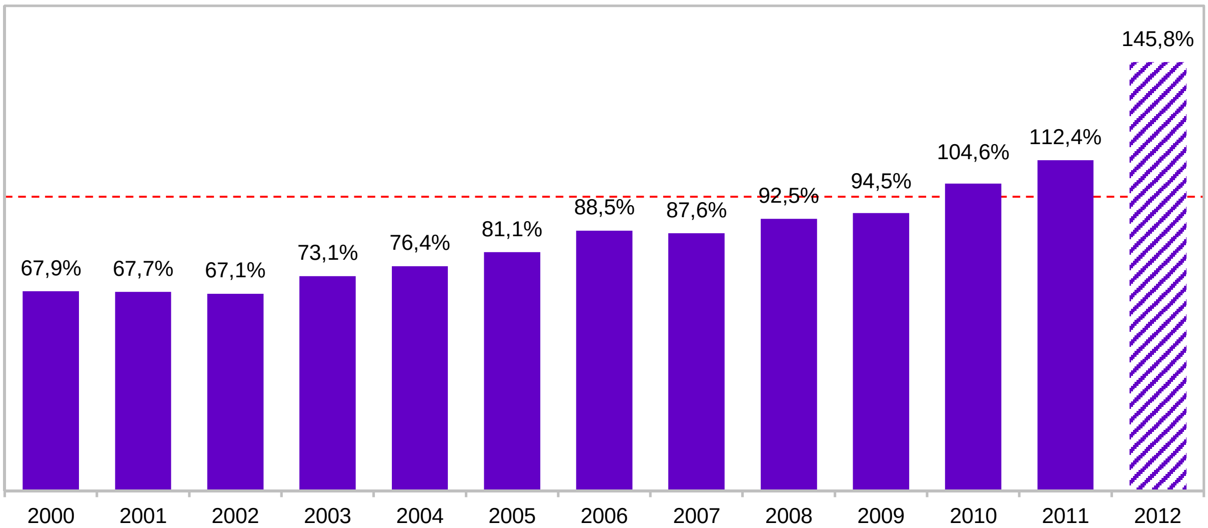
36 Item-oriented indicator used by the Karolinska Institutet, Sweden; for a comparison of indicators, see http://kib.ki.se/sites/kib.ki.se/files/Bibliometric_indicators_definitions_1.0.pdf

With the first method, the citation rate is not normalized to the lowest level of individual publications and this procedure generally results in a higher weight of older publications published in disciplines with high citation rates[37].

This Analysis uses the second method (item-oriented). The advantage of this method, in which normalization is carried out at the level of the various of articles, is that they have the same weight in the final indicator[38]. Another advantage of this method is that it is more sensitive to the presence of small numbers of highly cited works in a set with an average citation rate. In terms of identifying excellence amongst a series of average outputs in the various disciplines, this aspect of item-oriented averaging is an advantage.

Graph C.9 shows the averages of discipline-based standardised citation rates of Czech works published in the years 2000–2011. In the long term, the citation rate of Czech authors increased and in the middle of the last decade slightly exceeded the global average for the first time. During the last few years the rate has stopped increasing and is actually stagnating. The notable 10 % above the global average seen in 2010 cannot be considered reliable due to the short amount of time that has passed since the work was published[39]. A comparison of the dynamics of the increase in publications and their citation rates may indicate a gradual shift in the publication strategies of Czech authors towards publishing greater numbers of average works, which may be a response to the methods used to assess the results of research organisations used in the past.[40]

Chart C.9: Discipline-based standardised citation rates of publications of Czech authors in the years 2000–2012



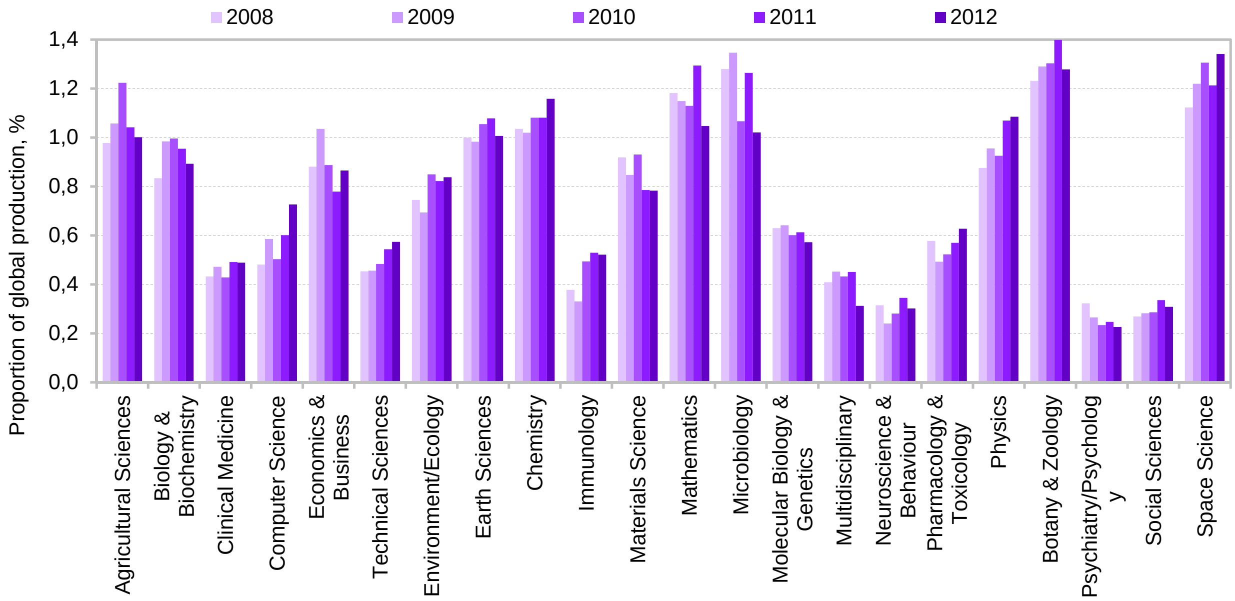
Note: 100 % as marked by a broken line is the discipline-based standardised global average
Source: Thomson Reuters Web of Science, InCites

The TR Essential Science indicators system of classification into 22 broader scientific disciplines is used to describe the discipline structure and proportion of Czech publications in relation to global production[41]. The proportion of Czech publications of global production ranges from 0.3–1.3 % (Graph C.10). Approximately one third of the disciplines repeatedly exceeded one percent. The agricultural sciences, space science, botany and zoology and mathematics have the highest proportion of the global volume of works. During the last five years, the disciplines with the fastest increasing proportion in terms of the global volume of publications are the agricultural sciences, Earth sciences, informatics and the technical sciences. The

37 C. Rehn, U. Kronman, Bibliometric handbook for Karolinska Institutet (2008).
38 J. Lundberg, Journal of Informetrics, 1, (2), 145, (2007).
39 The minimum time interval is generally two years.
40 Methodology for evaluating the results of research organisations and analyis of the results of completed programmes in the years 2009 to 2012 (http://www.vyzkum.cz/FrontClanek.aspx?idsekce=18748).
41 The Essential Science Indicators discipline classification methodology allocates a set of periodicals to each broader discipline. Each titles is allocated to just one discipline (unlike the more detailed system used by the Web of Science Categories, where one periodical title may be allocated to several disciplines). ESI indicators are derived from a subset of all titles indexed by WoS. ESI now cover approximately 10 million articles in around 11 800 magazines (http://thomsonreuters.com/essential-science-indicators/). For the ESI discipline definitions, see http://archive.sciencewatch.com/about/met/fielddef/

disciplines least well represented on the global publication scene are neuroscience, psychology-psychiatry and the social sciences. The proportion is also low for Czech authors in multi-disciplinary fields. Under the ESI classification system, this group includes prestigious titles with extreme impact factors and a very rigorous peer-review manuscript evaluation process. Although the proportion of Czech authors is low, in the last five years it has increased by almost 75 %. This is reflected in the rising global competitiveness of Czech research and excellent research groups.

Chart C.10: Proportion of Czech publications in relation to global production in broader scientific disciplines in the years 2008–2012



Note: The multi-disciplinary fields category includes publications in periodicals of a broad or general nature and covers a wide range of scientific disciplines. This category also includes periodicals publishing works of a multidisciplinary nature which study e.g. particular regions, ecosystems or biological systems and interdisciplinary journals aiming to highlight notable connections between disciplines (Thomson Reuters definition).
Source: Thomson Reuters Web of Science, InCites

Discipline-relative citation indexes (RCIO) for the Czech Republic

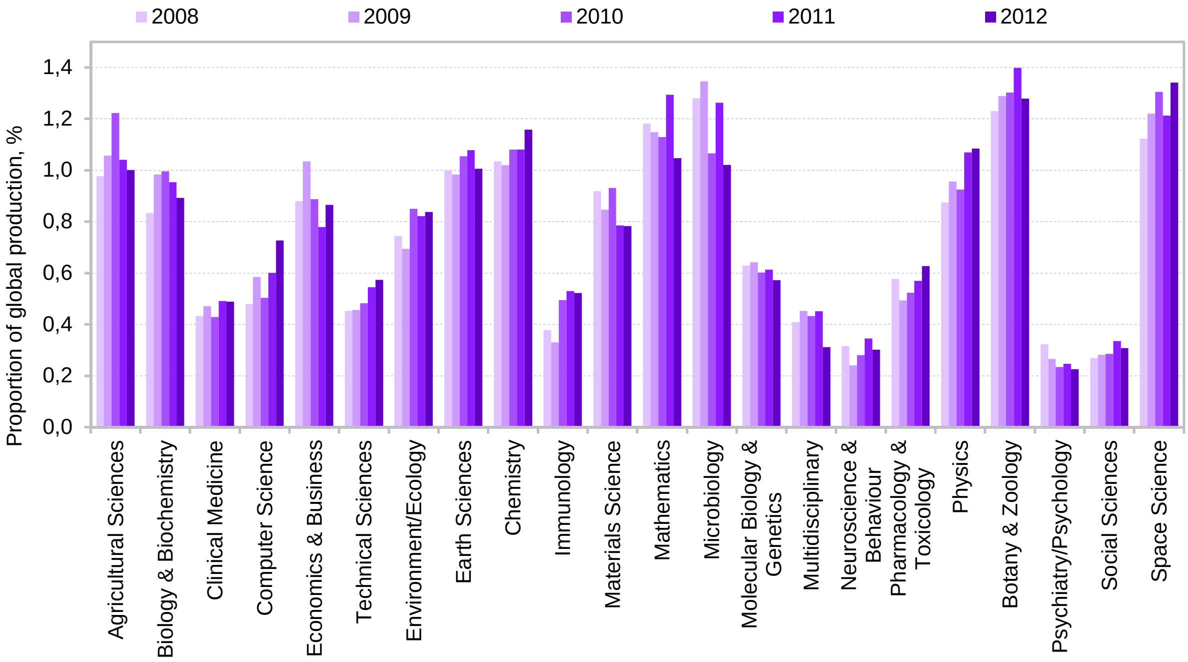
The standardised citation rates of publications of Czech authors in the five-year interval of 2007–2011 broken down by ESI categories are shown in graph C.11. Throughout this entire five-year interval, only 3 disciplines exceed the global average: Clinical medicine, the environment and physics. Of these three disciplines, the only considerable increase in the citation rate was in the physical disciplines. The citation rate of publications in clinical medicine tended to stagnate at around 20 % above the global average and the citation rate for works in the environment discipline fell sharply from an above-average 135 % to the global average. The discipline with the fastest growing citation rate is the social sciences, whose citation rate rose from less than half to 135 % of the global average. Other Czech disciplines whose impact in the context of global science significantly increased during the last five years are mathematics (almost double the citation rate) and the agricultural sciences (by almost 70 %). The citation rate in the group of multi-disciplinary fields fluctuates greatly every year. The numbers of Czech publications in this group are approximately 10/year. Several highly cited publications in prestigious periodicals such as Science or Nature may cause a considerable year-on-year fluctuation in the citation rate.

Graph C.12 shows scientific disciplines with an above-average citation rate sorted by more detailed *WoS Subject Categories,* the citation rate of which has exceeded 20 % of the global average for five years and with on average at least five publications a year published by Czech authors. The five most cited Czech disciplines include two medical disciplines: rheumatology, the citation rate of which is almost three times the global average, and general medicine, with twice the global citation rate, even though these are disciplines which make up a relatively small proportion of the global volume of publications.

Nuclear research stands out from Czech R&D both in terms of the quantitative proportion of global publications and also as regards citation response. The fields of nuclear physics, the nuclear sciences and technology have a citation rate of approximately 150 % of the global average and are also disciplines with the highest proportion in the global number of publications. In the WoS classification publications in experimental physics are also classed in the category instruments and instrumentation and spectroscopy, which also show a citation rate well above the average and also make up a relatively high proportion of global production.

The highest rate in the social science disciplines can be seen in the literary sciences and urban planning. Other social science and humanities disciplines with citation rates 25 % above the global average are education and educational sciences (1.742) and multi-disciplinary humanities (1.379).

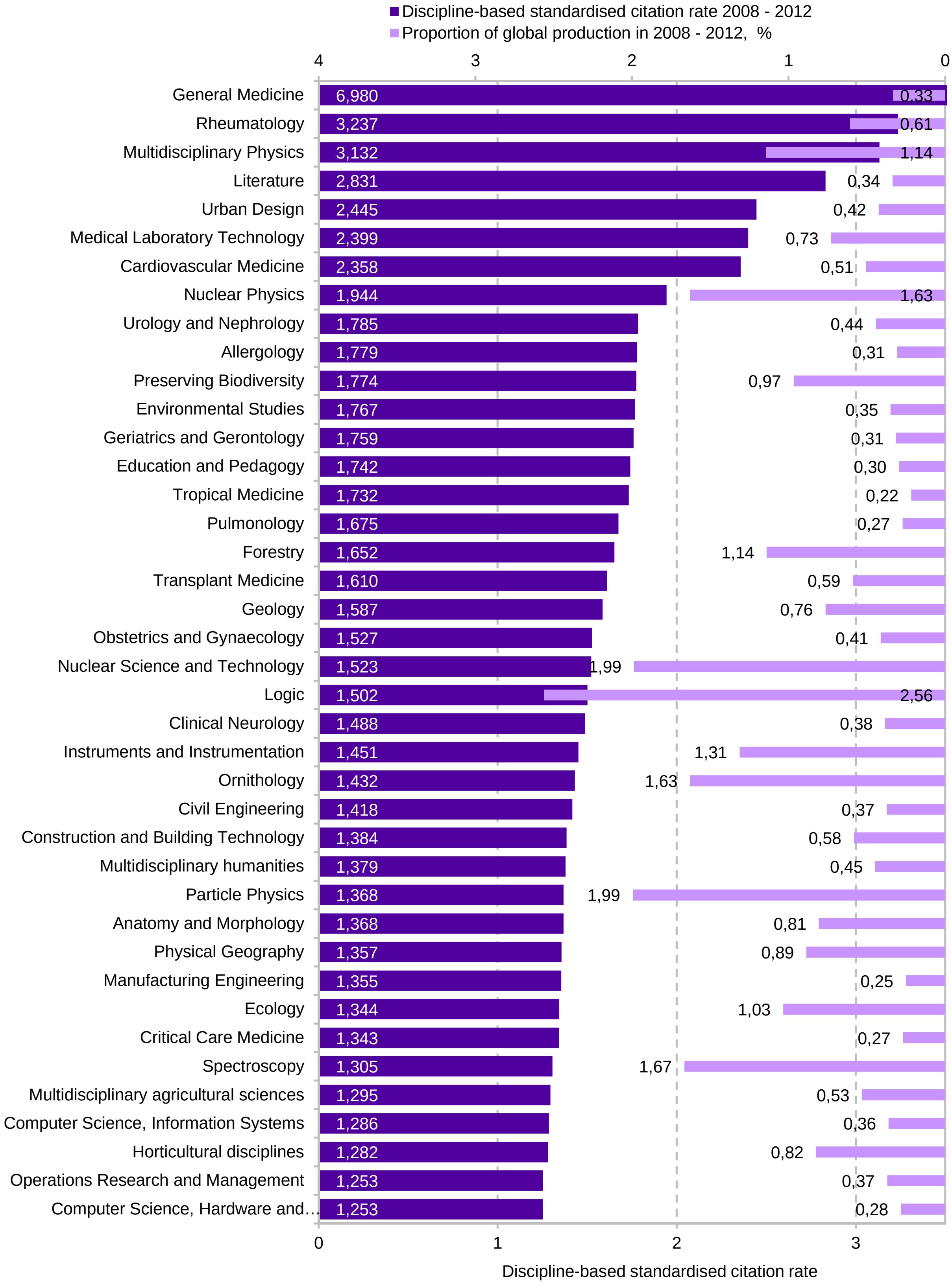
Chart C.11: Discipline-relative standardised citation rate of Czech publications in the years 2008–2012



Note: For a definition of multi-disciplinary fields, see the note to graph C.8.
Source: Thomson Reuters Web of Science, InCites

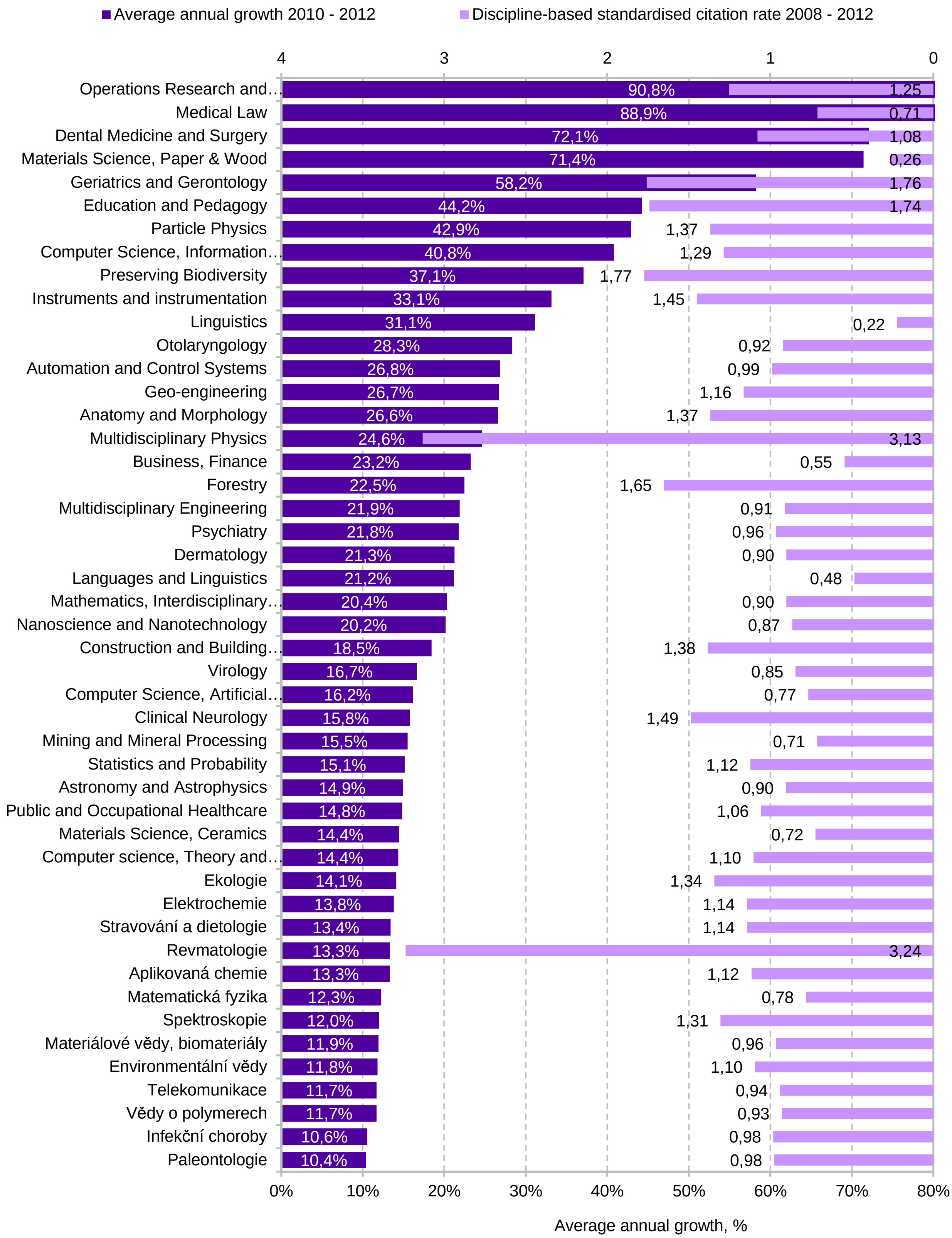
The fastest growing disciplines in the Czech R&D system are shown in graph C.13. the selection criteria are an average annual increase of at least 5 %, and at least 30 publications in the three-year interval 2009–2011, in order to suppress the impact of the year-on-year fluctuations in disciplines that less well represented in Czech R&D. In the first ten of the fastest growing disciplines, the number of publications increased on average by more than 30 % per year. There are three medicinal disciplines in this group: Gastroenterology and hepatology, radiological and nuclear medicine and imaging, transplant medicine and medicinal chemistry. With the exception of radiation and nuclear medicine, these disciplines are average or very above-average (average citation rate 0.99–1.55). In general, average and disciplines with an above-average citation rate predominate in the first ten disciplines. Czech disciplines that are seeing a considerable increase are nuclear science and technology, as mentioned above. In the past there has been a very considerable increase in publishing activity in several subfields of computer science (interdisciplinary applications: 49 %, software engineering: 31 % and cybernetics 21 %).

Chart C.12: Disciplines with an above-average citation rate in the years 2008–2012 and the Czech proportion of global production



Note: Selection criteria: Average discipline standardised citation rate exceeding 1.25 and at least 25 records during the period in question. For a definition of multi-disciplinary fields, see the note to graph C.8.
Source: Thomson Reuters Web of Science, InCites

Chart C.13: Disciplines with the fastest growing proportion of the total number of Czech publications in the years 2010–2012



Note: Selection criteria: at least 30 publications in the interval 2010–2012 and average yearly growth of at least 10 %
Source: Thomson Reuters Web of Science, InCites

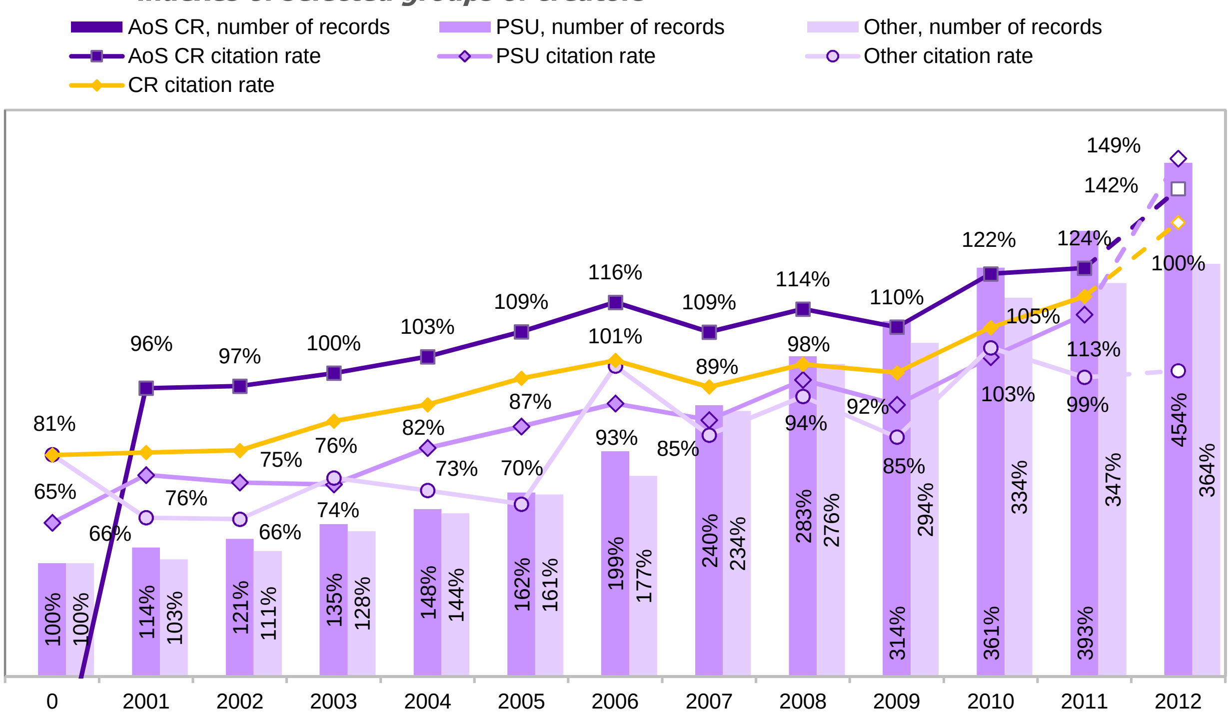
Relative citation indexes and publishing activity by creator groups

During the last five years there has been a sharp increase in the publication activity of universities in comparison with research institutions of the Academy of Sciences of the Czech Republic (Graph C.14). The average year-on-year rise in impacted journal publications (J_{imp}) 15 % was approximately double that of the Academy of Sciences of the Czech Republic. There was a year-on-year increase of approximately 15 % in the number of publications by institutions outside these two main groups[42], although only 17 % of Czech publication output came from this area in 2011. The increase in the production of impacted publications and their citation rate clearly indicates the rising importance of universities in the Czech R&D system. Impacted publications with at least one author from the Academy of Sciences of the Czech Republic achieved a citation rate on average approximately 10 % above the global average and the citation rate has increased by several percent per year.

In 2012 the proportion of articles in impacted periodicals continued to rise (as in previous years). The success of Czech publications in international *peer-reviews* is also indicative of positive changes in Czech R&D.

Considerable caution is required when comparing citation rates between these groups and such a comparison cannot be used to draw conclusions about the different quality of research in the defined groups. The numbers of impacted publications in the various discipline groups may be too low, which can cause a year-on-year fluctuation of the citation rate and hence the overall averages for the groups. Using the discipline standardised citation rate suppresses differences in the citation frequencies and practices of the various disciplines, although due to the uneven representation of the disciplines in the WoS database, on a factual level the discipline and thematic structure is projected into the representation of the publication outputs of research institutions, e.g. a greater university R&D focus towards applied research or issues more oriented towards the national environment, which results in less representation in WoS. It is for these reasons rather than differences in the citation rates between the various groups that there are significant long-term trends observable within groups, which clearly document the R&D dynamism of bother of the main players in Czech R&D.

Chart C.14: Number of publications relative to 2000 and discipline standardised citation indexes of selected groups of creators



Note: Joint publication of authors from more than one group are counted as the whole publication for each group. Medical facilities with the status of "faculty" are classed as Other creators. As a result of the fact that the co-authors of publications from faculty hospitals are generally the parent universities, this classification did not influence either the consequent citation rate or the number of publications created by universities. The citation rate figures for 2012 are subject to a considerable statistical error due to the low number of

42 The "Other" group includes organisational units of the state, state contributory organisations, public research institutions outside AS ČR and other legal entities and natural persons) *citations of both Czech publications and global publications from which the discipline standardised citation rate is derived. The calculated increase in the citation rate to almost 150 % of the global average does not indicate a surge in the quality of Czech R&D. Source: Thomson Reuters Web of Science, InCites*

C.3 Patents, utility models and licensing

Just as there are statistical indicators measuring inputs in science and technology (funding and human resources in the fields of research, development and innovation - Sections A and B), there are also indicators measuring the production of new knowledge in the form of outputs which can be used in practical applications, which may be protected through industrial or intellectual ownership (e.g. the granting of a patent or registration of a utility model). Industrial rights and intellectual ownership are most often commercialised through a licence, i.e. provision of the right to make temporary use of R&D products protected by industrial property institutes such a patents, industrial or utility models, production-related technical finding and processes (know-how) and other intangible results of R&D activity.

Patent activity of domestic entities in the Czech Republic

Patent data provide information about the results of research, development and innovation activity in selected fields of technology, the dissemination of scientific knowledge and the economic appeal of a particular country. For example, the numbers of patent applications filed by domestic entities with IPO CR, together with other indicators, tell us not only about the state of research, development, innovation and industry in the Czech Republic, but also about trends and competitiveness in the various disciplines and fields of technology, including their future.

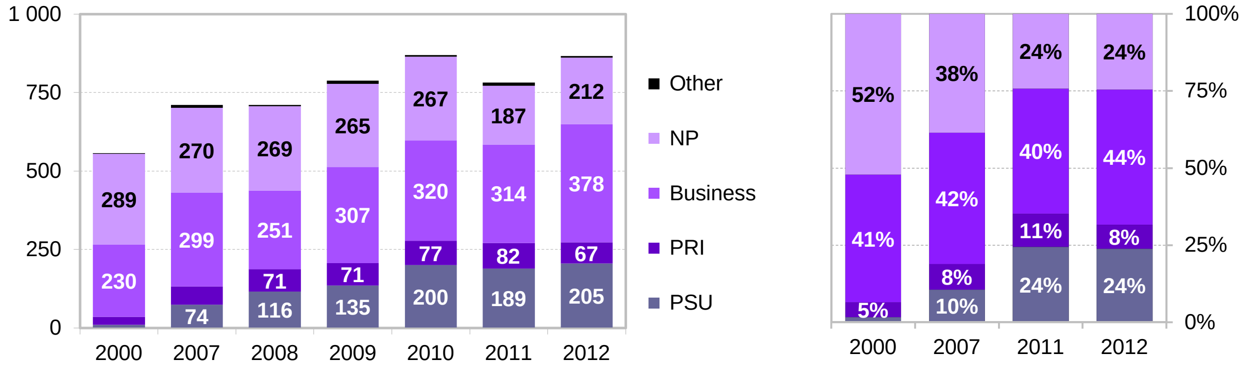
Statistics about the number of invention applications filed, patents granted and utility models registered to domestic entities in the Czech Republic show that there is a gradual increase in patent activity amongst subjects operating in the Czech Republic. The question remains whether this reflects rising awareness of the importance of industrial protection for success in the business sector and to boost research and development activities and the quality of those activities in the governmental and university sector, or whether, particularly in the case of universities, this is the result of changes in the system used to evaluate R&D and how it is funded from the state budget of the Czech Republic.

Patent applications filed and patents granted to domestic entities in the Czech Republic – basic data

A total of 867 invention applications were filed with IPO CR by applicants from the Czech Republic in 2012, i.e. 85 (11%) more than in the previous year and 156 (22 %) more than five years ago. There was also a marked year-on-year increase in the number of patents granted, when in 2012 a total of 423 patents were granted or validated by IPO CR for applicants from the Czech Republic, i.e. a quarter more than in the previous year.[43]

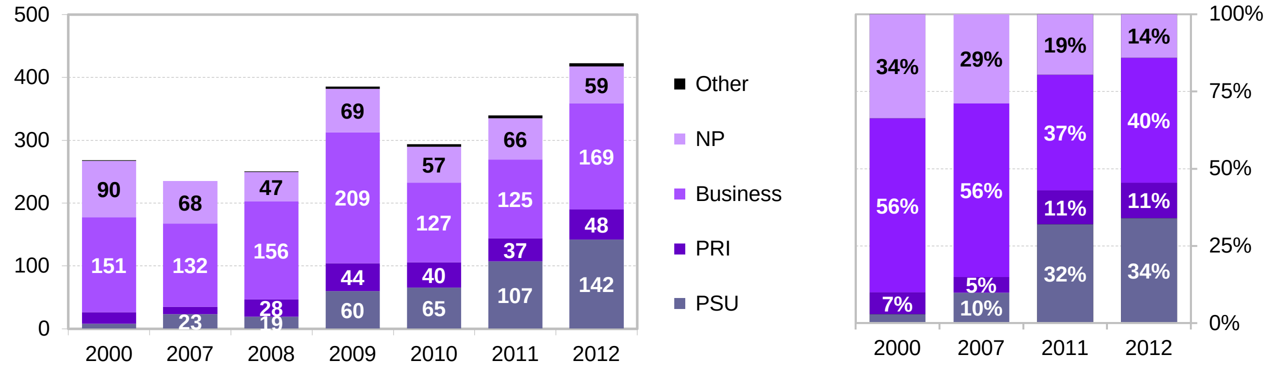
Chart C.15: Patent activity of domestic entities in the Czech Republic (number and structure)

a) Patent applications filed with IPO CR



43 Not all inventions filed through patent applications are eventually granted a patent. Of the applications filed with IPO CR between 1995 and 2003 by Czech applicants, a patent was granted to almost half (46 %). Public universities and public research institutions had the highest success rate, with a patent granted for 87 %, or 85 % of patent applications filed. With businesses the figure was 60 % and for natural persons, the rate was only 30 % of patent applications filed. The average time from the filing of the patent application to the granting of the patent was 3 years and 4 months for Czech applicants who had filed an application with IPO CR.

b) Patents granted or validated by IPO CR



Note: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Source: CSO 2013 according to IPO CR figures and own calculations

In 2012 there was a significant 20 % increase in the number of applications for patent protection for inventions, filed particularly by domestic businesses, which in that year filed 378 applications, i.e. the most since 1995, from when CSO has a detailed breakdown of these statistics. An even bigger increase, by more than a third, was seen in the number of patents granted to businesses. In contrast, over time there has been a considerable decline in the proportion of natural persons filing invention applications with IPO CR as well as receiving patents.

In the longer term we have seen a marked increase in patent activity particularly on the part of Czech public universities (PSU). While in 2007 PSU made up 10 % of domestic patent applications (in 2000 the figure was a mere 2 %), in 2012 the proportion was almost a quarter of that. Unlike PSU, in recent years there has been no significant increase in the number of patent applications filed by public research institutions (PRI). While back in 2005 PRI filed more patent applications than PSU, in 2012 the figure was just a third of the number of applications filed by PSU. In the case of patents granted, although most in 2012 still pertained to businesses (169), PSU were in second place. The increase in the number of patents granted to PSU is the result of the increasing number of applications filed for patent proceedings by these entities in recent years. [44]

Of almost 2 thousand patent applications filed with IPO CR by businesses in the years 2007 to 2012, two thirds came from domestic firms and a third from firms under foreign control. In the case of patents granted, the proportion of domestic firms was 10 percentage points lower. In terms of branch structure, the most invention applications filed during this period were from the engineering (224), automotive (190) and pharmaceutical (158) industries. In 2012 at least one patent application was filed with IPO CR by 226 domestic firms and a patent was granted to 118 firms. Since 2005 the most patent applications have been filed in the Czech Republic by Zentiva Group, a.s. and Škoda Auto a.s., which e.g. in 2012 filed 34 or 26 invention applications for patent proceedings with IPO CR. During the last 6 years, both companies have filed approx. 130 patent applications and have been granted 92, or 44 patents.

In 2012 a total of 17 out of 26 public and state universities filed patent applications (in 2007 the figure was 13 and in 2000 only 3 PSU). Although the Czech Technical University in Prague (ČVUT) is the PSU with the greatest patent activity since 1995, its share in the number of patents granted to universities has fallen over time. As regards patent applications, almost a quarter, i.e. 218 patent applications during the period in question (2007 to 2012) came from ČVUT in Prague, with tens of percent from another four technical universities: VŠB-TU in Ostrava (107 applications), the University of Technology in Brno (97), the Technical University of Liberec (94) and VŠCHT in Prague (81).

In 2012 patent applications were filed by a total of 29 out of 73 PRI compared with 24 in 2007. Although in terms of PRI between 2007 and 2012 more than half of the number of invention applications were filed by institutes of the Academy of Sciences of the Czech Republic, during the last three years more have been filed by departmental public research institutions. These are mainly the Institute of Animal Science, the Food Research Institute Prague and the Crop Research Institute, i.e. three departmental public research

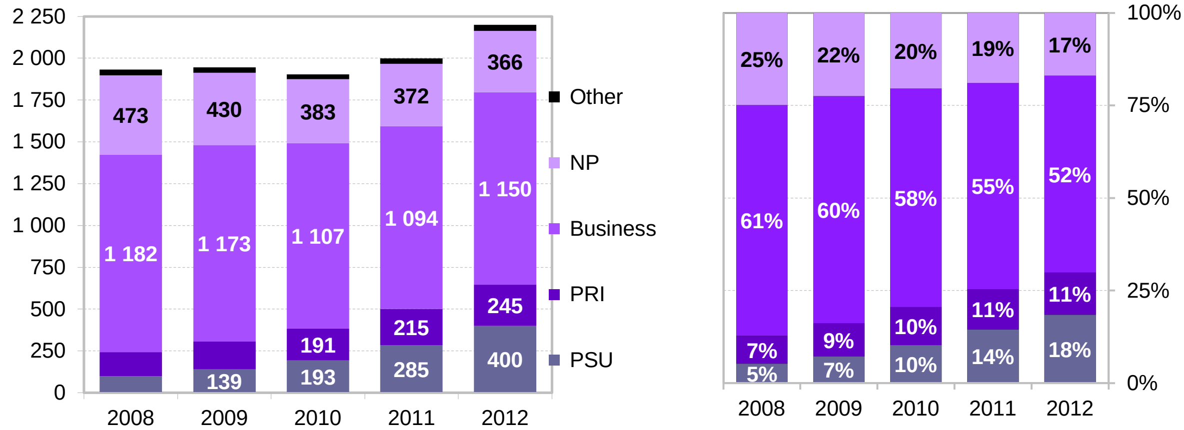
44 Based on data on the number of patent applications filed with IPO CR, the average time taken to grant a patent after receipt of an application, and the success rate of the various types of applicant, it is possible to estimate the trend in the number of patents granted in the Czech Republic to domestic applicants over approximately the next three years.

institutions in the food, crop and livestock production sectors. In contrast, institutes of the Academy of Sciences of the Czech Republic still considerably dominate as regards the number of patents granted. In the years 2007 to 2012 more than two thirds of patents granted to public research institutions belonged to institutes of the Academy of Sciences of the Czech Republic. These were particularly the Institute of Organic Chemistry and Biochemistry with 22 patents granted during this period and the Department of Microbiology and Institute of Chemical Processes, both with 15 patents granted.

Patents valid as of 31.12.2012 for the territory of the Czech Republic pertaining to domestic entities

A patent may provide legal protection for an invention for up to twenty years, provided that the maintenance fees continue to be paid. During the last twenty years, i.e. since 1993, IPO CR has granted a total of 6 556 patents to domestic applicants, yet as of 31.12.2012 only a third of them (2 200 patents) were still listed as valid. As the number of patent applications filed by and patents granted to PSU increases, so does the ratio of this type of applicant to the number of valid patents in the Czech Republic.

Chart C.16: Valid patents pertaining to domestic entities in the Czech Republic as of 31.12. (number and structure)



Note: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Source: CSO 2013 according to IPO CR figures and own calculations

Three quarters of the 245 valid PRI patents pertained to institutes of the Academy of Sciences of the Czech Republic, 28 of which are owned by the Institute of Microbiology, 27 by the Institute of Organic Chemistry and Biochemistry and 24 by the Institute of Macromolecular Chemistry. In the case of PSU, almost a third, i.e. 117 valid patents, belong to ČVUT in Prague, 49 to VŠCHT in Prague and 40 VUT In Brno. In the business sector, although by far the most valid patents (127; 11 %) belong to Zentiva Group a.s., in terms of sector, businesses from the engineering industry are first, with 181 valid patents.

In the case of domestic applicants, only a third of patents valid as of the end of 2012 were more than 5 years old and only 9 % were more than ten years old. With PSU the figure was a mere 8 %, or 1 % in the case of patents more than ten years old. In contrast, 45 %, and in the case of PSU, due to the aforementioned boom in patent activity in recent years, as many as 75 % of valid patents are less than 3 years old.

It is logical that all patents granted to domestic applicants in 2012 were still valid on the last day of the year. In the case of patents granted in previous years, however, the situation is completely different, and it may be observed that the farther back we look into the past , the fewer the number of patents that are still valid today and the fewer the fees are maintained. For example, while as of the last day of 2012 two thirds (66 %) of patents granted to applicants from the Czech Republic in 2008 were still valid, only around half of patents from 2005 were still valid, and only approximately a tenth of those granted in 2000. This indicator shows relatively significant differences depending on the type of patent owner. While 6 % of patents granted to natural persons in the years 1995 to 2004 were still valid, the figure for PSU was 5 %, for businesses it was 14 % (243 out of 1675) and for PRI as high as 16 % (35 out of 214) of patents granted by IPO CR during this period.

As the basic indicator of the protection of industrial rights, i.e. the number of patents granted, describes the situation in research, development and innovation with a delay of approx. 3-5 years, this section will present detailed information about the patent activity of domestic entities in terms of patent applications only.

Discipline-based structure of patent applications filed with IPO CR by domestic entities

The classification system for inventions is based on how the invention relates to a specific field of technology. Patent applications are classified under the International Patent Classification (IPC) system. This classification system, which contains 7 basic sections, is further divided up into classes, groups and subgroups. During the last six years domestic entities filed most invention applications for patent proceedings with IPO CR in the sections Industrial Technology (930) and Chemistry and Metallurgy (894); these sections constantly make up around 20 %, or 19 % of the total number of patent applications filed. The IPC also defines 31 disciplines. In 2012 applicants from the Czech Republic filed the most applications in the Transport and Storage discipline, which also includes the class Vehicles, Aircraft and Ships. Other significant disciplines include Measurement and Optics; Construction; Health; Motors or Organic and Inorganic Chemistry. Data from special categories such as high-tech are presented below in this section.

There are relatively significant differences in the discipline-based structure of patent applications filed by the various types of applicants. While PSU and PRI are dominated by Measurement and Optics, for businesses and natural persons it is Transport and Storage.

Regional breakdown of patent applications filed with IPO CR by domestic entities

The most patent applications, a third (1 625), were granted between 2007 and 2012 to applicants based in Prague. In 2012 the figure was as high as 36 %, i.e. three times higher than the number of applications filed in the same year by applicants from the Moravian and Silesian region and the South Moravian region. The proportion of other regions is considerably lower.

The proportion of Prague as the headquarters of patent applicants is nowhere near as high as the proportion of Prague as the headquarters of invention applicants. In 2012 the proportion of patent applicants from Prague was approx. 10 % less than the proportion of invention applicants.

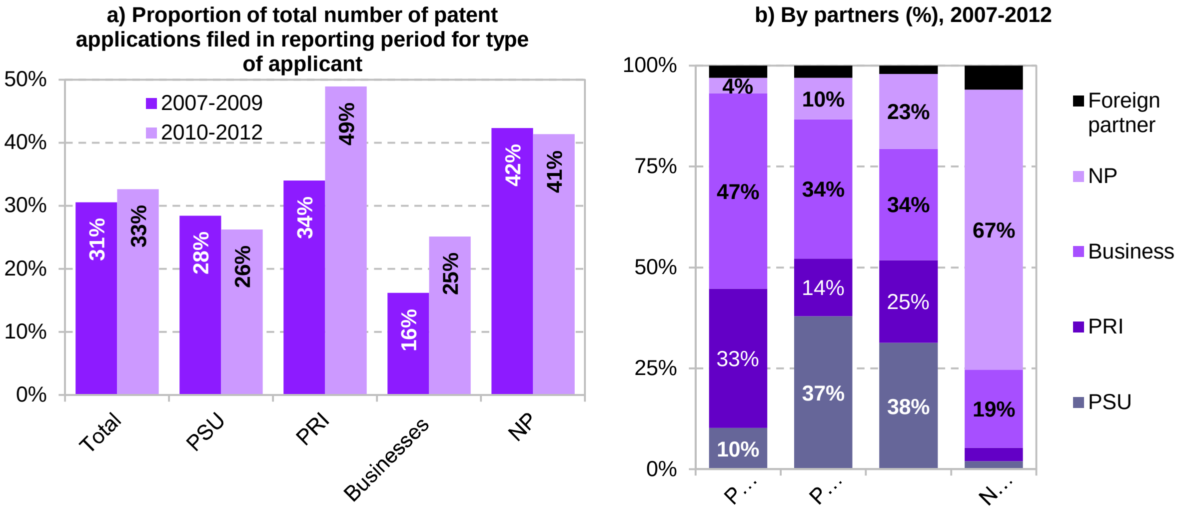
Women as the authors of inventions registered in patent proceedings

The author of an invention which has been filed for patent proceedings is always a natural person who created the invention as a result of their own creative work. The ratio of women as authors of inventions to the number of patent applications filed has been very low in this country for a long time. Between 2007 and 2012 women made up only 9.2 % (435) of all patent applicants with IPO CR from the Czech Republic. Over time, as the proportion of PSU has risen in terms of patent applications filed, there has been a slight increase in the ration of female inventors to the number of patent applications filed. For example, while in 2012 79 % of patent applications were filed by men, ten years earlier the figure was 95 %. As with the other indicators, there are evident differences between the various types of applicants. If an applicant was a business, the proportion of women during the last six years was 7.8 %. The proportion was even lower in the case of natural persons, which comprised only 5.0 % during the same period. The situation was somewhat more positive in the case of public research. Women (authors) made up 12.4 % of patent applications filed in the years 2007 to 2012 by PSU. The highest proportion of women, almost a quarter (22.0 %) of all the applicant types, was from PRI. These figures more or less reflect the situation as regards the number of researchers, or the ratio of female researchers to the total number of researchers both in the Czech Republic overall, as well as in the various sectors. For more, see section B1.

Cooperation in the area of patent protection

Most patent applications filed with IPO CR are filed independently by domestic applicants. The proportion of applications filed by applicants from the Czech Republic in collaboration with another entity in the years 2007 to 2012 was on average 32 % and is increasing over time, with the exception of PSU. What is notable is the particularly high proportion of cooperation amongst PRI, which actually increased considerably during the period in question. It is interesting that there is a higher level of cooperation amongst natural persons than there is amongst PSU. It is no surprise that the proportion of cooperation is low amongst businesses, although this has increased significantly.

Chart C.17: Patent applications filed with IPO CR in the period 2007 to 2012 by domestic applicants in collaboration with another entity



Note 1: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Note 2: 1% for the period 2007 to 2009 is equivalent to 9.9 for public universities; for public research institutions: 4.9; for businesses: 48.9 and for natural persons engaged or not engaged in business 14.6 patent applications filed in collaboration with another entity; 1% for the period 2010 to 2012 is equivalent to 19.5 for public universities; for public research institutions: 3.3; for businesses: 35.0 and for natural persons engaged or not engaged in business FO 12.5 patent applications filed in collaboration with another entity.
Source: CSO 2013 according to IPO CR figures and own calculations

Partners by type of applicant are shown in the second part of the graph above, which again displays data for 2007 to 2012. As the graph shows, there are marked differences between the various applicant types. Natural persons collaborated very closely during the period in question. Other natural persons made up a significant proportion of collaborating entities. What the other types of applicants had in common was a relatively high degree of collaboration with businesses, which was greater with PSU than with VVI. It is worth noting that universities collaborated more with PRI than with other PSU. The same is true for PRI, which collaborated more with universities than with each other.

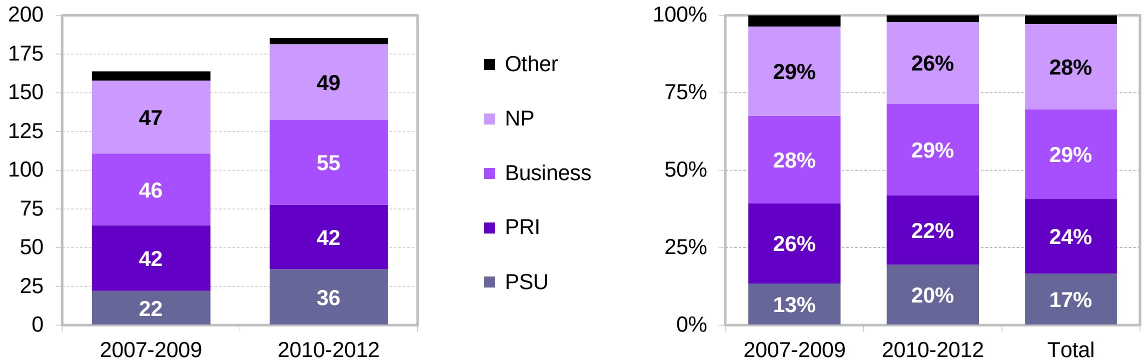
Patent protection in high-tech fields

One way of ascertaining the quality of patent protection other than royalty revenues from license fees (see below) or patent citations (source: Eurostat and OECD), is information about the proportion of patent applications classed as advanced (high-tech) technology. These figures were compiled by the CSO on the basis of the International Patent Classification System and definitions given in the OECD Patent Manual. Besides the group of so-called high-tech patents, which are further divided into six subgroups (communications technology, lasers, aerospace, microorganism and genetic engineering, computers and automated control systems and semiconductors), the CSO also processed figures for biotechnology and renewable resources.

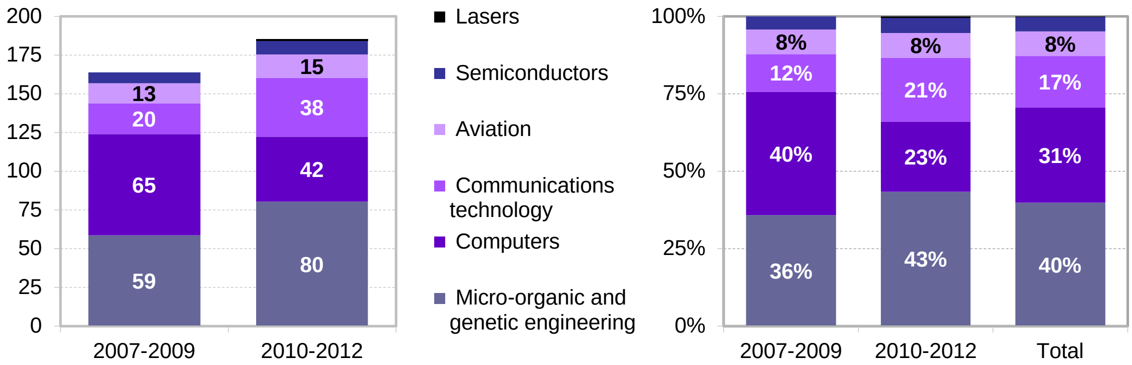
The number of high-tech applications has not changed much in the CR during the last three years and fluctuates at around 60 applications filed per year. During the whole of the period in question (2007 to 2012) the IPO CR received a total of 349 (7.5 %) patent applications in high-tech sectors. While high-tech applications have made up an average of around a fifth of the total number of PRI patent applications since 2007 (in 2012 the figure dropped sharply to 8 %), with other types of applicants the proportion is only around 5 %. In the years 2007 to 2012 domestic applicants filed 131 applications with the IPO CR in the field of biotechnology and only 10 in the field of renewable resources.

Chart C.18: Patent applications filed with IPO CR by domestic applicants in high-tech fields; 2007–2012 (number and structure)

a) By applicant (number, %)



b) By discipline (number, %)



Note: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Source: CSO 2013 according to IPO CR figures and own calculations

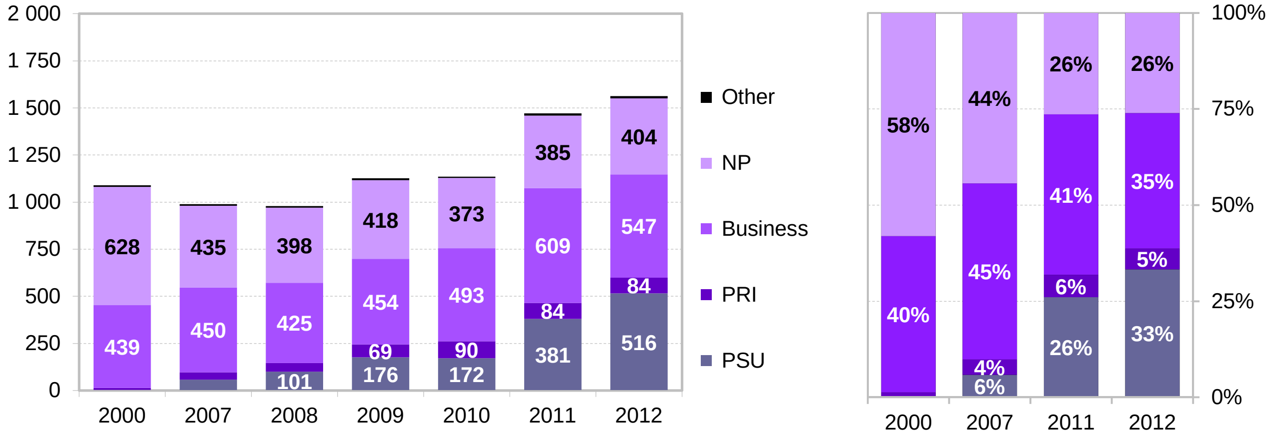
As regards the various disciplines investigated in the high-tech category, it was found that the dominant disciplines in the Czech Republic are Micro-organic and Genetic Engineering and Computers and Automated Control Systems. While the predominant discipline amongst businesses and natural persons is Computers and Automated Control Systems, with PRI most patent applications are for the field of Micro-organic and Genetic Engineering.

Utility models registered in the Czech Republic by IPO CR for domestic applicants

Although patents as legal protection for technical solutions and inventions have always been the principal means of protecting industrial property around the world, since the introduction of the utility model in the Czech Republic 21 years ago, this form of legal protection has been increasingly used to protect technical solutions.[45] In 2012, for example, domestic entities filed twice as many applications to register a utility model than they did patent applications, and 3.5 times as many utility models were registered than there were patents granted. This type of protection has been very popular in the past, particularly with individual applicants, mostly due to the lower cost and less time to wait for certification. In recent years this form of protection has also been used more by other types of applicants, particularly PSU, which were almost unknown or unused for this institute before 2007. During the last two years all types of applicants have used utility models more than patents to protect their technical solutions.

45 For subjects with a lower level of invention or lesser economic importance, it is possible to opt for a utility model as a simpler, quicker and cheaper form of protection. However, compared to patent protection, with utility models there is a significantly higher degree of legal uncertainty due to the absence of any official assessment of the novelty of the technical solution and the requisite level of creativity. In contrast, patent protection is particularly suitable for technical solutions that are a world first and which have a good chance of successfully getting through the rigorous assessment process, provided that the associated production process appears to be long term and perspective in the face of strong competition.

Chart C.19: Utility models registered by IPO CR to domestic applicants (number and structure)



Note: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Source: CSO 2013 according to IPO CR figures and own calculations

In 2012 the Czech Republic saw a further year-on-year rise in the number of utility models registered, although this increase was not as sharp as in 2011. The group that contributed most to this increase was PSU. The number of utility models registered to PRI and natural persons did not change much against the previous year. While there has been a considerable increase in the number of invention applications or patents granted for PSU during the last 6 years or so, there has been an enormous rise in the number of utility models registered. While ten utility models were registered to two PSU in 2005, seven years later there were 516 utility models were registered to 18 PSU.

Unlike patent applications or patents granted, in 2012 the most utility models in PSU, almost a third, were registered to the Czech University of Life Sciences in Prague. The number of utility models registered to this university (156 in 2012) is almost double the number of utility models registered to the PSU in second place and almost 8 times the number registered to businesses and PRI with the highest number of registered utility models. For PRI, far more (79 %) registered utility models, unlike, e.g. patents granted, have belonged to departmental PRI during the last six years.

As with businesses, domestic businesses used utility models much more than patents as compared with businesses under foreign control. For example, between 2007 and 2012, 8 out of 10 utility models registered belonged to domestic businesses and in 2012 the ratio was almost 9 out of the 10 in favour of domestic businesses.

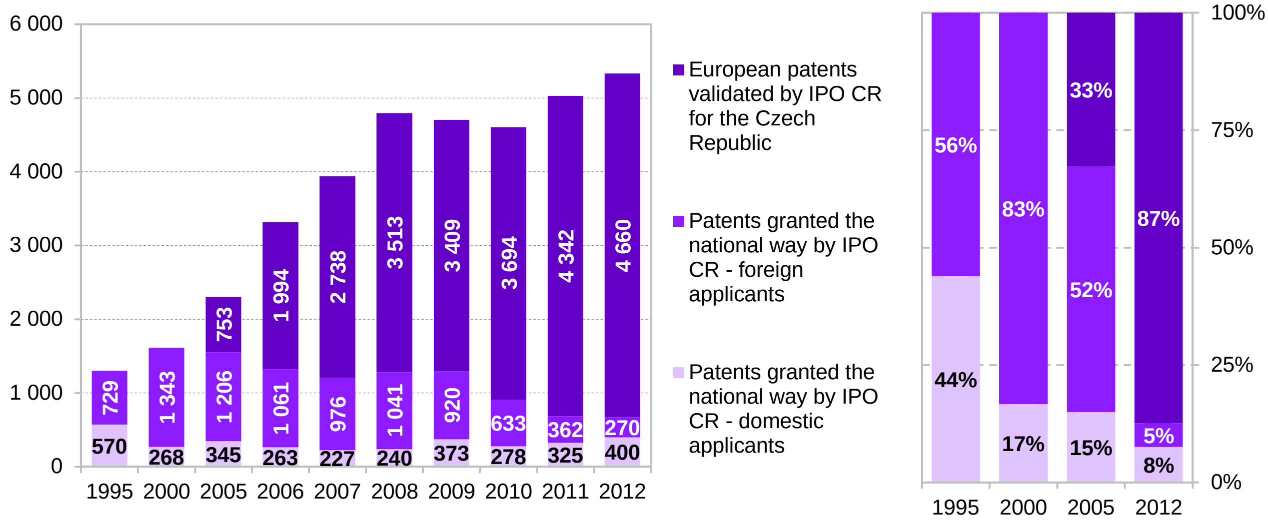
Patent activity of foreign entities in the Czech Republic

Unlike patent applications[46], the number of patents granted in the Czech Republic to foreign applicants may serve as one indicator showing the economic attractiveness of the Czech Republic.

Patents valid for the Czech Republic may be granted by IPO CR in two ways – the national way, or through the validation of European patents[47] for the territory of the Czech Republic. The second option has existed for the territory of the Czech Republic since 2002, although the practice did not become widespread until after 2004. In 2012 European patents validated for the Czech Republic made up 87 % of all patents granted in that year. With the exception of 23 patents, all European patents validated by IPO CR (4 660) for the territory of the Czech Republic in that year were granted to foreign applicants. Of the 670 patents granted the national way, 60 % were from Czech applicants and 40 % from foreign applicants.

46 Since 2002 foreign applicants have had the option to file patent applications directly with the European Patent Office, stating the designation of that application for any EU country. This has gradually led to a significant reduction in the number of patent applications filed by foreign applicants with IPO CR, i.e. via the national way, from approx. 5 thousand in 2000 to an average of approx. 100 a year in the last four years. For this reason figures about patent applications filed with IPO CR by foreign applicants are not published.
47 A European patent provides its owner, in each contracting state for which it was designated, after being validated by the national patent office, with the same rights as if the patent were a national patent issued in that country in the national (classic) way.

Chart C.20: Patents granted (validated) by IPO CR for the territory of the CR by granting method



Source: CSO 2013 according to IPO CR figures and own calculations

Since 1995 IPO CR has granted or validated almost 50 thousand patents for the Czech Republic, almost 90 % of which belonged to foreign entities. It was particularly for these reasons (the chance to validate European patents for the Czech Republic since 2002) that although in 1995 Czech applicants made up 44 % of the number of patents granted in the Czech Republic, in 2005 the figure was 15 % and in 2012 a mere 8 %.

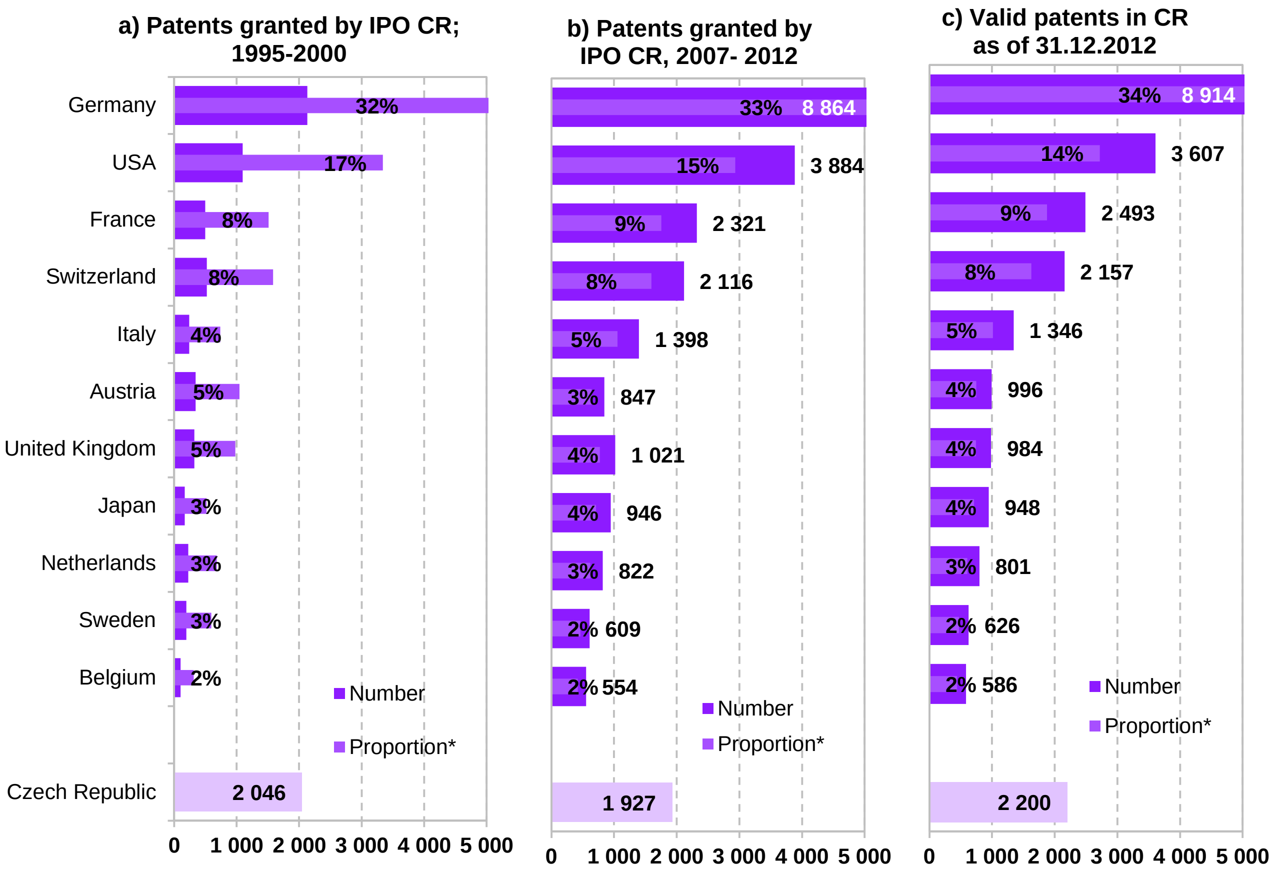
For a long time now, the highest proportion of the number of patents granted in the Czech Republic has comprised applicants from Germany. Every year almost a third of all patents granted (validated) by IPO CR are for applicants of our western neighbour. In 2012, the number of patents granted was 1.5 thousand. For a long time now, around 50 % of applicants from EU countries who have a patent granted (validated) for the territory of the Czech Republic are German. In the years 2007 to 2012 EU countries made up 68 % of patents granted in the Czech Republic to foreign applicants, which, by the way, is the same as between 1995 and 2000. Since 1996 the United States has been the second most significant foreign applicant, with the highest number of patents granted in the Czech Republic. In 2012 786 patents were granted to American entities in the Czech Republic. This was followed by Switzerland (in second place in 1995) and France, in both cases with 389 patents granted in 2012.

Of the 44 thousand patents granted in the Czech Republic to foreign applicants since 1995, as of 31.12.2012 60 % (26.5 thousand) were still valid, i.e. almost twice as many as in the case of domestic applicants. Almost a third (8.9 thousand) of valid patents in the Czech Republic belonged to German entities. This is 4 times higher than the figure for domestic entities. Besides Germany and the United States, entities from France own more patents in the Czech Republic than domestic applicants.

It is interesting that, based on past figures, foreign applicants are more likely to pay fees to keep their patents valid for a longer period of time. For example, whereas of the 2 thousand of patents granted to domestic applicants in the years 1995 to 2000 5.8 % of them are still valid, for foreign applicants the figure is almost twice as high, and from approx. 6.5 thousand patents granted during this period, almost 700 are still valid. In the case of Austria, this indicator is 28 %, and almost half in the case of Israel.

As regards the discipline-based structure of valid patents belonging to foreign entities as of 31.12.2012 for the territory of the Czech Republic, the most, 3.8 thousand (14 %), come under Organic Chemistry, 3 thousand (11 %) under Transport and Storage and 2.7 thousand (10 %) under Medical, Dental and Hygiene Products.

Chart C.21: Patent activity of foreign entities in the Czech Republic (number and structure)



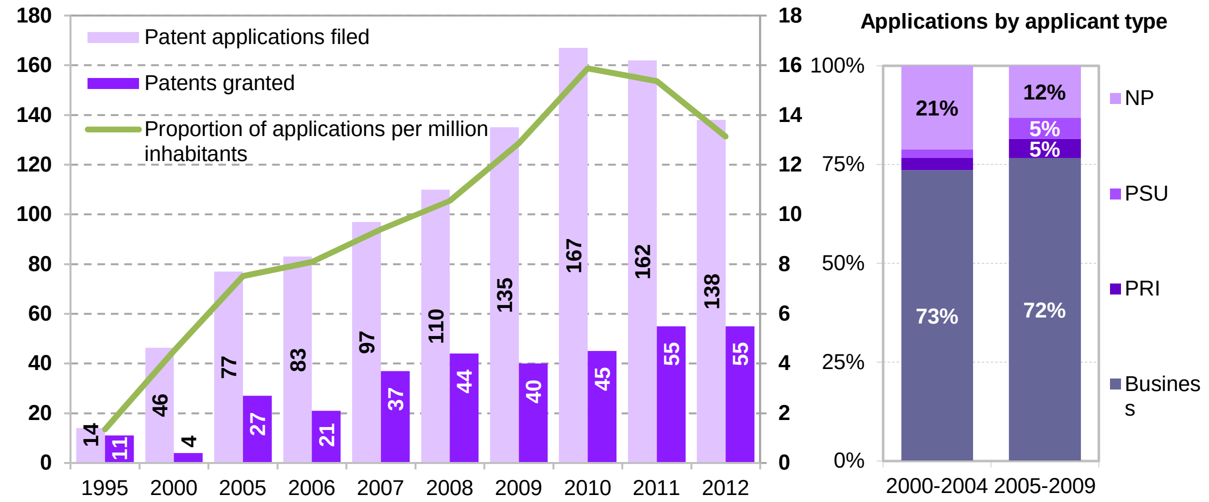
** Proportion of the total number of patents granted/valid in the Czech Republic belonging to foreign entities*
Source: CSO 2013 according to IPO CR figures and own calculations

Applicants from the Czech Republic applying to international patent offices

Besides data about patent activity of domestic entities in the Czech Republic, information is also available about the patent activity of applicants from the Czech Republic applying to the largest either international or major national patent offices. These are particularly the aforementioned European Patent Office (EPO) and the United States Patents and Trademarks Office (USPTO).

Although there has been a gradual rise in the patent activities of domestic entities abroad, we are still, together with other new EU member states, considerably behind the developed countries of the EU. Between 2007 and 2012 entities from the Czech Republic filed a total of 809 patent applications with the EPO, yet this the number is only 0.09 % of the total number of applications filed with the EPO during the same period. For example, during the same period applicants from Finland, Denmark and Austria filed around 10 thousand patent applications with the EPO; applicants from the Netherlands filed almost 38 thousand applications and from Germany the figure was as high as 158 thousand. Personal data also comes from patents granted by the EPO, when since 2007 applicants from the Czech Republic were granted 276 patents compared to almost 4 thousand to applicants from Austria or Finland and 76 thousand from Germany. As regards the patent activity of entities from the Czech Republic with USPTO, during the last approx. 6 years the figure has remained almost constant with an average of 18 patents granted per year. This makes up a mere 0.01% of the total number of patents granted by this office.

Chart C.22: Patent activity of domestic entities with the EPO (number and structure)



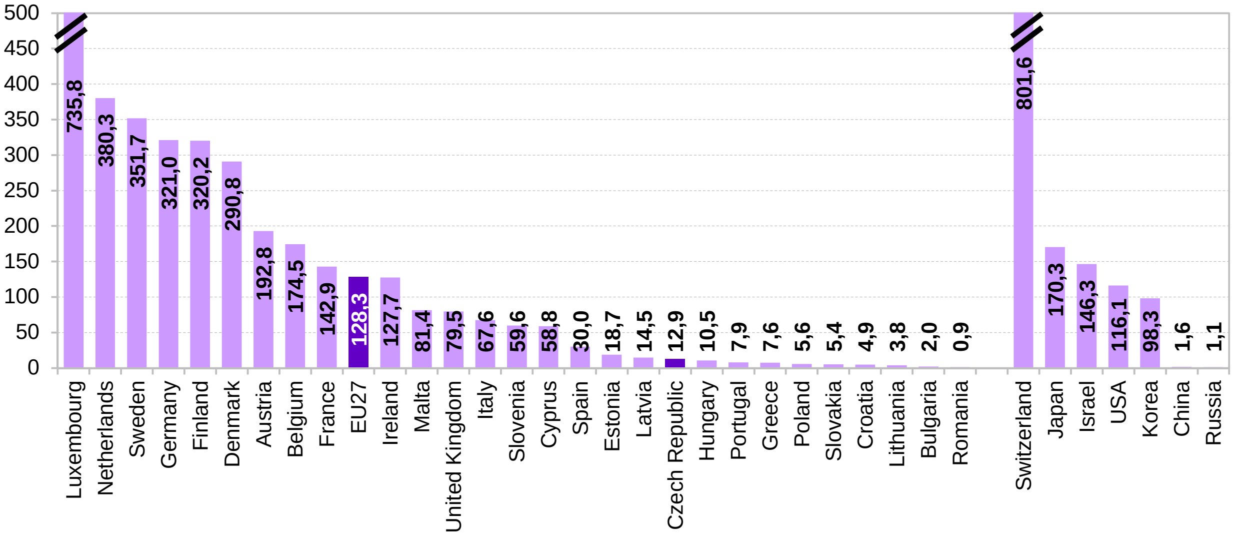
Note 1: VŠ – public university (PSU); VVI – public research institution (PRI); FO – Natural person
Note 2: 1% for the period 2000 to 2004 is equivalent to 4.6 and for the period 2005 to 2009 equivalent to 8.3 patent applications filed
Source: CSO 2013 according to EPO, OECD and Eurostat figures

During the entire period, as in the case of other EU countries, most of the patent applications filed with the EPO by Czech applicants come from the business sector; in the years 2005–2009 (there are no figures available for later years) there were 596 (72 %) applications. In the EU27 countries during the same period this figure averaged 84 %. During the same period there were 102 patent applications from private natural persons. During that period applicants from the governmental sector filed 38 patent applications with the EPO, and 42 applications were filed from the university sector. As with universities, public research institutions have also seen a relatively sharp rise in the number of patent applications filed with the EPO in recent years.

International comparison

In 2012 entities from the Czech Republic filed 138 patent applications with the EPO (24 fewer than in the previous year), making 13 applications per million inhabitants. Within the European Union as a whole, in the same year 65 thousand patent applications were filed with the EPO, making up 45 % of all applications filed with the EPO. Since 2005 the United States has made up approximately one quarter of all applications filed with the EPO; the figure for Japan is approximately 15 %. In Europe, the greatest number of applications filed with the EPO has long been in Germany, comprising 18 % since 2005. Some way behind Germany is France (comprising 6.5 in the years 2007 to 2012), Switzerland and the Netherlands with a share of approximately 4.5 % during the same period.

Chart C.23: Patent applications filed with the EPO, 2007–2012 (number per million inhabitants)*



**Average annual number of patent applications filed in the years 2007 to 2012 per million inhabitants*
Source: CSO 2013 according to EPO figures

If we consider patent applications in terms of the number per million inhabitants, Switzerland is first with 832 patents per million inhabitants in 2012. There were more than 300 applications per million inhabitants in Luxembourg, the Netherlands, Germany, Finland and Sweden. In the same year the EU27 average for this indicator was 129 patent applications, compared with 13 in the Czech Republic. This puts us well below the EU27 average with this indicator, coming in at 18th place in the EU27 rankings. Besides Estonia, Slovenia, Cyprus and Malta, however, we are ahead of all the new EU27 member states.

During recent years, besides the rising in the number of patent applications, there has also been an increase in the number of patents granted by the EPO to applicants from the Czech Republic. While in 2005 applicants from the Czech Republic received 27 patents from the European Patent Office, during the last two years 55 patents have been granted each year. Even so, in terms of the number per million inhabitants (5.2), with this indicator we are still well below the EU27 average (58.7 in 2012). The most patents granted by the European Patent Office per million inhabitants, as with patent applications, were in Switzerland, Luxembourg, Germany, Sweden and Finland.

Income from license fees on patents and utility models

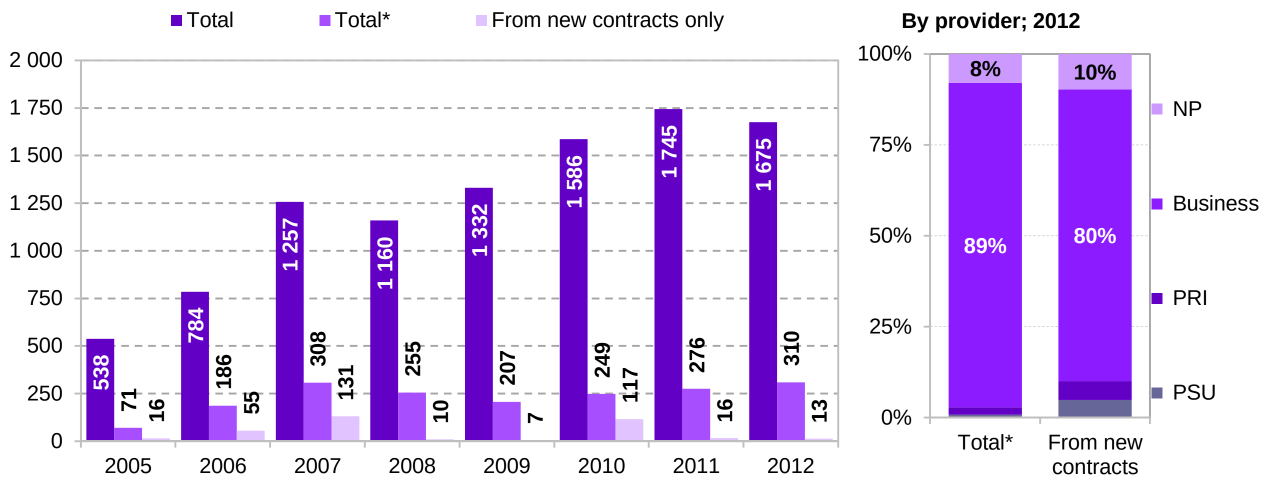
The provision of patent and model licences is one means of obtaining financial income or other forms of benefit from the results of inventive activity. Particularly with public universities (PSU) and public research institutions (PRI), we may expect that inventions or new technical solutions resulting from their research and development activities and which are protected by patents or utility models will be used commercially through being licensed to third parties (businesses). We may also expect that, as has been the case in this country in recent years, with the considerable rise in the number of patents granted and utility models registered, particularly by public universities (see the previous section), there may also be a rise in the number of licence contracts for these concluded by industrial property institutions, and an increase in revenues from these licences. The data acquired for the above licence survey clearly refutes this. While the PSU granted 249 patents and registered 898 utility models during the last two years, during the same period these institutions concluded 36 new licence contracts for patents and 12 for utility models.

In 2012 there were a total of 748 valid licences in the Czech Republic (in 2011 there were 599) granting the right to use an invention or technical solution protected by a patent or utility model. Those 748 patent or model licences were provided to 122 entities, half of which were businesses, 31 were natural persons, 13 were PRI and 13 were PSU. In the same year income from these licences was 1 675 million CZK. It should, of course, be emphasised that, according to the available information, 82 % of this sum was achieved by the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the Czech Republic. This

Institute also made up a similar proportion in previous years. Not counting the licence revenues of this institution, revenues from the commercialisation of research and development activities through the licensing of patents and utility models in the Czech Republic are negligible, to particularly in the case of PSU and other PRI (see also data obtained in the Annual Research and Development Survey VTR 5-01 given in section A1).

Of the total number of patent licences and utility models that were valid in 2012, a fifth of them (160) were newly concluded in 2012. Each newly concluded licence made an average of 78 thousand CZK in collected licence fees. What is relatively surprising is the fact that higher incomes from newly concluded licence contracts in 2011 were generated by rights for the use of technical solutions protected by a utility model or patent-protected inventions (12.6 million CZK versus 3.4 million CZK). In 2012 there was a turnaround and revenues from newly concluded licence contracts for utility models totalled 4.5 million CZK in comparison with 8.1 million CZK for patent licences.

Chart C.24: Revenues of entities operating in the Czech Republic from license fees for the right to use inventions/technical solutions protected by a patent or utility model (million CZK, %)



**Not including licence revenues of the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the Czech Republic as stated in the relevant annual reports*
Note 1: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Note 2: V roce 2012 se 1 % příjmů z licenčních smluv celkem rovná a z nově uzavřených*
Source: Czech Statistical Office2013, Annual Licence Survey Lic 5-01

Patent licences

Although in 2012 entities from the Czech Republic received almost 1.5 billion CZK from patent licences, only 8 million CZK came from new licences. As mentioned above, by far the main generator of licence revenues from industrial property in this country is the Institute of Organic Chemistry and Biochemistry of the Academy of Sciences of the Czech Republic, which, for inventions resulting from the work of the team of Prof. Antonín Holý, particularly in the 1980s, in Czech terms earns considerable licence fees every year[48]. Not counting these revenues, other income from patent licences in the Czech Republic amounts to mere tens of millions of crowns, most of which are generated by businesses. In 2012 the figure was 100 million CZK, of which 70 % (49 million CZK) was achieved by businesses, only 6 million CZK by other PRI and 2 million CZK by PSU.

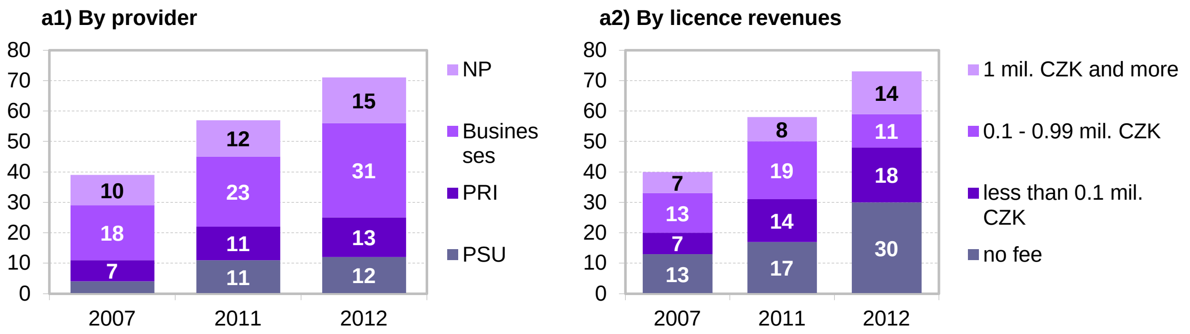
In the Czech Republic there are 73 entities, which in 2012 had a valid licence contract granting the right to use patent-protected technical solutions or inventions, i.e. 15 more than in the previous year and 33 more than in 2007. Of those 73 entities, 60 % were in the business sector (businesses or natural persons engaged in business). While businesses, natural persons and, to some extent, PRI licensed their patents before 2011, universities only started licensing their inventions during the last two years. While in 2012 12 PSU concluded 51 patent licences granting the right to use their inventions or technical solutions, in 2007 there were 4 universities with 7 patent licences and revenues of 200 thousand CZK.

48 http://iocb-tto.cz/content/view/antiviral-drugs

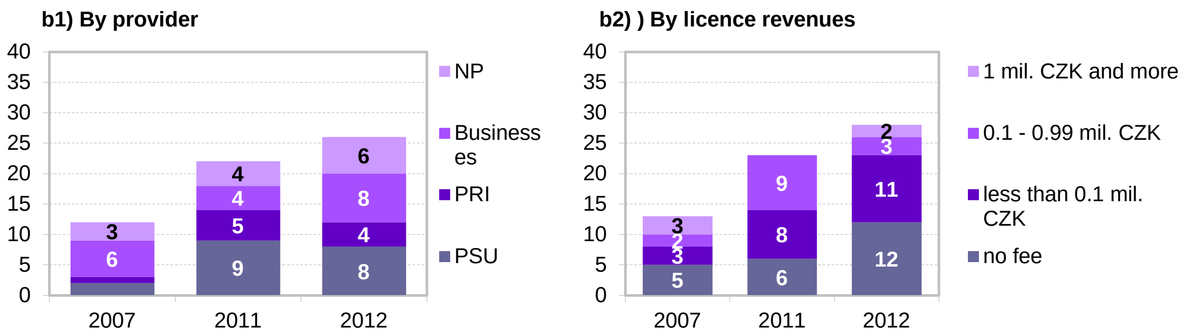
In 2012 eight out of ten entities with a valid licence contract granting the right to use a patent-protected invention had concluded that contract with a Czech entity, and of those, four out of ten had signed a new contract in 2012. What is interesting is the number of providers of patent licences according to the amount of annual fees charged for those licences. In 2012 one fifth of entities received more than one million crowns from their licences; in contrast, almost 40 % granted the right to use a patent-protected invention or technical solution without any licensing revenues during the year in question.

Chart C.25: Number of entities in the Czech Republic with a valid licence contract granting a third party the right to use a patent-protected invention

a) Total



b) With a newly concluded patent licence during the year in question



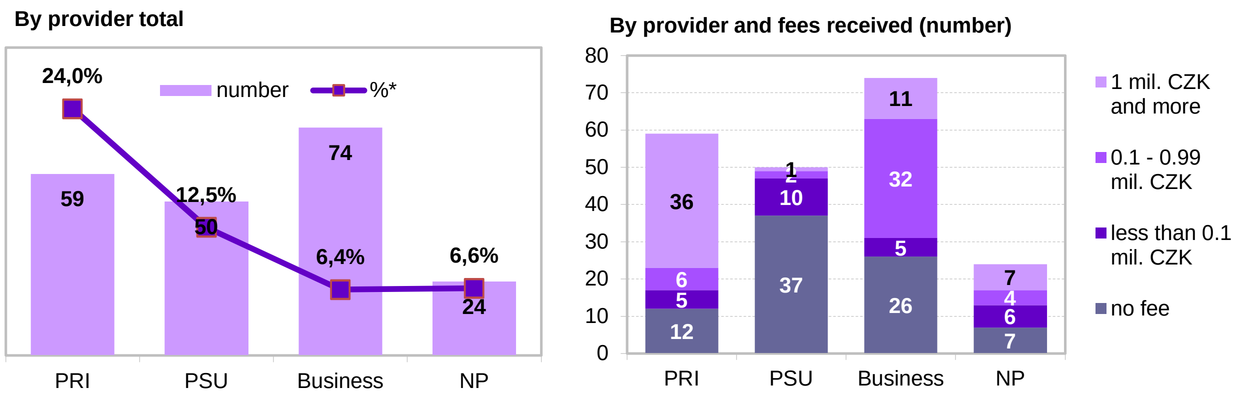
Note 1: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Source: Czech Statistical Office2013, Annual Licence Survey Lic 5-01

These 73 entities concluded a total of 418 valid licences for 214 patents, 80 of which were concluded in 2012. For a long time now, most patent licences come from businesses, which made up more than one half (215) of all valid licences in 2012. In the same year PRI had 59 (49 of which pertained to institutes of the Academy of Sciences of the Czech Republic) and PSU had 51 patent licences. During the last two years the number of newly provided licences is considerably higher for PSU than for PRI. In 2012 there were 16 licences for PSU, as opposed to 5 for PRI, although the revenues from these new licences were almost the same for both types of entity (588 thousand CZK for PSU and 661 thousand CZK for PRI).

If we compare the number of valid patents for the territory of the Czech Republic pertaining to domestic entities with the number of patents for which a license contract has been concluded, the proportion of licensed patents is still very low in this country. It may therefore be assumed that the increase in the number of patents in recent years reflects the fact that some research organisations protect their intellectual property more to acquire points under the R&D assessment methodology rather than for their true commercial value.

In 2012, only one in ten of the 2 200 patents valid as of 31. 12. 2012 in the Czech Republic pertaining to domestic entities were licensed. Most of these licensed patents were owned by PRI. Specifically, there were 59 of these patents, i.e. 28 % of all licensed patents of Czech applicants. It is interesting that while every fourth patent was licensed in the case of PRI in 2012, the figure was only approximately one in eight for PSU, and approximately one in fifteen for businesses and natural persons. In 2012 only a quarter (55) of licensed patents brought their owners more than a million crowns in licence revenue.

Chart C.26: Licensed patents by type of provider and fees received, 2012



**Proportion of total number of valid patents pertaining to that particular type of entity*
Note 1: VŠ – public university (PSU); VVI – public research institution (PRI); FO – natural person engaged or not engaged in business
Source: Czech Statistical Office2013, computation according to Annual Licence Survey Lic 5-01 and IPO CR figures

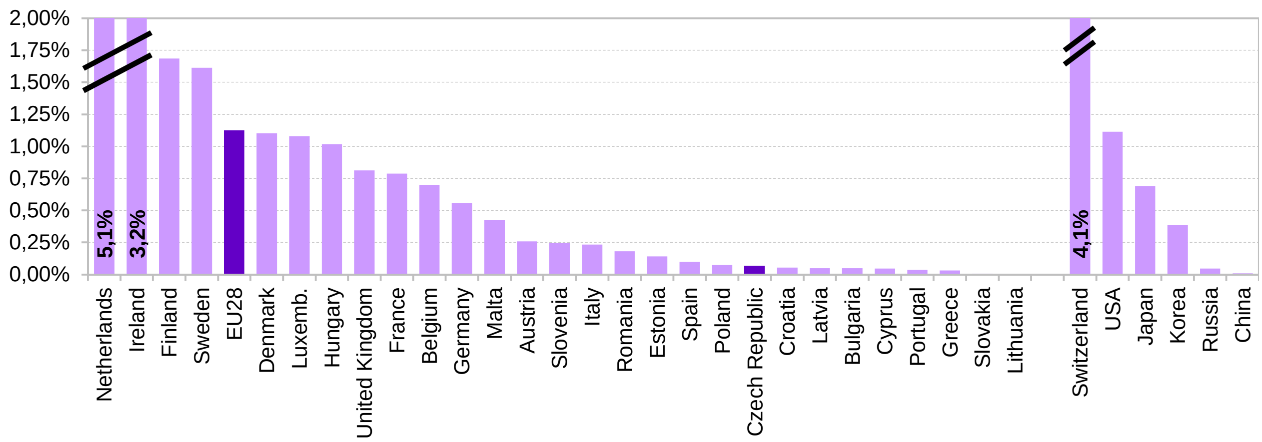
In 2012 there were 64 newly licensed patents, i.e. patents for which a licence contract was concluded for the first time in 2012, while those patents came from 28 different entities (8 of which were PSU and 4 PRI). Not one of these patents achieved licence revenues of million or more crowns in the same year.

International comparison

International comparison of revenues from economic transactions with foreign countries, relating to licence fees and trademarks comes from Eurostat data sources obtained from balance of payments statistics. The definition of services in the field of license fees and royalties is based on code 266 of the EBOPS (Extended Balance of Payments Services) extended service classification, which also includes revenues associated with the use of copyright and therefore data for international comparison cannot be compared with the results of the LIC 5-01 survey, which focuses only on the value of licence fees received for the provision or acquisition of industrial rights.

In 2012 the highest revenues from the export of services in the field of licensing feesand royalties were achieved by the United States (168 billion Eur), the Netherlands (41 billion Eur) and Japan (40 billion Eur). The Czech Republic, with 150 million Eur, made up 0.1 % of total revenues generated by EU28 countries in this field, which in 2012 totalled 143 billion Eur. If we express revenues from the export of services in the field of licensing fees and royalties in relation to GDP, in the same year the highest results were achieved by the Netherlands and Switzerland. Together with the other new EU member states (apart from Hungary and Slovenia), Portugal, Greece and Spain, Czech Republic is down at the bottom of the EU28 rankings as far as this indicator is concerned.

Chart C.27: Revenues from licensing fees collected from abroad, 2011 (proportion of GDP)



Source: Czech Statistical Office 2013 according to United Nations Service Trade Statistics Database (September 2013) and own calculations

D Innovation and High-Tech Sectors

This part presents the analysis of the Czech Republic's innovation performance and innovation efficiency of Czech businesses with the emphasis on international comparison. This chapter pays attention in particular to the technologically demanding branches of the Czech economy, which have the potential capacity to create and use new knowledge and innovations.

Main trends

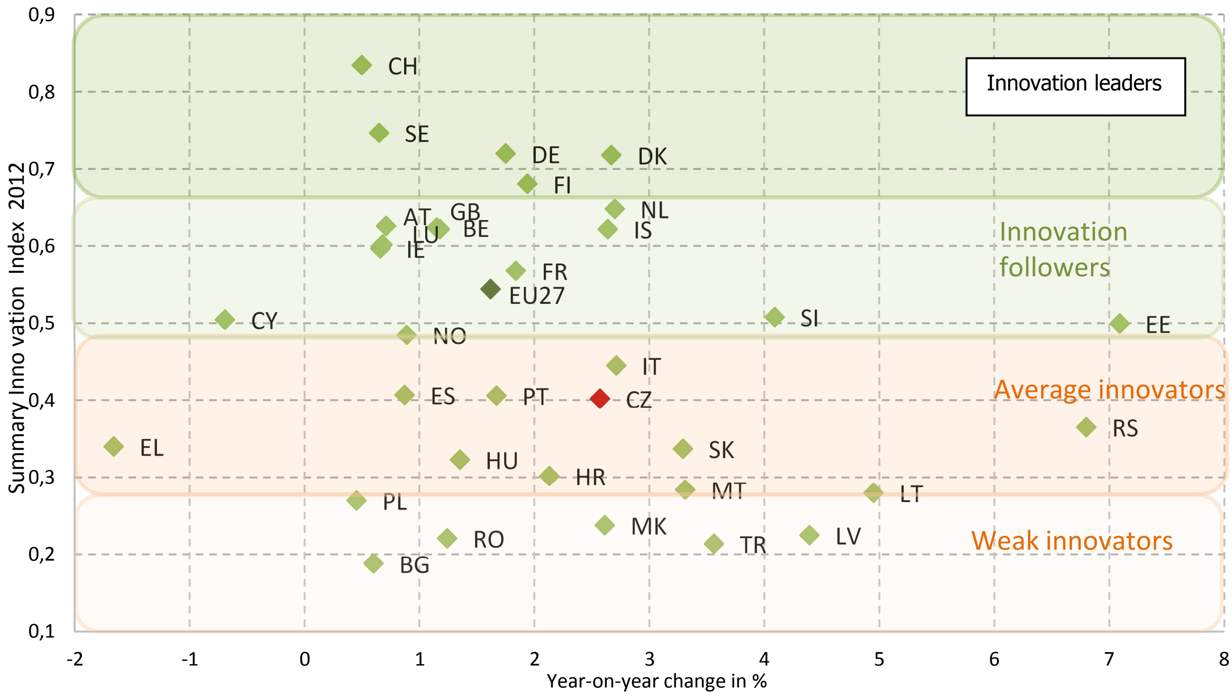
- One of the ever growing shortcomings of the innovation environment in the Czech Republic is the lack of invested venture capital, which decreased even more in 2012; its average value between the years 2008-2012 is at 0,003% of GDP.
- The international comparison of the Czech Republic shows that despite a positive year-on-year change the innovation of the economic environment is still below the EU27 average, which means that the Czech Republic is in the group of average innovators.
- Businesses in the Czech Republic perceive the significance of individual barriers in the innovation process very similarly to most EU countries. The three most important factors, which define innovation activities, pertain to the lack of financing sources and to the costs of innovation activities. The lack of information on markets and technologies is the least important factor for businessmen.
- According to SITC information technologies, electronics and communications account for the highest share in high-tech exports. It should be remembered that these two groups are significantly overrated due to the branding effect.
- The ratio of added value in the high-tech sectors of the Czech manufacturing industry in the total added value created by the manufacturing industry is very small (4.2%) as compared to the other EU countries. If compared to the other EU countries, the Czech Republic is in the last places together with Portugal and Lithuania.
- Evidently, the Czech Republic's competitiveness in the manufacturing industry is still created by medium high-tech and medium low-tech activities, which generate a vast majority of added value in the manufacturing industry.
- The trends indicating that high-tech industrial sectors do not develop in the country are demonstrated also by expenditures on R&D in the high-tech industry (according to NACE), which are stagnating in these sectors.
- The technology balance of payment of the Czech Republic is negative in the long term. Prague, reporting a considerably positive technology balance of payment, is a specific region.

The first part of this chapter focuses on the innovation performance of the Czech Republic in comparison to other European countries via the Summary Innovation Index (SII) and the venture capital investments. This section uses the current data from the Innovation Union Scoreboard and Eurostat. Other parts of this chapter contain an international comparison of innovating businesses with regard to the types of innovations, to the ratio of innovating businesses and to the R&D activities of innovating businesses. The selection of the types of partners in the innovating businesses' innovation process and subjective barriers of the innovation process in EU countries are also assessed. Special attention is paid to the high-tech sector in the Czech Republic and its international comparison, in particular to the performance of the high-tech industry (mainly the manufacturing industry). These aspects are analysed with respect to the ratio of high-tech exports in the total Czech exports, to the added value created in the high-tech sector, and to the technology balance of payment of Czech regions.

D.1 Innovation Performance

The economic development based on knowledge and innovations is one of the most important preconditions for the growth of competitiveness of European states. The direct link between the ability of economy to produce new ideas and innovations and the economic growth is demonstrated not only by the theories of development of regions and states, but also and in particular by the long-term development and experience of the countries. That is why initiatives of the EU and individual states have been more focused in the past decades on the conditions for research, development and innovations, as well as on cooperation in research and development across sectors. However, the ability to create and utilize innovations still differs considerably across EU states. The main tool for comparing innovation performance on the level of the European countries is the Summary Innovation Index (SII)[49]. Both the value and the year-on-year change of the index are monitored. Traditionally, the highest year-on-year growth can be seen in some countries with relatively low values of innovation index. In most countries the year-on-year change is positive up to 3% of its value.

Chart D.1: Innovation performance of selected countries according to the Summary Innovation Index 2012



Source: Innovation Union Scoreboard 2013, own analysis

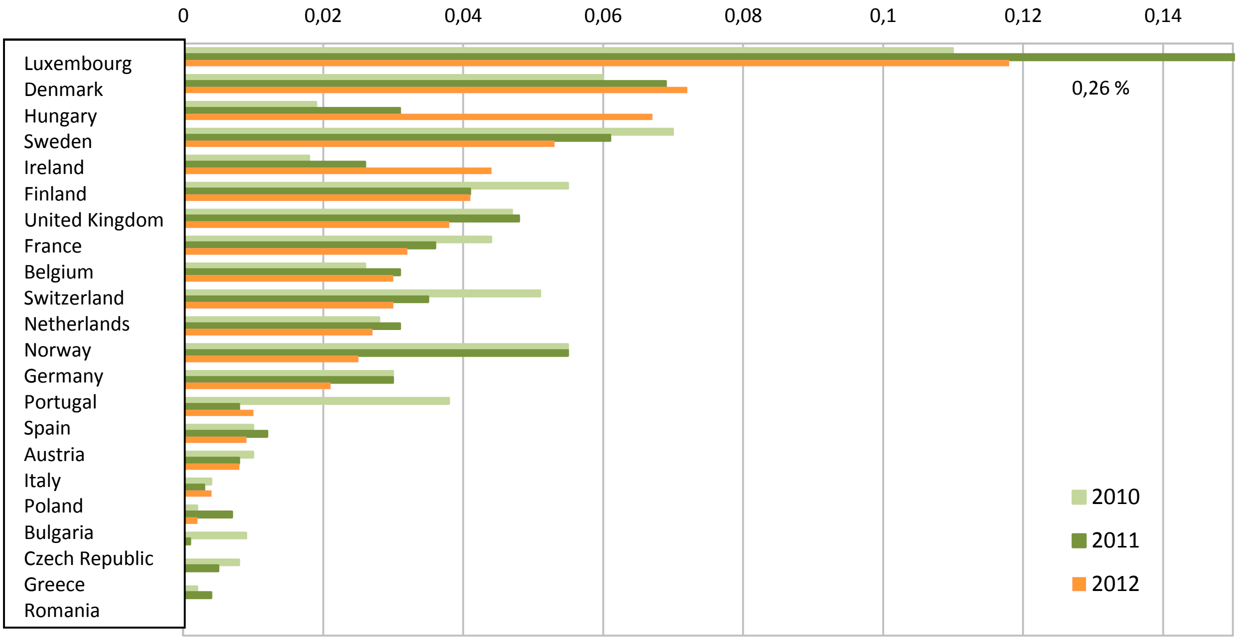
It is not surprising that developed Northern EU member states plus Germany and, traditionally, Switzerland are the innovation leaders in Europe. On the other side of the scale there are weak innovators, such as Romania and Bulgaria. As regards innovation performance, the Czech Republic is in the group of average innovators (chart D.1), still below the total value achieved by EU27 in 2012.

Human resources and economic effects, which are input indicators to assess the innovation performance of countries using the Innovation Union Scoreboard, are the Czech Republic's relative strengths. Openness, excellence and attractiveness of the research system are its relative weaknesses. A sharp decrease in venture-capital investments was also reported; besides, such investments had not achieved the EU average in the preceding years either. Venture-capital investments and projects, which would lead to a major growth of new ideas, technologies and innovations in economy, are insufficient in the Czech Republic in the long term. The Czech Republic lags behind all innovation leaders of Europe in the venture-capital investments (chart D.2). The projects of innovation start-ups are considered too risky for the usual way of support by financial institutions; that is why it is necessary to involve other funding sources for the establishment and initial development of innovative businesses having the potential of fast growth. Therefore, financial tools and venture-capital funds with participation of private and public sources are usual in the countries that are considered innovation leaders. The share of venture-capital investments in GDP was quite insignificant in 2012 in the Czech Republic. There is not enough experience with this support in the Czech Republic, and the market distrusts this form of business plan funding. A rapid decline of the share of venture-capital

49 The Summary Innovation Index evaluates the innovation performance of the EU countries and other selected European countries; the calculation is made based on the statistical analysis of many partial separate indicators in the innovation activity area, divided into several blocks. Using the method of weighted aggregation of partial indicators and a robust analysis the SII is derived.

investments was evident also in the states with high innovation performance, such as Sweden, the United Kingdom, Norway and Germany. Hungary is a country, which managed to increase efficiently the share of venture-capital investments. This success of Hungarian venture-capital investments is backed up by a programme funded under the ERDF (Joint European Resources for Micro to Medium Enterprises).

Chart D.2: International comparison of venture capital investments as % GDP



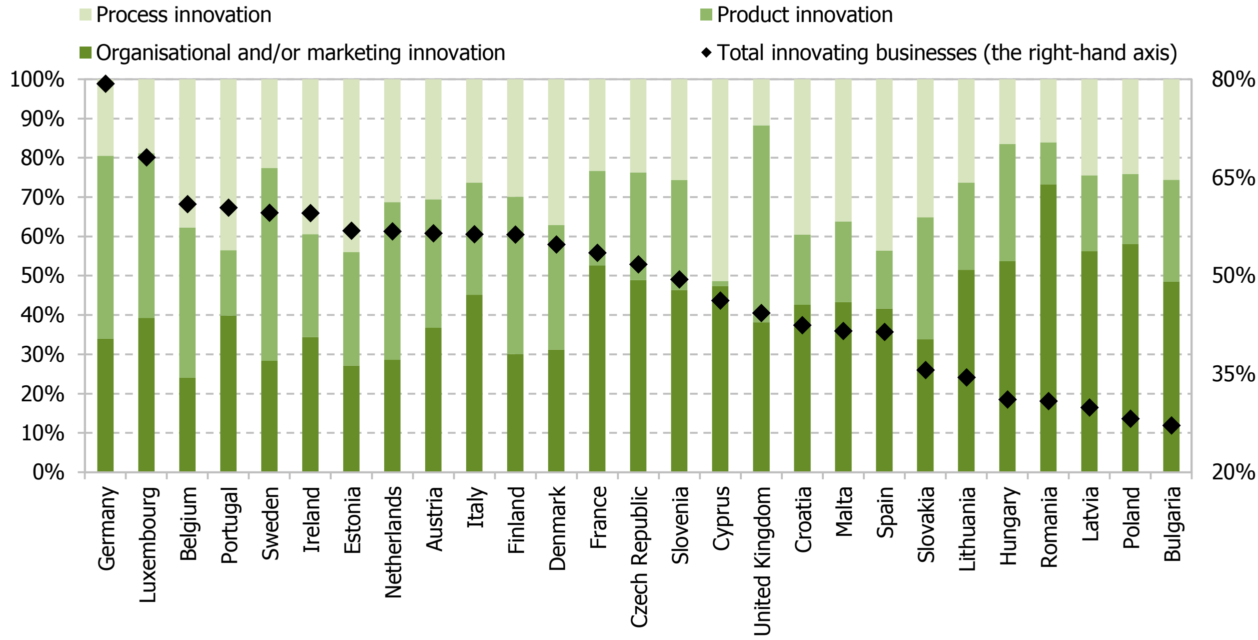
Source: Eurostat 2013
Note: Data for the EU member countries, which are not included, were not available.

D.2 Innovation Performance in Business Sector

Analysis of innovation activities of businesses is based in particular on the data from the Innovation Survey of Businesses 2008-2010. This survey was conducted based on the harmonized questionnaire of the EU member states within the common innovation survey CIS2010 - Community Innovation Survey 2010. The focus is only on innovative businesses. According to the Eurostat methodology the analysis includes only the innovative businesses, which either performed continuous or interrupted innovation activities or implemented one of the four innovation types during the monitored period (i.e. product, organizational, marketing or process innovation). The survey was conducted according to the Commission Regulation (EC) No. 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on innovation. Within this Regulation a statistical survey TI2010 was conducted in the Czech Republic monitoring the period 2008-2010 with the reference year 2010. The questionnaire was sent to 6,229 reporting business units from the selected industries and services with at least 10 employees.

Being exactly in the centre according to the share of innovating businesses in economy in the EU, the Czech Republic ranks among the states where majority of businesses report innovation activities (chart D.3). The share of innovating businesses is closely connected with the absorption capacity of a given economic structure to use and apply new knowledge and information in the form of innovations. The share of businesses with innovation activities is usually even higher in the countries with relatively high innovation performance rather than in the Czech Republic. The member state with the lowest aggregate innovation index – Bulgaria is also the state with the lowest share of innovating businesses in the economic structure. The list is dominated by strong German economy with almost 80% of businesses with innovation activities.

Chart D.3: Innovation businesses according to innovation type (2008–2010)



Source: Eurostat 2013, CIS 2010

The division by type of innovation, which is pursued by businesses in a given state, is highly diversified. Although process innovations (new methods and ways of work) are considered as easily and relatively cheap innovations to be implemented and this type of innovation is often assumed to have the highest share in innovation activities of businesses, this is not the case either in the Czech Republic, or in other countries with average or below-average innovation performance. Focus in the Czech Republic is placed on organisational and/or marketing innovations. Organisational innovations deal with cost-cutting and business development; however, this type of innovation usually does not bring forth technological change or new products. Those are the result in particular of product innovations. Organisational innovations contribute to better organisational management of the enterprise or to better business practices. The ratio of businesses focusing mainly on organisational innovations is lower in the states with lower innovation performance and usually also with a lower share of innovating businesses. Product innovations, which require a sophisticated implementation strategy and, often, considerable investments in new technologies, encompass both innovation of products and innovation of services. Focus on product innovations is placed more by enterprises in the states with a higher share of innovating businesses and with higher total innovation performance. A high ratio of businesses focusing on product innovations can be found in the developed countries of Western and Northern Europe, in particular in Germany, Belgium, the Netherlands, Sweden, Finland and the United Kingdom.

Innovativeness of businesses is necessarily associated with whether and how the businesses invest in research and development (R&D hereinafter). The European Union knows that Europe would lose its position in international competitiveness without higher investments in R&D; therefore, the aim is to achieve by 2020 the investment in R&D amounting to at least 3% of EU GDP. Cooperation in R&D is also an important parameter in the development of innovation activities. Because enterprises pursue their own competitiveness, they often undertake their own innovation activities, which suit best their individual needs. That is why the involvement of innovating businesses in external R&D activities is lower in all EU states rather than the share of businesses undertaking their own R&D, and the Czech Republic is not exceptional (Tab. D.1).

Table D.1: The shares of innovating businesses undertaking their own and external R&D activities (2008–2010)

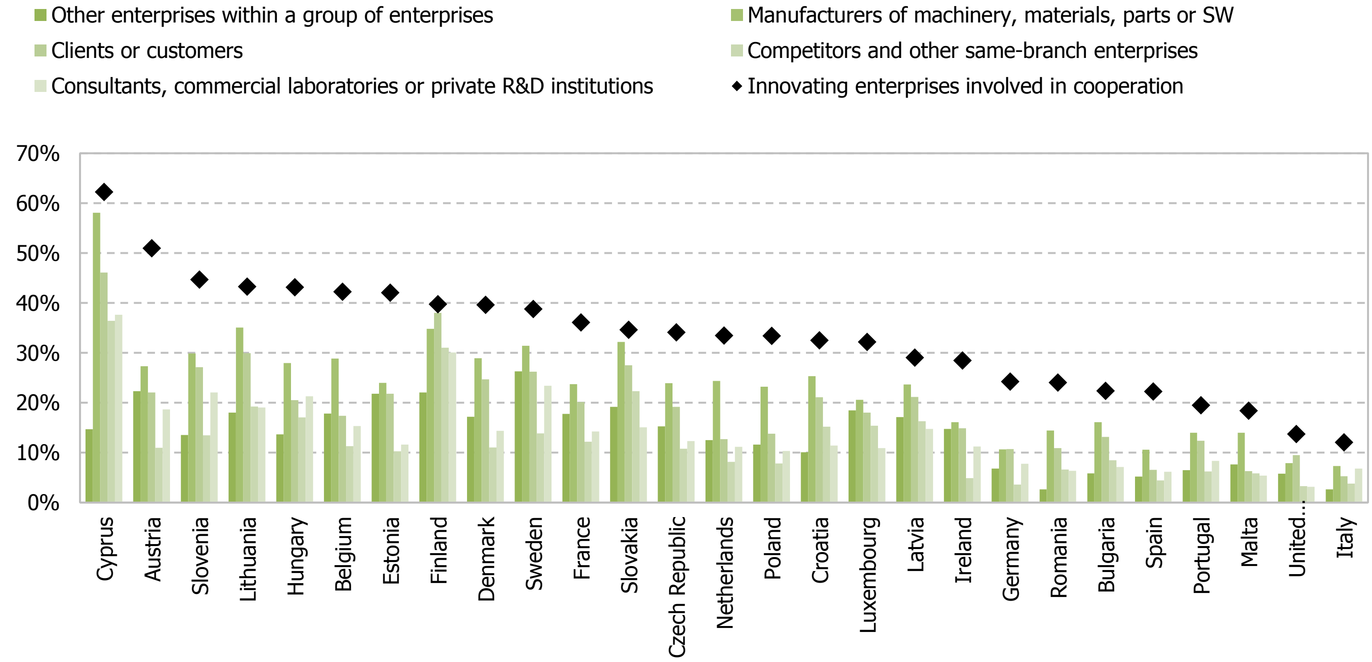
	Businesses undertaking their own R&D activities	Businesses involved in external R&D activities
Belgium	56,27%	31,46%
Bulgaria	14,8	9,61
Czech Republic	58,11%	30,14%
Denmark	44,84%	20,69%
Germany	48,48%	16,94%
Estonia	51,89%	29,29%
Lithuania	53,57%	40,71%
Luxembourg		21,62%
Hungary	46,53%	26,32%
Malta	35,14%	1,
Netherlands	56,86%	24,07%
Austria	50,91%	28,34%
Ireland	45,50%	20,93%
Spain	32,30%	18,96%
France	66,75%	32,19%
Croatia	64,71%	31,50%
Italy	46,20%	16,97%
Cyprus	42,02%	39,75%
Latvia	33,02%	18,67%
Poland	31,07%	20,46%
Portugal	42,92%	22,92%
Romania	37,23%	12,41
Slovenia	74,15%	37,49%
Slovakia	48,97%	27,14%
Finland	79,19%	54,89%
Sweden	59,66%	28,04%

Source: Eurostat 2013, CIS

Not only R&D activities can support cooperation. Innovation activities in their full width are the area where cooperation between businesses and entities from various spheres is common (chart D.4). If compared to the European Union as a whole, the share of cooperating businesses in product and process innovations in the Czech Republic is average, and the structure of business cooperation in the Czech Republic also corresponds to the European average.

The level of cooperation across the EU states is very different. Most frequently, manufacturers of machinery, materials, parts and software providers are the dominating cooperating partners and entities. Because of their rivalry on the market, the group "Competitors and other same-branch enterprises" logically accounts only for a small share in innovation cooperation.

Chart D.4: Types of partners of innovating businesses for product and process innovations (2008–2010)



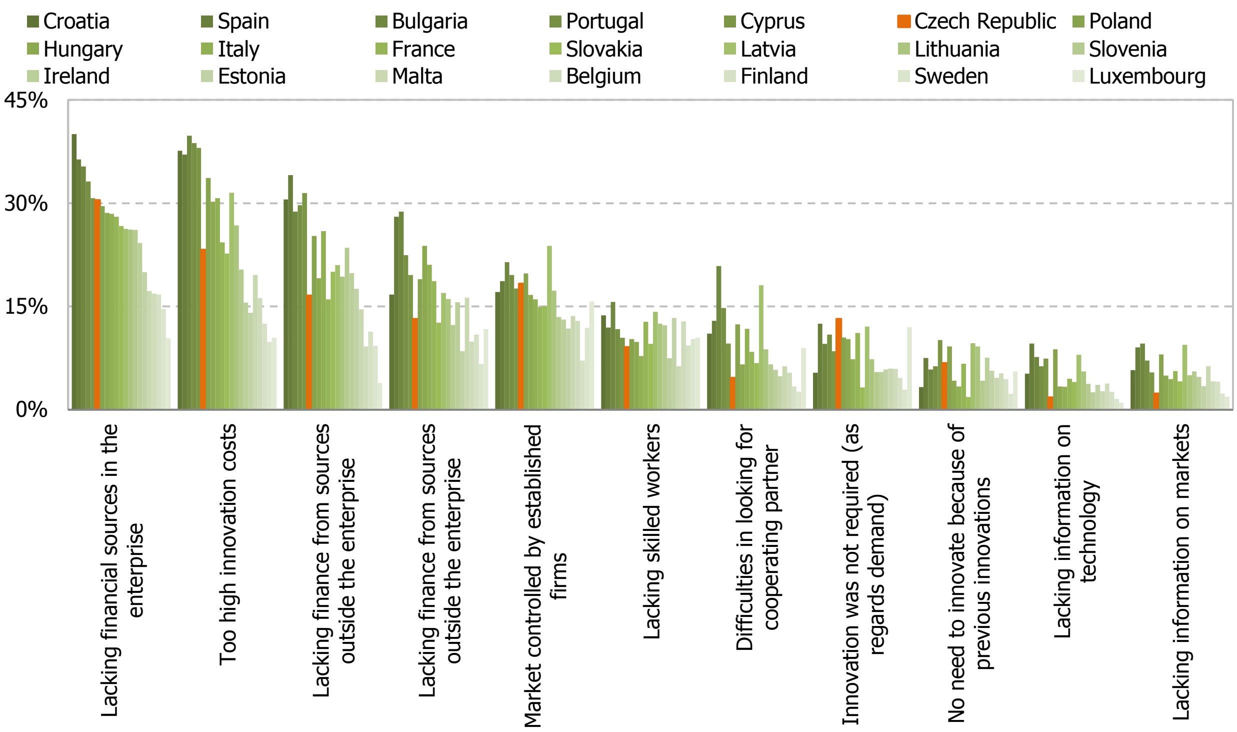
Source: Eurostat 2013, CIS

Innovation performance of economy is also influenced by the business environment and subjective approach of enterprises to innovation activities as such. Innovation activities usually require a sophisticated strategy with a clear objective, which should provide for return of the invested sources and reinforce competitiveness of enterprises. Therefore, every entity should consider the risks and barriers, which could jeopardise the success of innovation activities. The survey of innovation activities across European states demonstrates that significance of the barriers preventing innovation in business is perceived in a similar way (Chart D.5).

The character of innovation environment in individual countries is also depicted by the comparison of the share of businesses, which assessed the factors as significantly limiting. Evidently, businesses in the states with high innovation performance do not perceive barriers so much as businesses in the countries, which are average or below the average in the creation of innovations. Not surprisingly, the differences are higher in particular in the factor of financial sources. Whereas high innovation costs are a significant limitation for almost 40% of businesses in Croatia, Spain and Bulgaria, this factor is limiting in Finland and Sweden (the European innovation leaders) for less than 15% of businesses. The Czech Republic ranks among the countries where the share of businesses perceiving barriers as significant is rather high.

Businesses in the Czech Republic perceive gravity of barriers in a very similar way to most EU countries. The three most important factors limiting innovation activities include lacking financial sources and costs of innovation activities. The lack of information on markets and technologies is the least important factor for entrepreneurs. Difficulties in looking for cooperating partner represent a factor, which is not as significant in the Czech Republic as in the most monitored states.

Chart D.5: Perceiving barriers in innovation activities (2008–2010)



Source: Eurostat 2013, CIS

D.3 High-Tech Branches

The analysis of high-tech branches in this section is based on several sources of data. First, on the statistic of foreign trade, showing the flows crossing the state border. This statistic has its limitations, and it should be noted that significant overvaluation can be present in certain branches, the so-called branding[50]. Furthermore, this statistic does not show the actual imports and exports of arms (which belong to the category "Other high-tech"). Because of the changes in SITC in 2007, the data on foreign trade with high-tech are not fully comparable with the preceding years.

Results of the annual structural business statistics (SBS), which are based on a combination of the CSO's own statistical surveys and administrative data, are also a source of data for an analysis of the high-tech and medium high-tech branches according to CZ-NACE. Analysed are data for the population of active business entities, i.e. legal entities and natural persons in the position of entrepreneurs. As regards legal entities, the

50 For more information on this issue go to www.czso.cz/csu/tz.nsf/i/zahranicni_obchod_v_narodnim_pojeti20110308.

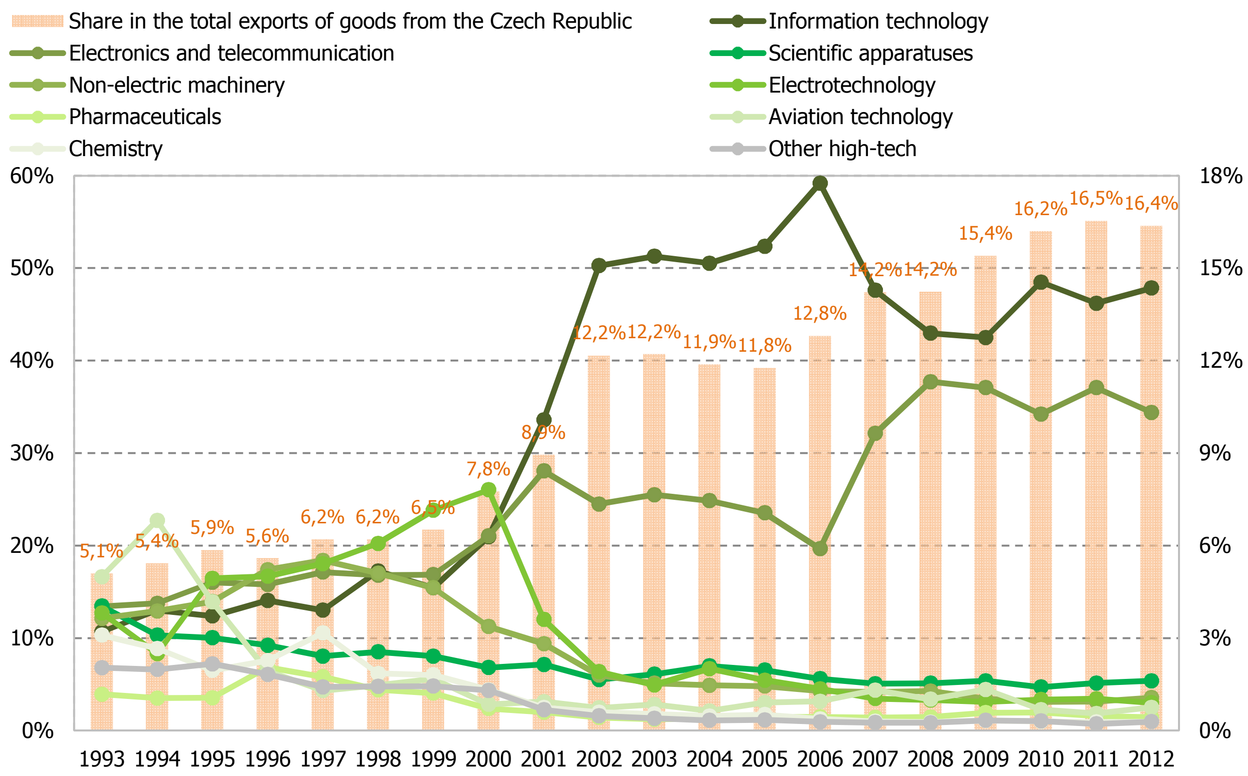
data cover only the sector of non-financial enterprises. In those statistics business entities are allocated to branches by their main activities according to CZ-NACE.

The last source consists in the data from Annual National Accounts (ANA), which make it possible to monitor longer time lines.

Economy, which is significantly export-focused, largely derives its economic situation from the businesses' ability to compete with their products on the international market. Economy of the Czech Republic is very open, and the businesses capable of exporting form competitiveness of Czech economy. Therefore, the focus is placed in the long term on the character of exports as regards high-tech branches.

Although the foreign trade balance is positive in the long term, the balance of high-tech trade was rather negative since the beginning of the economic crisis. The share of high-tech exports in the total Czech exports, however, significantly increased in the past ten years (Chart D.6).

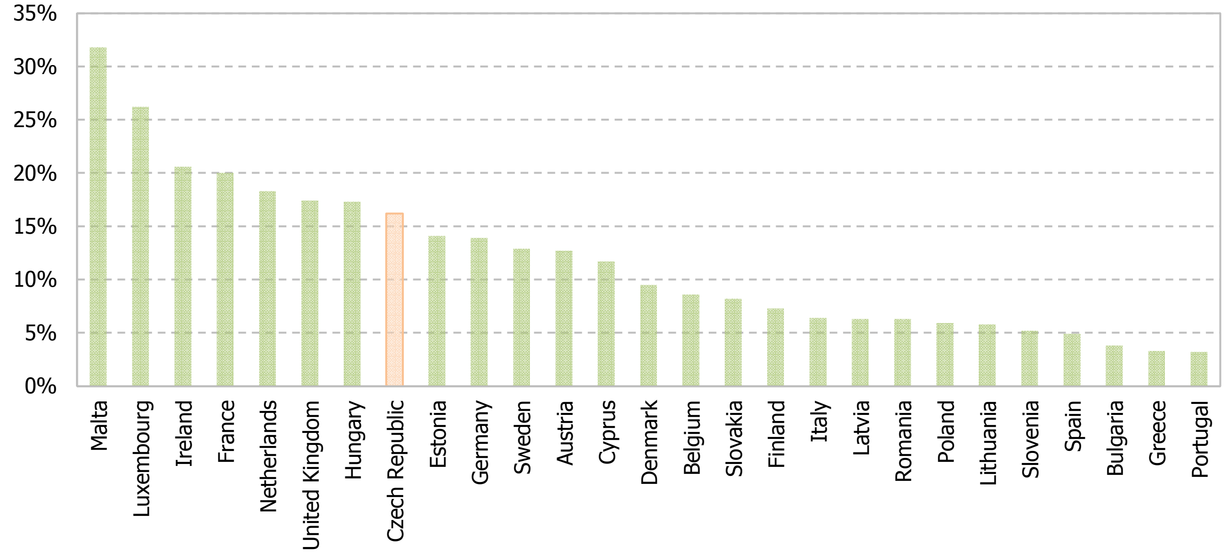
Chart D.6: Exports of high-tech goods from the Czech Republic according to SITC (1993–2012)



Source: CSO 2013, Database of the foreign trade statistics

Information technology and electronics and telecommunication according to SITC account for the largest share in high-tech exports. It should be noted that these two groups are highly overvaluated due to the effect called branding. Amongst other, this is one of the factors why the Czech Republic ranks among the above-average exporters of high-tech goods compared to the other European countries as regards the share in the total national exports (Chart D.7). This is an example how poorly interpreted statistics can distort the ability of economy to produce own high-tech goods. The share of other high-tech branches did not change during the decades.

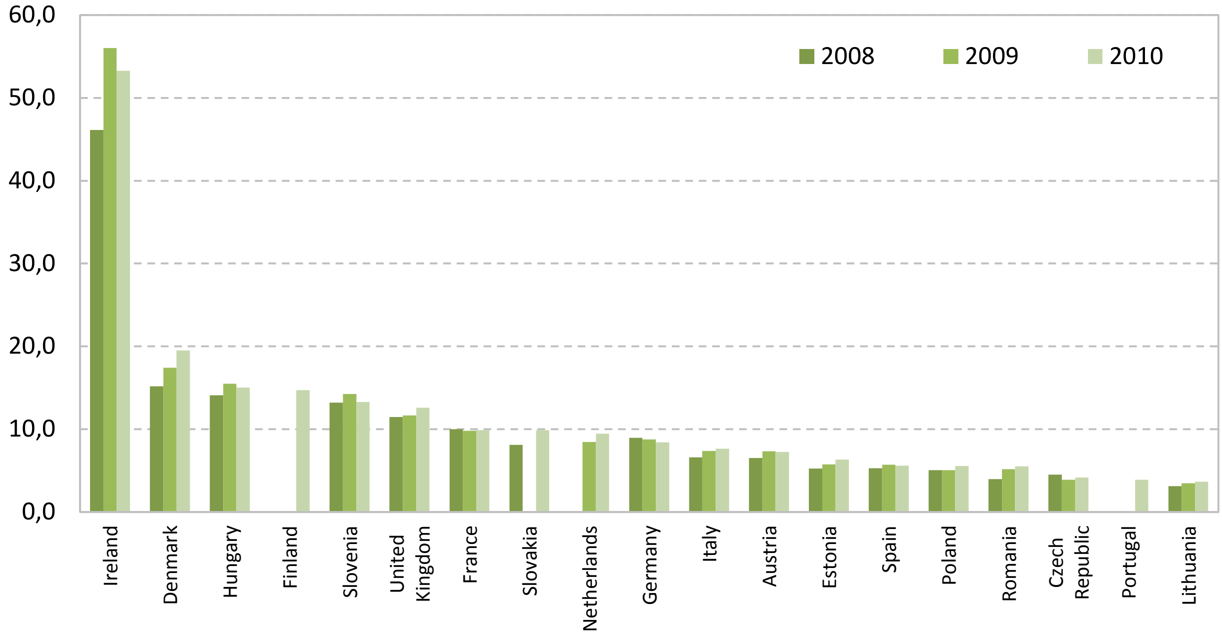
Chart D.7: The share of exported high-tech goods in the total national exports of goods in 2012



Source: Eurostat 2013

Although data on high-tech exports can be quite misleading, below-average innovators evidently rank among the countries with a low share of exported high-tech goods. Nevertheless, further conclusions arising from a comparison according to the statistics of high-tech trade should always be supplemented with other points of view. The added value created in high-tech branches is another factor that can be monitored in international comparisons of the Czech Republic (Chart D.8).

Chart D.8: The added value created in the high-tech branches of the manufacturing industry as a share in the manufacturing industry

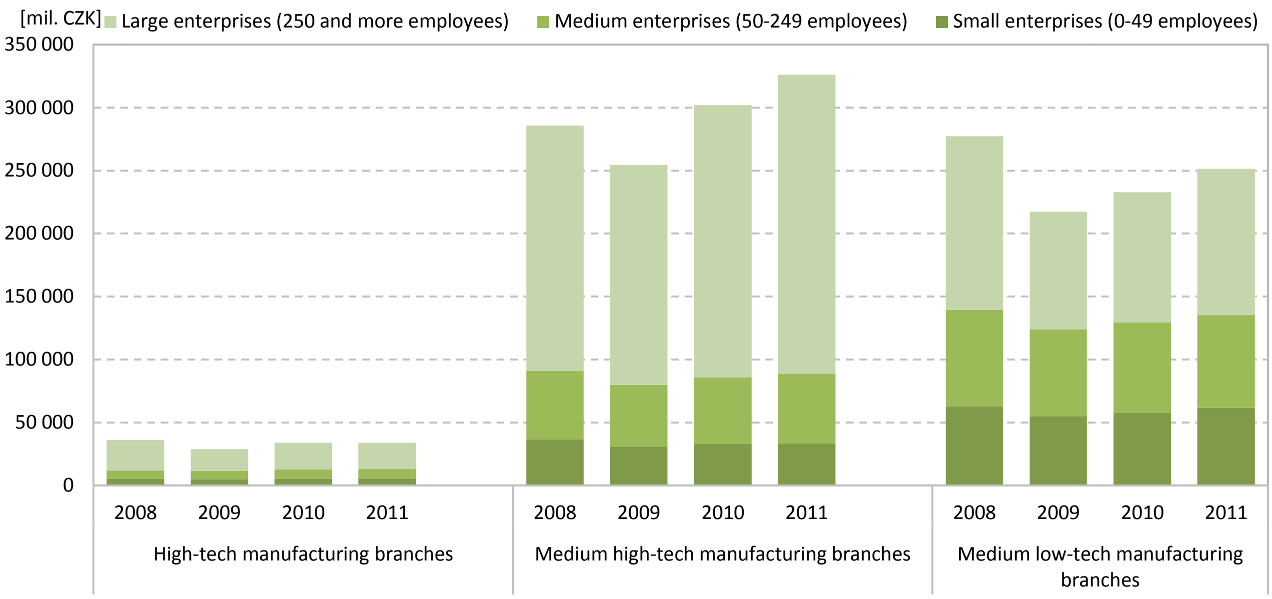


Source: Eurostat 2013

The Czech Republic is a country with strong industrial tradition, in particular in the manufacturing industry. Economic activities belonging to the manufacturing industry are perceived as a significant source of Czech economy competitiveness. In this context the manufacturing industry in the Czech Republic is also expected to have a high potential of further development, because it includes numerous branches, which are technologically very intensive. The high-tech sector includes the activities that use developed technologies for their production, and the development of outputs of those activities is often associated with high expenditures on innovations and/or on research and development. Such activities create a higher added value. Nevertheless, the share of the added value of high-tech branches of the manufacturing industry in the Czech Republic in the total added value created by the manufacturing industry is very small. As compared to the other EU countries, the Czech Republic is even in the last places together with Portugal and Lithuania. Evidently, Czech competitiveness in the manufacturing industry is still created by medium high-tech and medium low-tech activities.

This fact is clearly illustrated by Chart D.9. As regards the size structure of enterprises in the manufacturing industry, the highest added value is created by large corporations with 250 and more employees, in particular in the category of medium high-tech branches. The share of medium high-tech branches in the added value created in the manufacturing industry since the decline in 2009 due to the economic crisis has been growing considerably. Large corporations, which are mostly under foreign control, can be expected to continue their investments in medium high-tech and medium low-tech branches. That means the Czech Republic still builds its competitiveness on relatively good-quality, but rather cheap labour force; not on high-quality labour force and on an environment attractive for investments in technologically intensive sectors, which frequently require the presence of research and development activities, as well as the presence of highly skilled human sources.

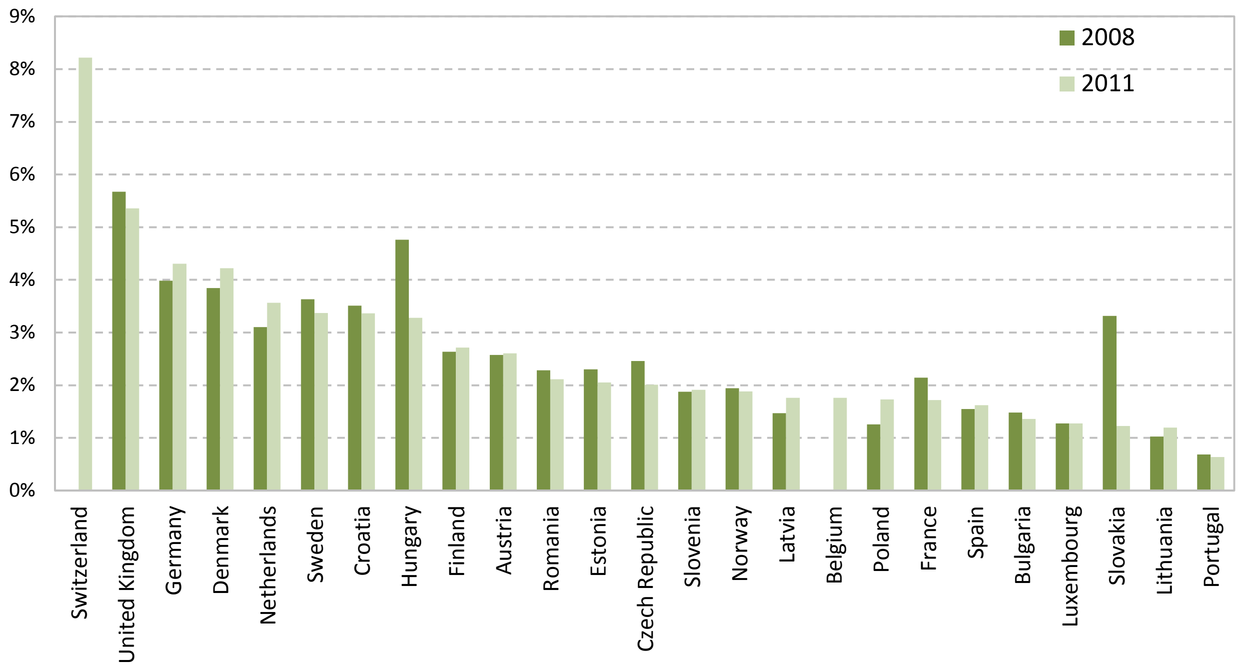
Chart D.9: The added value created in the manufacturing industry by technological intensiveness (in mil. CZK)



Source: CSO 2013, Annual structural business statistics

The number of firms in high-tech branches in the Czech Republic accounts for about 2% of the total enterprises in the manufacturing industry. This is a below-average value in international comparison (Chart D.10). The highest share of high-tech firms can usually be found in the countries with high innovation performance, such as Switzerland, the United Kingdom, Germany and Denmark. Although the countries are very different, either as regards their population size or the nature of competitiveness sources of their economies, the simple share of firms in high-tech branches clearly illustrates those countries' abilities to produce and transform knowledge into innovation.

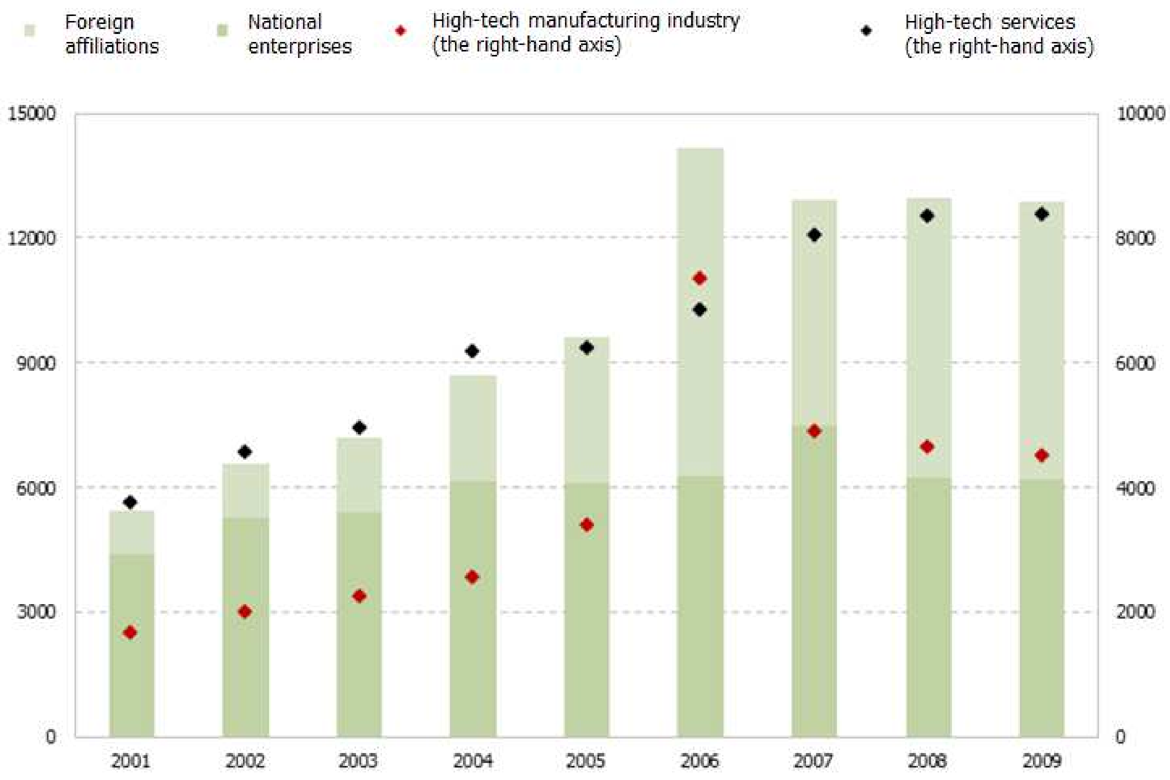
Chart D.10: The share of firms in high-tech manufacturing branches in the total number of firms in the national manufacturing industry



Source: Eurostat 2013

Higher expenditures on R&D are reported by the sector of high-tech services (Chart D.11). The share of national and foreign enterprises in R&D in the high-tech sector (both industries and services) is quite levelled, although the share of foreign affiliations in the expenditures on R&D in high-tech branches keeps growing during the years. That industrial high-tech branches do not develop too much in the Czech Republic is also demonstrated by stagnating expenditures on R&D in high-tech industries (NACE). And vice versa, high-tech services develop continually and expenditures on R&D in this sector keep growing in the Czech Republic.

Chart D.11: Expenditures on R&D in the high-tech sector (according to NACE, in mil. CZK)

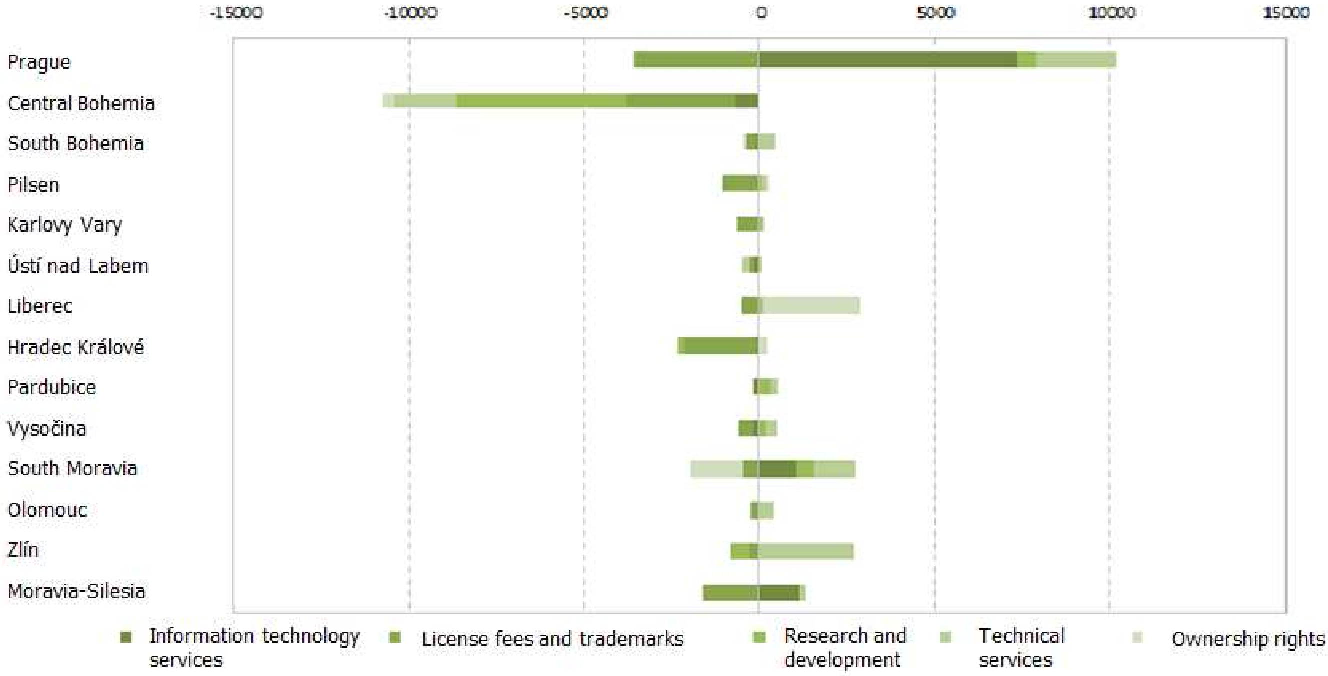


Source: CSO 2012, Survey on research and development VTR 5-01

The technology balance of payment (TBP) characterises sales or purchases of intangible technology in relation to the other economies; that means TBP includes outgoing technological payments from a given country abroad and technological incoming payments from abroad. The data on the technology balance of payment are a valuable source of information. Those data make it possible to measure intensity and scope of R&D dissemination through the international trade. The technology transfer between countries is multiplied by the global character of economy, by direct foreign investments, mergers, etc. The TBP also refers to the technological independence of the country and to the origin of technologies used in the production system or in exports and, last but not least, to the interconnection between the country's technology income and research and development activities. The TBP statistics also include patents, licence agreements, know-how (i.e. inventions not protected by patents), transactions involving trademarks, designs and models, technical services (preliminary technical designs and engineering works, general technical assistance for operation and maintenance) and research and development performed abroad. The TBP does not include intellectual property of non-industrial character and software.

The Czech technology balance of payment is negative. Although the TBP reflects the ability to compete with one's technologies on the international market, the negative value of the TBP does not necessarily mean that competitiveness of a region/state is low. Negative values can be associated with foreign investments and with new technologies transferred to the region/state. The Czech TBP is, however, negative in the long term, and in the context of other data (see the text above) the Czech Republic evidently lags behind the European average in the creation of knowledge-intensive products (either tangible or intangible ones). High income resulting in a positive total TBP is reported by the Prague region. Due to its economic strength and very specific economic structure Prague is a national centre of services with high added value (Chart D.12). The regions of South Moravia, Liberec and Zlín are also successful as regards their TBPs. The positive value of the TBP in the latter two regions is created by exports of technologic services and ownership rights. The highest sum of imports of technologic services is reported by the Central Bohemia Region. This is associated also with the relatively high value of direct foreign investments in the Central Bohemia Region.

Chart D.12: The Czech technology balance of payment in 2011 (in mil. CZK)



Source: CSO 2012, Survey ZO 1-04

E International Cooperation in Research and Development

International cooperation in R&D continuously gains in significance, which is aided by the deepening integration of the European Research Area. Using the funds from framework programs and from the state budget, the Czech Republic supports cooperation with foreign partners either in the form of bilateral and multilateral agreements or specific programme schemes.

Main trends

- The Czech Republic lags significantly behind in the relative amount of submitted proposals and the number of teams in the 7th framework programme (24th position among EU countries); on the other hand its financial success rate (14.9%) is the second highest of all new member countries.
- The Czech institutions recorded a total of 1,190 project participations during the 7th framework programme, which is a number that exceeds the same indicator for the 6th framework programme (1,068) – the Charles University being the largest supplier of project participations together with the Czech Technical University, Masaryk University, and the Institute of Nuclear Research at Řež.
- Countries with similar number of inhabitants (Austria, Belgium, Portugal and Hungary) usually receive larger amounts from the 7th framework programme – so far the Czech teams received financial support in the amount of EUR 217 million and invested EUR 64 million from their own sources.
- The aid from the 7th framework programme plays a minor role in R&D funding in the Czech Republic – with EUR 16.5 mil. from the 7th framework programme per billion of total expenditures on R&D, the Czech Republic belongs to five countries with the lowest share in the 7th framework programme.
- The Czech Republic allocated a total of CZK 680.9 million for international cooperation support from the state budget through the MoEYS chapter in 2012 (except for operational programmes), which is a year-on-year increase by 14% and 92% allocation.
- Besides, contributions to international organisations were paid (CZK 223.4 mil. to CERN, CZK 71.7 mil. to JINR).
- The integration role and connection to the network of ESFRI strategic infrastructures are provided for by 33 large R&D&I infrastructures approved to date with their current annual budgets amounting to CZK 799.6 mil.

A complex overview of the activities and the success rate of Czech beneficiaries, including the topical focus of the R&D, can be gained from data on framework programs (FP) in the E-CORDA database. The funding for R&D activities, which is allocated through the FP, includes a considerable portion of foreign sources; therefore, the major part of this chapter focuses on the FP and on the related programme Horizon 2020 (subchapter E.1). The funds invested into the FP by the Czech Republic from the national budget are allocated through the mechanisms described in E.2 subchapter. The main data sources are information given by relevant ministries and project data from the Information System of Research, Development and Innovation (IS R&D&I).

E.1 Framework programs for R&D support

From the very beginning in 1984, EU framework programs supporting research and development (R&D) have been focused mainly on target-oriented research with goals responding to the needs of European society. Unlike the preceding programme, the 7th Framework Programme for Research, Technological Development and Demonstration (FP7), which is in progress, extends the support of fundamental research, where the projects' contents are decided by the research teams themselves. The 7th EURATOM Framework Programme**,** which is focused on research in the area of the peaceful use of atomic energy, runs in parallel with FP7.

The rules for participation in both programmes are practically identical. The European Commission (EC) allocated in the current programming period EUR 50.5 bn. to FP7 and EUR 5.3 bn. to EURATOM.

FP7 consists of four specific programmes: Cooperation, Ideas, People and Capacity.

- The specific program Cooperation supports target-oriented research based on the needs of society. This program is divided into ten thematic priorities with annually updated detailed work agendas, referred to in European Commission calls for submission of project proposals.
- The specific program Ideas supports blue-sky research work. For this program no a priori research targets are set; those appear in the proposals for projects. The programme Ideas is controlled by the European Research Council (ERC), which on the basis of peer review recommends submitted project proposals for financing. A proposal's worth is decided exclusively by its scientific excellence.
- The specific program People supports the development of human capital in sciences in the form of internships, establishing training networks for beginning researchers or cooperation between the academic sphere and private sector. It is a direct continuation of the Marie Curie Events, which were part of the preceding FPs.
- The specific program Capacity has as its goal the strengthening of the research capacity within the European Research Area and contribute to achievement of the goals stipulated in the strategic documents. It supports the development of research infrastructures, innovation activities of SMEs, the linking-up of knowledge regions, popularising activities and international cooperation with third countries.

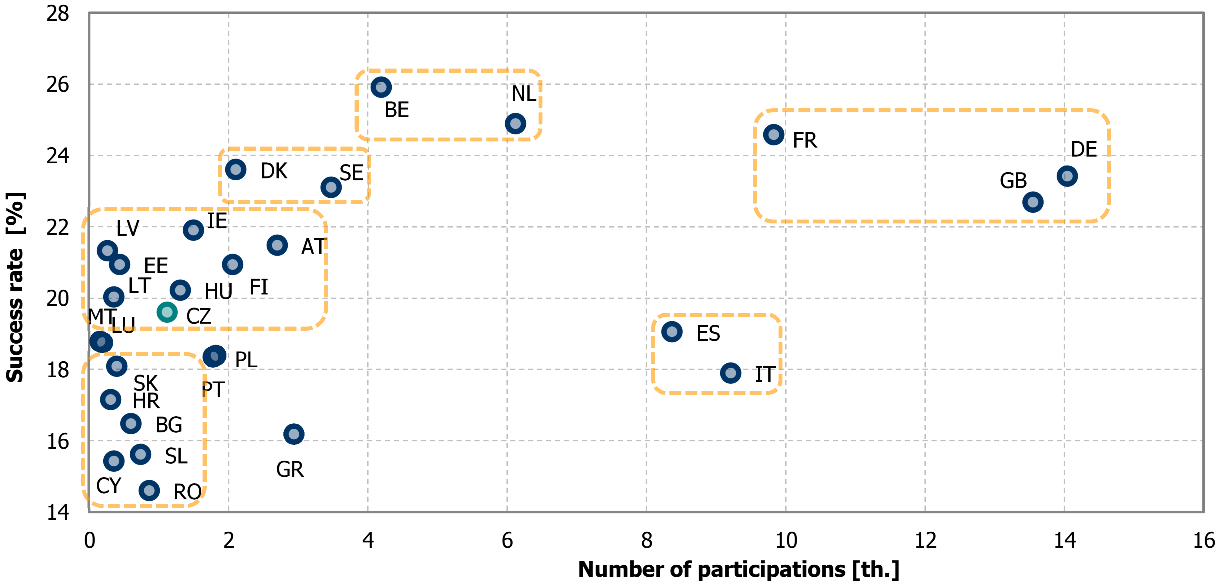
EURATOM includes activities in research, technological development, international cooperation, dissemination and use of technical information, and specialised training. It is divided into two research areas - fusion energy research and research of nuclear fission and radiation protection.

Participation in FP7 and EURATOM projects[51]

2013 is the closing year of the current programming period, though many projects in progress will continue in the next years. That is why numerous cumulative indicators show relatively high values. The projects for implementation are selected upon extensive expert evaluation based on the method of independent review. The success rates of individual countries are determined according to the total numbers of submitted proposals (free of formal errors) and the numbers of implemented projects. The numbers of participations expressed as absolute values naturally give preference to large countries (Germany, France, the United Kingdom). A combination of the indicators of participation success and absolute number of participations divide the states into clusters of countries with similar results (Chart E.1). Large southern states (Spain, Italy), separated from the EU core, show high numbers of participants in FP7 in accordance with their size, but relatively low success rates; on the other hand, smaller Benelux countries (Belgium, the Netherlands) and northern states (Denmark, Sweden), with lower numbers of participating teams, record high success rates. The success rates of Estonia and Latvia, as representatives of new member countries, are close to the level of EU-15 states. Czech teams reached a success ratio of 19.6%, which places them in the 15th place in general and in the 5th place among the new member states. All new member states located to the south of the Czech Republic, except for Hungary, have lower success rates. Institutions from the Czech Republic participated to date in 1,119 projects, which is a value exceeding the final number of Czech participations in FP6 (1,068).

51 The following analysis text will use the abbreviation FP7 for both FP7 and EURATOM

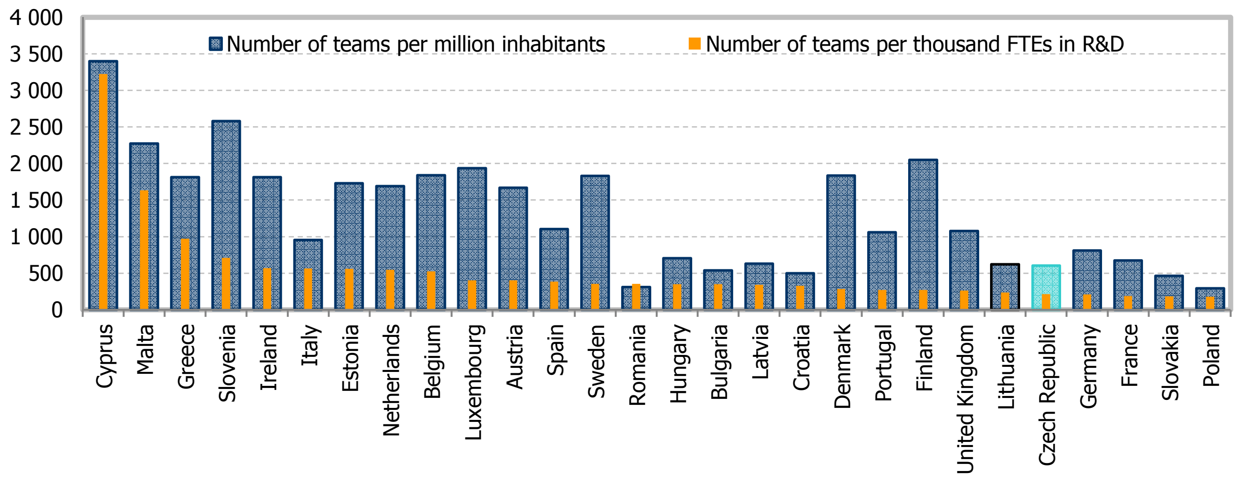
Chart E.1: Number of participations and success rates of EU states in FP7



Source: E-CORDA

Individual member states' responses to calls within the FP7 depend strongly on their R&D sites capacity. If capacities are compared with the numbers of teams preparing proposals for projects being assessed, it is evident that the FP7 is very attractive for smaller member states; on the other hand, large states, except for Italy, achieve considerably lower values in relative terms (Chart E.2). As regards the numbers of submitted proposals, the Czech Republic clearly lags behind large countries, except for Bulgaria. According to the indicators relativized by numbers of inhabitants or R&D employees, only Slovakia and Poland ranked worse. This fact shows a relatively low activity of Czech researchers as regards FP7.

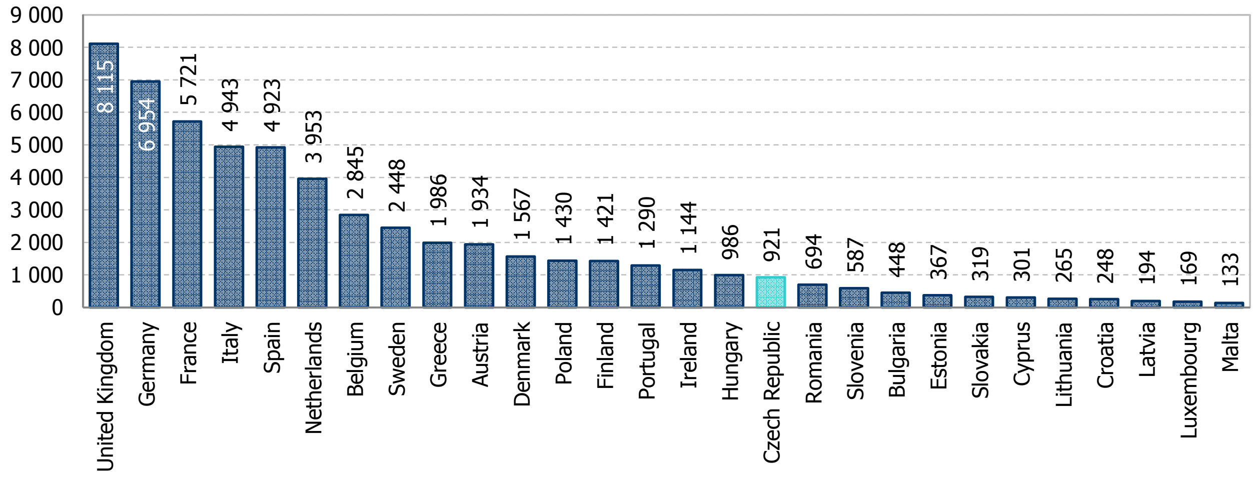
Chart E.2: Relative activity of EU countries participating in FP7



Source: E-CORDA

The mentioned 1,119 teams from the Czech Republic participate in 921 projects with signed grant agreements and secured funding. The total number of projects, in which Czech researchers participate, is relatively low in comparison to other states (Chart E.3). The large states naturally receive most projects.

Chart E.3: Number of projects implemented within FP7 in the EU states

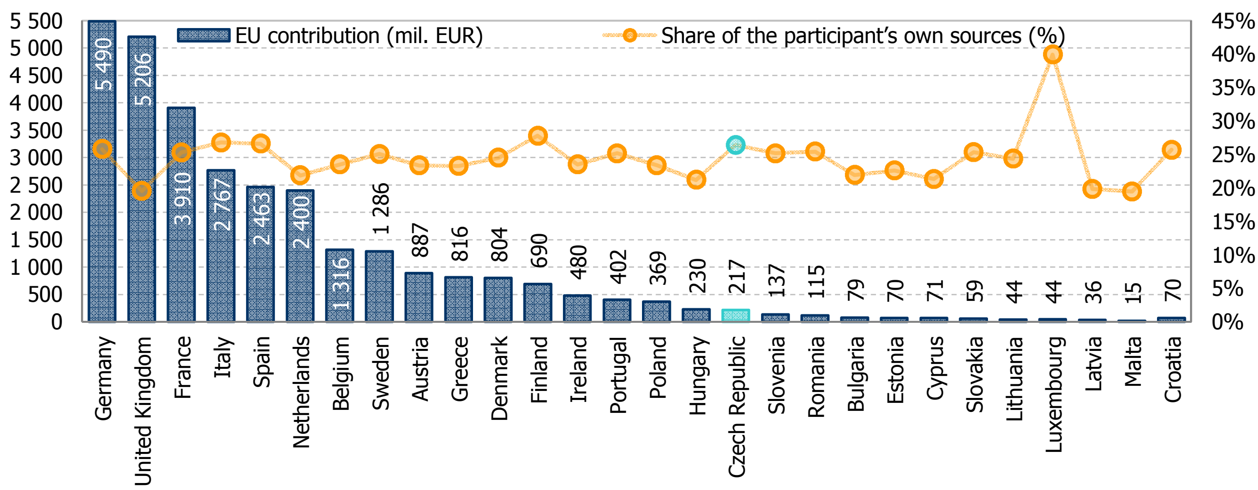


Source: E-CORDA

Financial indicators

The contribution of the team participating in a project under FP7 depends on the type of activity and on the type of applicant. The contribution is between 50% of total costs in the case of demonstrational activities, 50-75% in the case of research activities and 100% contribution for basic research or coordination and support activities. Higher contributions go to non-profit public entities and research organisations, educational institutions and SMEs. Teams from the Czech Republic received to date a financial aid in the amount of EUR 217 million and contributed to projects EUR 78 mil. from their own sources (Chart E.4). The total amount is EUR 295 million, which is comparable to Hungary. Hungary, however, manages to secure a much larger share of funding from the EU sources in contrast to the Czech Republic. Other states with similar population (Portugal, Austria, Sweden, Belgium) receive multiple times higher funding.

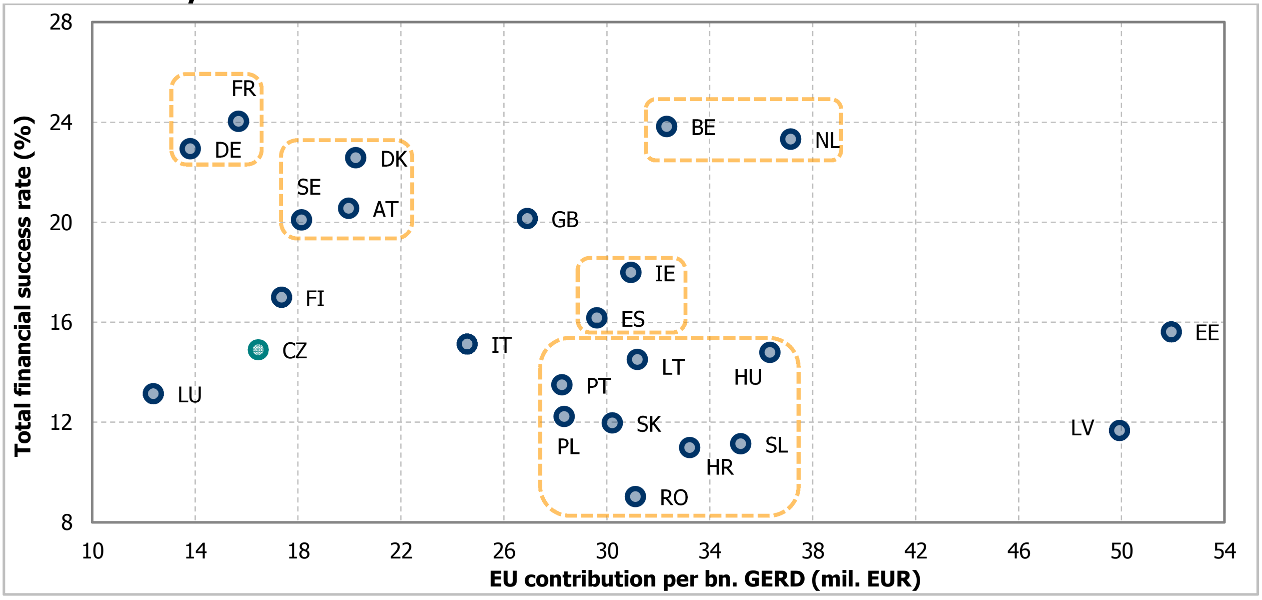
Chart E.4: Financial indicators of FP7 by EU countries



Source: E-CORDA

The role of the aid received under FP7 can be expressed as a relation between the received funding and the total expenditures on R&D in the given country (GERD). The Czech Republic received approx. EUR 16.5 million under FP7 per EUR 1 billion of its total expenditures on R&D. This value places the Czech Republic to the five bottom EU countries (Chart E.5). That means the funding under FP 7 is rather marginal in the Czech system of R&D. The financial success rate of the Czech Republic - the requested/received funding ratio - is the second highest of the new member countries (14.9%), surpassing even some old member states.

Chart E.5: Required contribution and success rate of EU member states

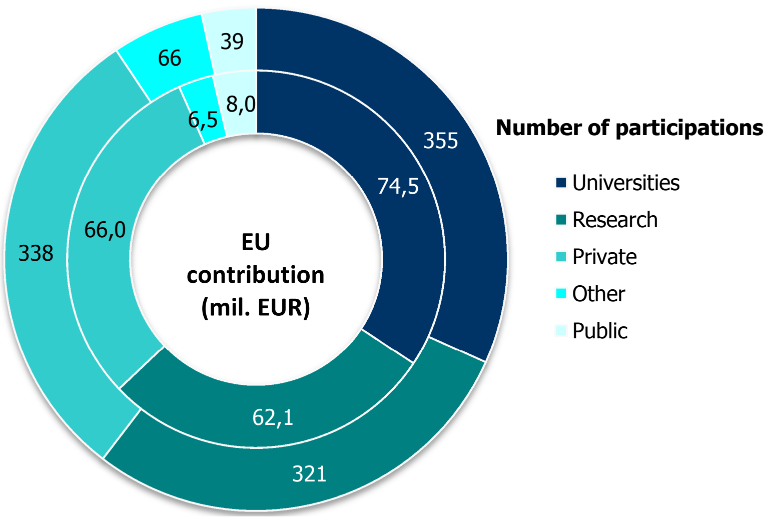


Note: As the analysed period of the FP7 includes mostly years 2007 - 2012, (and a very small part of 2013), we use the sum of R&D expenditures from 2006 – 2011, which are available via Eurostat - excluding Greece for which there are no relevant data.
Source: E-CORDA

Structure of FP7 participants

The participation of the private sector in the FP7 is decreasing compared to previous framework programmes and effort is made to turn this trend around – the long-term goal is to achieve a 15% share of SMEs in the total number of participations. The Czech Republic traditionally reports a strong participation of the private sector (the 12th highest of all member countries). Out of 1,119 participations in the Czech Republic 240 are SMEs, which accounts for 21.4% (as regards the EU contribution, the share is slightly higher – 21.5%). The involvement of universities, research and private sectors is levelled in the Czech Republic, with teams from universities mildly prevailing (Chart E.6). The Academy of Sciences institutes (59% of participations and 64% of contributions) play the major role in the sector of research. The sector of Czech public administration participates very sporadically in the activities under FP7.

Chart E.6: Participation of Czech teams and EU contribution to teams by sector



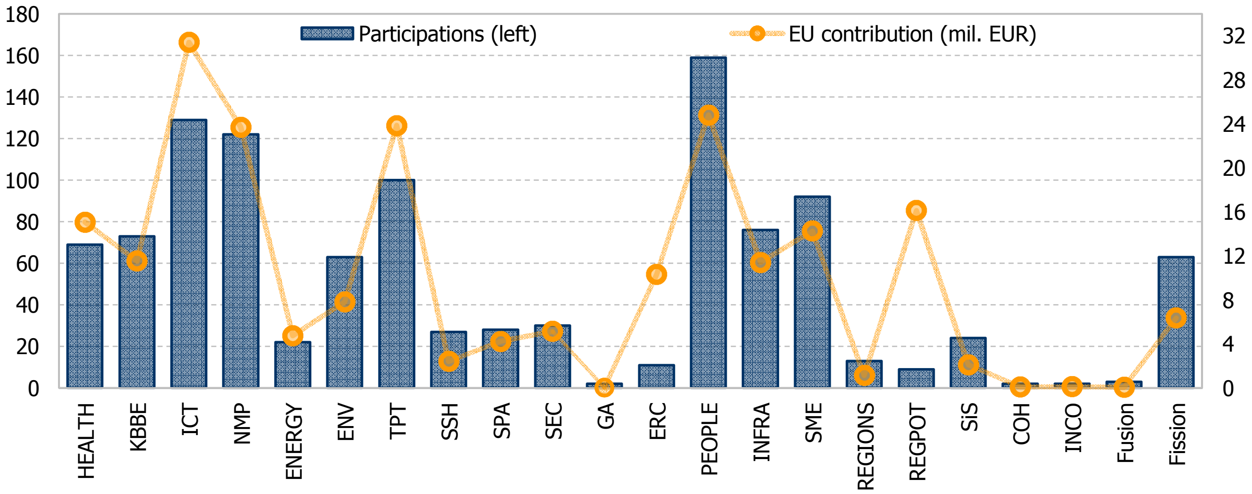
Source: E-CORDA

FP7 priorities

Each of four specific programmes, to which the FP7 is divided, includes several topical or horizontal priorities. Topical priorities pursue research goals (health, transport, environment), horizontal goals target aspects forming the ERA (blue-sky research, scientific mobility, development of research infrastructures). The number of participations and the total contribution are influenced by the budgets allocated to individual priorities. The budget-largest priorities are the ICT and HEALTH; the Ideas programme also has a sizeable budget with a very large average EU contribution per participant. An extensive aid is granted also to the priorities Nanosciences, Materials and New Technologies, Transport, and People.

The Czech Republic participates mostly in the programme PEOPLE and in thematic priorities ICT and Nanosciences (Chart E.7). Other priorities with significant Czech participation include Health, Transport, R&D in favour of SMEs, Infrastructures, Agriculture, Food and Biotechnology, Environment, and Nuclear Fission of the EURATOM programme. On the other hand only two of the Czech teams participated in the priority of international cooperation with third countries. The contribution strongly correlates with the number of participations. The Czech teams received the most resources in ICT, People, Transport, and Nanosciences. An above average contribution related to the number of projects was achieved by Czech teams in the priority Research Potential.

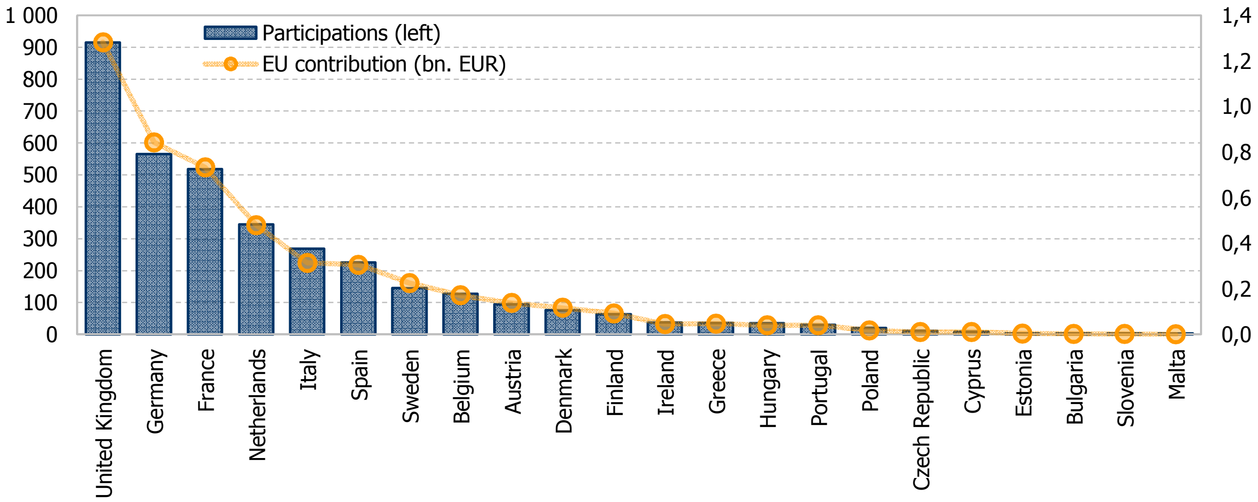
Chart E.7: Participation of Czech teams and EU contribution in individual priorities of FP7



Note: HEALTH – Health; KBBE - Agriculture, foods and biotechnologies; ICT – Information and communication technologies; NMP - Nanosciences, materials and new technologies; ENERGY – Energy; ENV – Environment; TPT – Transport; SSH – Socio-economic sciences and humanities; SPA – Space research; SEC – Security; GA – General activities; ERC – Ideas; PEOPLE – People; INFRA – Research infrastructures; SME – Research for SMEs; REGIONS – Regions of knowledge; RESPOT – Research potential; SiS – Science in society; COH – Development of research policies; INCO – International cooperation; Fusion – Nuclear fusion; Fission - Nuclear fission.
Source: E-CORDA

The Ideas (ERC) programme is exclusive among all activities. The programme includes projects that are solved usually by only one main solver working in a selected host institution – that is why the contribution is several times higher than for other priorities. The profits from those grants are assessed as one of the measures of scientific excellence. Most represented country (26% of total EU participation) in Ideas is clearly the UK (Chart E.8), followed by Germany, France, as well as the much smaller Netherlands. Research institutions in the Czech Republic acquired 11 ERC projects and create conditions as host institutions for seven main (Czech and foreign) solvers with ERC grants. The total contribution for the Czech Republic is EUR 10.3 million. In the group of new member states only Poland and Hungary, which is of similar size, have higher participations; however the Hungarian value is thrice as high as the Czech one (35 projects and EUR 40.1 million).

Chart E.8: Participation of EU teams in ERC grants (specific programme Ideas)



Source: E-CORDA

The most successful institutions in terms of the number of teams are located in advanced and large EU states, which are able to develop a wide knowledge base in the given field – in France, Germany, the United Kingdom and Italy (Tab. E.1). The leading European research institution Centre National de la Recherche Scientifique (CNRS) has a higher number of participations than the whole Czech Republic. In the Czech Republic the institutions with the largest number of projects within FP7 are the Charles University in Prague followed by the Czech Technical University in Prague, Masaryk University and the Institute of Nuclear Research in Řež, which has the bulk of its activities in the EURATOM programme.

Table E.1: Most frequent participants in FP7 from the EU states and the Czech Republic

Institution name	State	Participations
Centre national de la Recherche Scientifique	FR	1 259
Fraunhofer Gesellschaft zur Foerderung der Angewandten Forschung e.v	DE	922
The Chancellor, Masters and Scholars of the University of Cambridge	GB	598
Max Planck Gesellschaft zur Foerderung der Wissenschaften e.v.	DE	575
Consiglio Nazionale Delle Ricerche	IT	574
Institution name	**State**	**Participations**
Univerzita Karlova v Praze	CZ	100
České vysoké učení technické v Praze	CZ	72
Masarykova univerzita	CZ	47
Ústav jaderného výzkumu Řež, a.s.	CZ	32
Vysoké učení technické v Brně	CZ	28
Technologické centrum AV ČR	CZ	25
Vysoká škola chemicko-technologická v Praze	CZ	24
Fyzikální ústav AV ČR, v.v.i.	CZ	21
Výzkumný a zkušební letecký ústav, a.s.	CZ	16
Centrum dopravního výzkumu, v.v.i.	CZ	15

Source: E-CORDA

New Framework Programme HORIZON 2020

The European Parliament and Council of Ministers approved in early July 2013 a budget for the upcoming EU Framework Programme for Research and Innovations – Horizon 2020 (H2020), which will commence in January 2014. Horizon 2020 is planned to be the largest and most important programme financing European science, research and innovations in 2014 through 2020, with the budget exceeding EUR 70 bn. H2020 follows up the preceding Framework Programmes for Research and Innovations (in particular FP7) announced by the EU.

Contrary to FP7 the H2020 programme will include many new elements, which should facilitate prompt and efficient addressing of current issues, provide for long-term sustainable development and ensure competitiveness of Europe. Innovations will receive more support, which will be reflected in practice, for example, in the form of new credit instruments and support to innovation in SMEs. The H2020 programme also integrates the previous Framework Programme for Competitiveness and Innovation (CIP) and the European Technological and Innovation Institute (EIT). Interconnections with Structural Funds and other EU programmes will be supported. Unlike FP7, the so-called bottom-up approach will be supported more in formulation of research subjects, young scientists will receive more opportunities, research and innovation will be more interconnected with market principles and creation of business opportunities and jobs will be stressed.

The structure of H2020 consists of three main, mutually reinforcing priorities - excellent science, leading industries and social challenges. Although the proposed structure of H2020 is slightly different than that of the FP7, the main areas of research activities remain the same in H2020. The table E.3 serves for quick orientation in the thematic priorities of both FPs; the Table also indicates the percentages of financial support allocated to H2030 priorities.

H2020 is not a homogenous programme; added to its basic structure should be numerous tools and programmes, which are quite autonomous as regards H2020 and which announce their own calls for project proposals. Such tools include, for example, ERA-NET, Joint Technology Initiatives (JTI) or Joint Programming Initiatives (JPI). The simplified rules for participation and the more user-friendly structure of H2020 can be expected to increase participation in the programme's future projects in the Czech Republic.

Table E.2: Topical overlap of Horizon 2020 and FP7, H2020 budget

Horizon 2020		FP7	H2020 budget [%]
I. **Excellent Science**	European Research Council (ERC)	SP Ideas	17.00
	Future and Emerging Technologies (FET)	SP Cooperation (ICT, NMP)	3.50
	Marie Sklodowska Curie Actions (MSCA)	SP People	8.00
	European Research Infrastructures (including e-infrastructures)	SP Capacity (INFRA)	3.23
II. **Leading Industries**	Industrial and breakthrough technologies (ICT, NMP, advanced materials, biotechnology, advanced manufacturing and processing, space applications	SP Cooperation (ICT, NMP, KBBE, ...)	17.6
	Access to risk finance of research and innovation	x	3.69
	Innovation in SMEs	SP Capacity (SME)	0.80
III. Social Challenges	Health, demographic change and wellbeing	SP Cooperation (HEALTH)	9.70
	Food security, sustainable agriculture, maritime research and bio-economy	SP Cooperation (KBBE)	5.00
	Secure, clean and efficient energy	SP Cooperation (ENERGY, SEC)	7.70
	Smart, green and integrated transport	SP Cooperation (TPT)	8.23
	Climate action, resource efficiency and raw materials efficiency	SP Cooperation (ENV)	4.00
	Europe in the changing world - Inclusive, innovative and reflexive societies	SP Cooperation (SSH, SEC)	1.70
	Protection of freedom and security in Europe	SP Cooperation (SEC)	2.20
Other activities	European Institute of Innovation and Technology	x	3.52
	Non-nuclear direct actions of the Joint Research Centre	JRC	2.47
	Disseminating excellence and expanding participation	x	1.06
	Science with and for society	x	0.60

Note: The current available sources were used to prepare the table; although the structure and contents of H2020 programme can be expected to remain basically unchanged, those data are informative only. The updated information on the preparation of the H2020 programme are posted at – http://fp7.cz/cs/horizon-2020

Source: Technologic centre of ASCR with the use of EC documents

E.2 Support to International Cooperation

The Czech Republic supports international cooperation in R&D through various mechanisms, be it programme schemes or various forms of partnership agreements. Selected international organisations are also supported by the Ministry of Foreign Affairs (CERN organization – CZK 223.4 million, the Joint Institute for Nuclear Research in Dubna - CZK 71.7 million ~ year-on-year +36%)[52]. However, the major part of funding from the state budget is allocated through the MoEYS chapter. In 2012 MoEYS allocated a total of CZK 680.9 million for institutional support to international cooperation in R&D (fees for the Czech Republic's participation in programmes and for membership in organisations, in addition to the operational programmes), which is a 14% year-on-year increase and 92% fulfilment[53].

Specific support is distributed through programmes COST CZ, EUPRO II, EUREKA CZ, INGO II and KONTAKT II[54]. The list of activities is supplemented with the GESHER/MOST programme, EEA/Norway financial mechanisms and other. The DELTA programme will be included in early 2014; the DELTA programme is announced by Technology Agency of the Czech Republic. Thirty-three projects of large infrastructures for R&D&I, which were approved to date, also form a prerequisite for the development of international cooperation; their current annual budget is CZK 799.6 million[55]. These projects play an integration role and are directly connected with the strategic infrastructure network included in the ESFRI Roadmap. Two other projects of large infrastructures were recommended by RDIC for funding in June 2013.

The setting of the programmes is similar in many regards – their term is limited to a maximum of four years (three for INGO); all expect measurable and assessable results in the form of publications, applied outputs, patents, research reports etc. The projects are assessed according to their goals, international cooperation rate, necessity and practical use of their results. The support can be as high as 100% of certified costs; in case of applied research this amount is limited to 50%.

Four national programmes to support international cooperation were assessed in the first half of 2013[56], including a survey among beneficiaries. The main outputs are indicated in the tables below for the programmes. The drawing of support and thematic focuses are summarised in the charts in the end of this section.

The COST (CZ) programme is aimed at the support of multilateral cooperation in fundamental research between entities in the Czech Republic and COST member countries. Each member state choses its own form of support for its institutions. The programme is implemented through so-called Actions, to which R&D institutions access with their own projects. Czech institutions achieved good results in 2012 in numerous domains, be it the evaluation of image quality in digital TV broadcasting, detection of changes in DNA in patients with haematology diseases, or research of surface plasmons and photonic platforms for optical biosensors.

Table E.3: The main outputs of the evaluation of the COST programme

Period of evaluation	1993–2012	Number of projects	716
Certified costs	CZK 2,075.5 mil.	State support	CZK 1,021.7 mil. (49%)
Beneficiaries	ASCR, public universities		
Results	Articles in technical magazines and articles in event proceedings		
Research type	Both basic and applied research represented evenly; outputs for the application sphere are relatively scarce		
Use of results	Further research in the beneficiary's institution; use during university instruction		
Benefits	Establishing contacts to develop international cooperation and acquiring new foreign grants; using research capacities of foreign partners		
Conclusion of evaluation	The numbers of supported projects and amounts of support allocated to individual sectors were quite uneven. There were relatively few outputs typical for the application sphere. Most (75%) completed projects were evaluated as projects with excellent results. The necessity to annually defend the projects is perceived in a very negative way.		

Source: Čadil, Vondrák (2013): Evaluation of the COST programme. Technology Centre ASCR.

[52] The closing statement of the MFA chapter for 2012 2012 [http://www.mzv.cz/jnp/cz/o_ministerstvu/majetek_a_rozpocet]
[53] The closing statement of the MoEYS chapter for 2012 (http://www.msmt.cz/vzdelavani/skolstvi-v-cr/ekonomika-skolstvi/szu)
[54] 2012 is the final year of implementation of the projects supported under the previous programmes COST, EUPRO, EUREKA, INGO and KONTAKT. The current programmes marked with CZ or II follow up those programmes. The statistics of drawing show summary data.
[55] The budget of the MoEYS chapter for 2013 (http://www.msmt.cz/vzdelavani/skolstvi-v-cr/ekonomika-skolstvi/rozpocet-kapitoly-msmt)
[56] Čadil, Vondrák (2013): Evaluation of the COST, EUREKA, INGO, KONTAKT programmes. Technology Centre ASCR.

The EUPRO (II) programme creates the infrastructure needed for coordination of European research and mediates the information necessary for the successful participation of Czech R&D activities in ERA. In 2012 this goal was fulfilled in particular by the National Information Centre for European Research III (NICER) and by regional and departmental contact organizations. The Czech Liaison Office in Brussels CZELO is an important project. Mobility of researchers is facilitated by a network of consultation offices – EURAXESS.

Table E.4: The main outputs of the evaluation of the EUPRO programme

Period of evaluation	2003–2012	Number of projects	70
Certified costs	CZK 898.4 mil.	State support	CZK 704,4 mi. (82%)
Beneficiaries	Other legal entities and natural persons; to a lesser extent, universities and ASCR		
Results	Organisation of workshops and conferences, articles in technical periodicals, other		
Research type	Infrastructure for R&D&I, applied research		
Use of results	Information events, further research in the beneficiary's institution		
Benefits	Integration of the Czech R&D&I in European structures, involvement in international research projects, behavioural additionality		
Conclusion of evaluation	Satisfaction of the high demand for information, facilitated participation in international projects; however, the relatively low success rate of Czech teams in framework programmes still persist		

Source: Čadil, Vondrák (2013): Final Evaluation of the EUPRO programme of international cooperation in R&D&I. Technology Centre ASCR.

The EUREKA (CZ) programme is an instrument for intergovernmental cooperation in the area of applied research and innovation activities; the programme involves industrial companies, research institutes and universities across the technological sectors. A Brno-based company and a Prague-based firm were awarded in 2012 for the use of nanotechnologically processed particles of silver in medicinal products and for an integrated detector of radionuclides, respectively. EUREKA member countries are also involved in the Community programme EUROSTARS. EUROSTARS focuses on cooperation of SMEs, which carry out their own R&D in addition to their business operations – Czech enterprises used CZK 64.3 million under EUROSTARS in 2012; by a half more rather than in the preceding year.

Table E.5: The main outputs of the evaluation of the EUREKA programme

Period of evaluation	1993–2012	Number of projects	257
Certified costs	CZK 2,678.5 mil.	State support	CZK 1,152.8 mil. (43%)
Beneficiaries	Private enterprises		
Results	Articles in event proceedings and technical magazine, technically implemented results		
Research type	Applied research, relatively few outputs of the intellectual property rights		
Use of results	Further research in the beneficiary's institution and innovation of own products and services		
Benefits	Acquiring knowledge for innovation of own products and services and acquiring information on new markets		
Conclusion of evaluation	The programme supported the applied research and development in technical sectors. Because of the large span of financial sizes of projects, it is questionable whether the single metrics and rules for evaluation, selection and implementation of projects make sense. Benefits include in particular innovation of own products and contacts for the development of international cooperation.		

Source: Čadil, Vondrák (2013): Evaluation of the EUREKA programme. Technology Centre ASCR.

The aim of the INGO (II) programme is to enable participation of Czech research sites in international non-governmental research organisations and promote participation of Czech scientists in managing bodies of those institutions. Without a programme of this type it would be impossible, for example, to participate in the CERN or Laue-Langevin Institute (Grenoble) research projects. The projects in the field of nuclear and neutron research or nanotechnology are the most prestigious in their evaluation.

Table E.6: The main outputs of the evaluation of the INGO programme

Period of evaluation	1998–2012	Number of projects	357
Certified costs	CZK 1,648.2 mil.	State support	CZK 1,346.3 mil. (82%)
Beneficiaries	ASCR, public universities, enterprises		
Results	Articles in technical magazines and articles in event proceedings		
Research type	Basic research (70% of the state support); very low numbers of applied results		
Use of results	Further research in the beneficiary's institution or in other Czech research institutions		

Benefits	Establishing contacts to develop cooperation and strategic focusing of international research organisation
Conclusion of evaluation	The programme supported non-comparable projects (participation in important research infrastructures vs. non-important scientific societies). The numbers of supported projects and amounts of the state support allocated to individual sectors were quite uneven, with increasing representation of basic research.

Source: Čadil, Vondrák (2013): Evaluation of the INGO programme. Technology Centre ASCR.

The KONTAKT (II) programme supports international cooperation of R&D institutions in the countries with which the Czech Republic signed scientific-technical cooperation agreements. While in the previous years the programme focused primarily on cooperation with EU member states, now it focuses on the USA, China, Russia, Japan and South Korea. Its first stage received excellent evaluation, e.g. the projects dealing with the analysis of molecular events in the assembly of retrovirus particles (Institute of Chemical Technology Prague), express diagnostic tests for atypical TBC forms (MediGEN) or the atomic-level characterisation using the atomic force microscope (Institute of Physics ASCR).

Table E.7: The main outputs of the evaluation of the KONTAKT programme

Period of evaluation	2006–2012	Number of projects	1,461
Certified costs	CZK 2,317.9 mil.	State support	CZK 1,456.1 mil. (63%)
Beneficiaries	Public universities, ASCR		
Results	Articles in technical magazines and articles in event proceedings		
Research type	The ratio of basic research was increasing during the programme implementation to become dominant in the end.		
Use of results	Further research in the beneficiary's institution		
Benefits	Establishing contacts to develop cooperation, foreign experts hosting in the Czech Republic, disclosure of information		
Conclusion of evaluation	The programme was defined in a very broad way, determining only general objectives without priority sectors. The numbers of projects and amounts of the support allocated to individual sectors were quite uneven. One fourth of projects completed by 2010 did not achieve any of the results as listed in the R&D&I IS. The project contribution in the development of human resources is significant, even though this was not the purpose of the programme.		

Source: Čadil, Vondrák (2013): Evaluation of the KONTAKT programme. Technology Centre ASCR.

Varying goals of individual programmes become apparent in the prevalent topical focus of supported projects (Table E.7). A clear situation is in the programme EUREKA (CZ), which focuses on the support of applied R&D, and industrial applications dominate among branches. The EUPRO (II) programme is exceptional; it shows high participation of social sciences. The Czech Republic has traditionally high attractiveness for foreign partners in the fields of physics, chemistry, biosciences or technical sciences.

Table E.8: Topical focus of project within international cooperation (2007–2013)

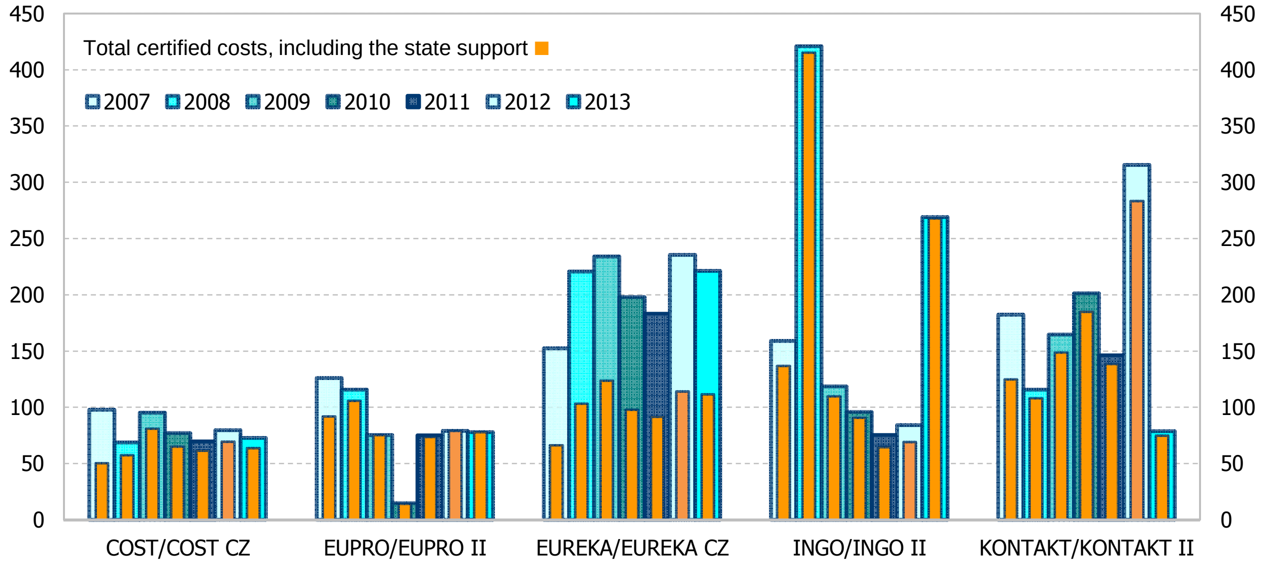
Group of sciences	COST/COST CZ	EUPRO/EUPRO II	EUREKA/EUREKA CZ	INGO/INGO II	KONTAKT/KONTAKT II
Social sciences, humanities and arts	3	0	0	0	20
Social sciences I	1	40	2	11	15
Social sciences II	19	3	4	9	14
Technical sciences and informatics	71	9	83	65	183
Agriculture	40	0	3	16	67
Earth sciences	33	0	7	15	65
Mathematics	0	0	1	3	46
Physics	55	1	5	46	149
Chemistry	53	0	4	33	143
Biology	66	2	6	16	178
Medicine	18	0	3	2	44
Total	359	55	118	216	924

Note: The sciences are classified according to the currently applicable Methodology; projects are shown by the first year of implementation; numbers of projects are shown.
Source: R&D&I IS

The programmes are announced annually in the form of public competitions; funding always starts in the subsequent year (the amounts of financial support are shown in Chart E.9). The volume of support in programmes differs in years. Except for the EUREKA (CZ) programme, which involves applied research, the total certified costs are practically identical with the amount of support – beneficiaries start their projects with minimum own funds. The programmes also differ in absolute numbers of supported projects, which is in general inversely proportional to the size of project (Chart E.10) – fewer larger projects are typical for EUPRO (II) or EUREKA (CZ) in contrast to the KONTAKT (II) programme.

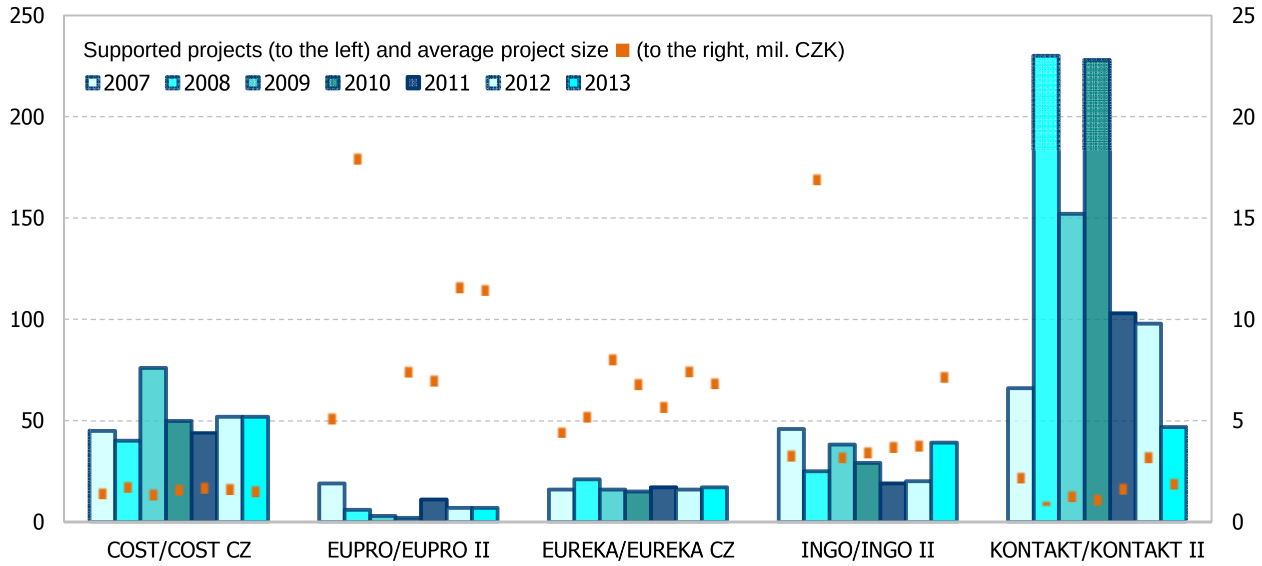
The current programmes are planned to be completed in 2017 – the draft budget expects a mild increase of allocations. Commencing from 2016, allocations to the original programmes should partially overlap the newly announced third wave of initiatives to support international cooperation[57].

Chart E.9: Volumes of supported projects in the programmes of international cooperation (2007–2013; mil. CZK)



Note: The total project allocation is included in the first year of project implementation.
Source: R&D&I IS

Chart E.10: Comparison of the number of received proposals and supported projects (2007–2013)



Source: R&D&I IS

57 The draft expenditures from the Czech Republic's state budget on experimental development and innovation in 2014 with perspective to years 2015 and 2016

F Using Structural Funds for R&D&I

The ratio of expenditures on R&D&I coming from foreign source in the Czech Republic keeps growing in the long term, in line with the trend of deepening integration of the European Research Area (ERA) and expanding globalisation of knowledge-based economic activities. The EU structural funds (SF) provide an important opportunity to improve the R&D infrastructure background, modernise the educational system, develop human resources in R&D and support innovation activities in the business sector.

Main trends

- The ratio of expenditures on R&D from foreign sources in the Czech Republic keeps growing in the long term (currently 25.9% ~ CZK 18.89 bn.) – the trend escalation is evident from 2011 (60% average year-on-year change).
- The increasing volume of foreign finance in R&D is accompanied with the increasing number of research sites using those funds – though the business sector reported a mild decrease in 2012.
- The volume of expenditures on R&D covered from public foreign sources was almost CZK 11.6 bn. in 2011; EU sources were clearly dominant (99%).
- EU structural funds, more exactly, the selected areas of support under five operational programmes directly connected with R&D&I, supported by June 2013 2,874 projects with CZK 103.9 bn. – beneficiaries received to date CZK 47.3 bn.
- The highest shares of support were given to the OP Research and Development for Innovation (CZK 55.8 bn., primarily for the infrastructure for R&D) and the OP Enterprise and Innovation (CZK 33.9 bn., in particular for innovation and cooperation in the application sphere).

Financial indicators in section F.1 describe the total volume of funding invested by foreign entities in Czech R&D, as well as the way of its distribution. In addition to those indicators, CSO and Eurostat data also show the Czech Republic's position compared to the other EU member states. Extensive data on the drawing from structural funds in 2007-2013, which come from the monitoring systems of managing authorities, are analysed in section F.2. The volume of funding for R&D&I activities, which is distributed through operational programmes (OP), includes a considerable part of foreign sources; that is why this newly included discussion chapter deals mainly with implementation of the cohesion policy in the Czech Republic. The final section describes in more details the topic of research infrastructures – probably the most visible output of the current R&D&I support from SFs.

F.1 Financing Research and Development from Foreign Sources

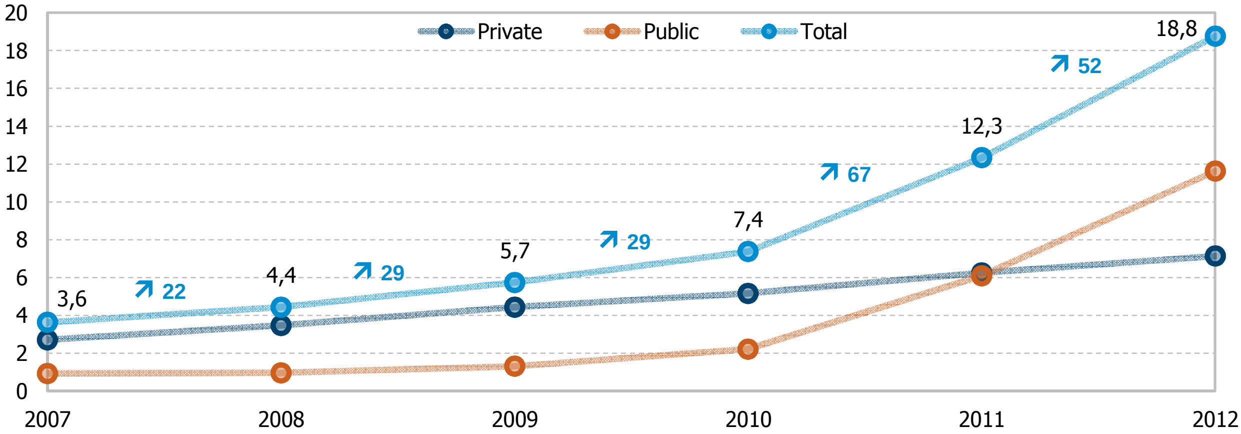
The category of foreign sources consists of private funding coming mainly from enterprises based outside the Czech Republic and from public sources flowing to the country mainly from EU funds, from international organisations and governments of other countries. The ratio of expenditures on R&D from foreign sources in the Czech Republic keeps growing in the long term; the trend escalation is evident in particular from 2011 (Chart F.1). The average year-on-year change of total expenditures from foreign sources in the subsequent two years achieved 60%, in particular due to the unprecedented growth of the volume of public funds (from CZK 2.2 up to 11.6 bn.) associated with the progress in SF drawing for R&D&I. The inflow of private funds, which had driven the growth until 2009, did not considerably decrease in spite of persisting economic recession, and the shares of private and public foreign sources in R&D practically levelled in 2011[58]. In summary, foreign sources account for 26% of the total expenditures on R&D in the Czech Republic; the ratio is same also when private sources only are taken into account; as regards public sources, however, the ratio of foreign ones is 44%.

The increasing volume of foreign funds in R&D is accompanied with the increasing numbers of research sites using the funds – the numbers of research sites featuring the required quality or experience to get foreign

[58] The described development differs from the trend presented in the preceding Analysis because of revisions and corrections of source data.

public sources keep increasing[59]. The highest relative growth is evident in private enterprises under foreign control; the number of national firms drawing public foreign funds is practically four times higher. The trend, however, stopped in 2012; more exactly, the public sector became stabilised and the business sector mildly decreased, which can be interpreted as certain saturation – not in terms of the volume of funding, but in terms of the number of research sites that can become partners for foreign capital.

Chart F.1: Expenditures on R&D from foreign sources (the Czech Republic; 2007–2012; bn. CZK)



Source: CSO 2013 – Annual Statistic Survey of Research and Development VTR 5-01

The volume of expenditures on R&D in the Czech Republic covered by foreign sources amounted in 2012 almost to CZK 11.6 bn.; the EU sources were clearly dominant (CZK 11.5 bn. – including the prefinancing from the state budget). In addition to the crucial growth of funding from SFs, funding from other sources increased as well, though in a slower pace (framework programmes, etc.). Because EU funds form majority of expenditures on R&D from public foreign sources, their sectorial, topical and geographical focusing practically copies the data in Table F.1. As regards the sector, the use of funds, not their origin is shown this time.

The main trends in the public foreign sources include the continuing dominance of the sector of higher education, the four-times higher volume of funding for medical sciences in the last monitored year, and the widening of gap between formerly dominant Prague and the Region of South Moravia – which received in 2012 as much as a double of the funding volume.

Private funds are allocated based on market principles. The pattern is quite different – the role of the business sector is unquestionable and still growing, while the sectors of higher education and government are practically invisible; its evidently better position is due to the results of one site only (Institute of Organic Chemistry and Biochemistry ASCR). Prague is still the target of almost a half of private foreign sources for R&D and it grows more significantly than the Region of South Moravia.

[59] *For foreign private sources, data on target entities are not available.*

Table F.1: Structure of Expenditures on R&D from Foreign Sources (Czech Republic; 2007–2012; bn. CZK)

		2007	2008	2009	2010	2011	2012
Public Foreign Sources							
Total		925	964	1 305	2 216	6 093	11 622
Sector	Business	170	232	441	877	1 306	1 979
	Government	324	319	397	422	1 072	2 118
	Higher education	406	391	425	881	3 636	7 443
Sciences	Natural	371	365	440	532	1 623	3 765
	Technical	313	403	549	1 114	3 351	5 047
	Medical	103	80	151	305	349	1 526
Region	Prague	538	553	698	823	1 485	2 113
	South Moravia	165	169	174	481	1 947	4 233
	Moravia-Silesia	30	22	47	119	1 092	1 151
Private Foreign Sources							
Total		2 707	3 467	4 431	5 160	6 242	7 136
Sector	Business	1 867	2 836	3 740	4 063	4 971	5 954
	Government	836	628	691	1 076	1 267	1 180
	Higher education	5	3	1	6	5	3
Sciences	Natural	920	791	996	1 454	1 928	1 913
	Technical	1 674	2 425	3 174	3 421	3 917	5 022
	Medical	91	251	260	282	323	170
Region	Prague	2 220	2 939	1 850	2 413	2 714	3 377
	South Moravia	145	177	1 518	1 454	1 786	1 905
	Moravia-Silesia	0	2	500	427	520	671

Note: The colour band shows the share of the respective sector/science/region in the total expenditures (the largest three items are shown).
Source: CSO - Annual Statistic Survey of Research and Development VTR 5-01

411 R&D sites received foreign public sources in 2012. The average sum received was CZK 28 million; if categories are narrowed, the sums differ considerably (businesses CZK 10 million vs. universities CZK 68 million; financial requirements of social sciences and humanities account for one third of those of other sciences). The volume of acquired funds increases with the size of sites, with the exception of small sites up to 5 employees – those sites receive in average a double sum as compared to the sites with 5-19 employees. The ASCR institutes use foreign sources primarily for research in natural sciences (75%); the distribution in higher education is more levelled – technical sciences prevail (45%). The differences are transferred to the regional level, too – in the government sector 65% of funding goes to Prague; in the sector of higher education it is 6% to the benefit of the Regions of South Moravia (45%) and Olomouc (16%). The business sector is clearly the most successful in the Region of Liberec (35%).

The growing volume of foreign private sources is driven mainly by investments in R&D in ICT (year-on-year +26%) and by a broad group of professional, scientific and technical activities.

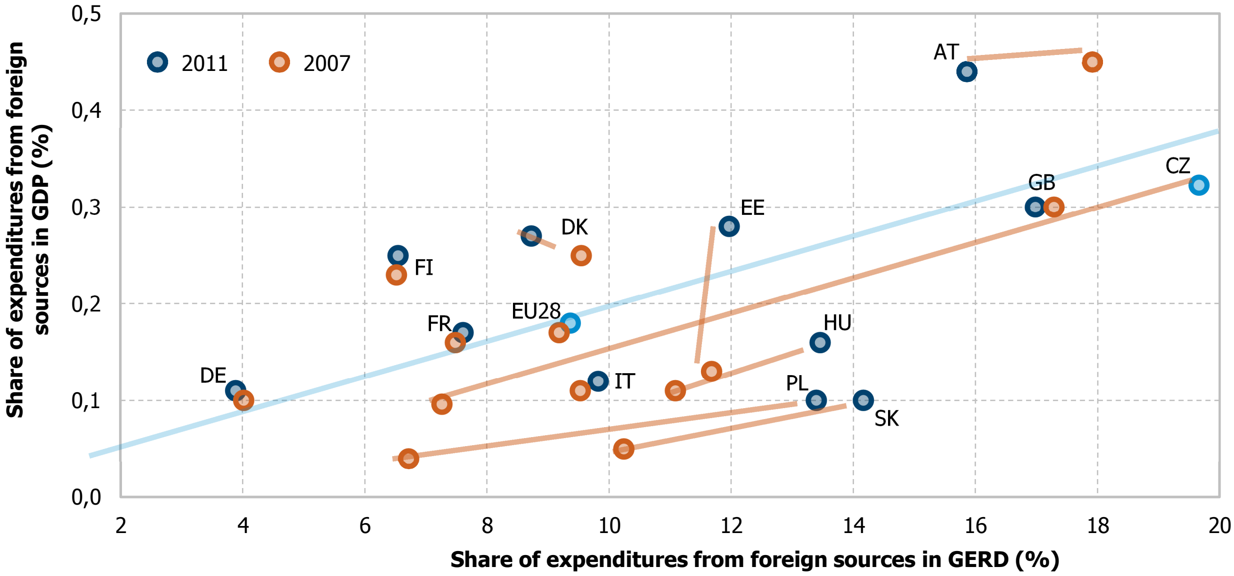
The ratio how national sources for R&D are supplemented with foreign sources differs across the states. The ratio of European states in foreign sources for R&D is much higher rather than that of Asian countries where R&D is financed only on a national basis. The size of national economy plays its role within the EU. Large economies (Germany, France) have lower representation of foreign sources in their R&D (the share in GERD); those countries contribute more to the European re-allocation mechanism – in Chart F.2 they are to the left from the value of EU28. The United Kingdom is an exception in this respect.

The volume of foreign sources flowing to the Czech Republic increased five times between 2007 and 2011, which was almost a threefold increase of the share in (also growing) GERD – the Czech Republic was high above the EU28 average in this indicator, achieving the highest value of the countries for which data are available.

Foreign sources converted to GDP eliminate the effect of total expenditures on R&D. The Northern countries (Denmark, Finland), Austria or the United Kingdom are high above the EU average; all new member states, except for Estonia and Czech Republic, are below the EU28 value. Due to the significant growth of foreign sources in R&D and, on the other hand, stagnating GDP, the Czech Republic moved above the level of all countries, except for Austria.

It is the development trend between 2007 and 2011, which gives the Chart its third dimension. The Czech Republic experienced in that period a massive inflow of foreign sources in R&D and went through the most significant change of all depicted countries. The share of foreign sources in GDP grows slightly faster rather than their share in GERD – while GDP stagnates, GERD increases even in the time of economic recession (which is due to foreign public sources).

Chart F.2: Shares of Expenditures on R&D from Foreign Sources in GDP and GERD (EU countries; 2007–2011)



Note: The Chart shows only selected EU countries with available data for 2011.
Source: Eurostat; CSO - Annual Statistic Survey of Research and Development VTR 5-01

F.2 Supporting R&D&I from Structural Funds

Institutional Context

The EU implements the objectives of its regional and structural policies in seven-year cycles, for which member countries always prepare new programme documents. After its accession (May 2004) the Czech Republic joined the shortened programming period 2004 - 2006[60]; the current programmes are defined for years 2007 and 2013. Funds can be drawn for the projects in progress for a longer time, using the N+2[61] rule, until the end of 2015.

The objectives of EU regional and structural policies are financed through structural funds (SF) – investment projects from the European Regional Development Fund (ERDF), social programmes or human resources development from the European Social Fund (ESF). CZK 26.7 billion (i.e. almost CZK 800 bn.) was allocated within SFs for the Czech Republic in the current programming period. A part of the allocation still remain in the operational programmes (OP), and OP managing authorities plan to distribute it (in June 2013 it was 14.5% of the total allocation).

The National Strategic Reference Framework (NSRF) is the fundamental Czech programming document to use the funds, determining the system of OPs. The focuses of OPs are specified by the structure of priority axes, areas of intervention and partial programmes or activities – Chart F.3. In addition to the factual definition of borders, those programmes differ mainly in the sources of support (the OP Education for Competitiveness – ESF, and the OP Research and Development for Innovation, the OP Enterprise and Innovation – ERDF) or in the rules for the state aid stipulated by the European Commission (the OP Research and Development for Innovation focuses on the academic sphere, the OP Enterprise and Innovation follows up with support to R&D&I processes in enterprises).

Different state aid regimens also play a role in the definition of OPs. Support through the OP Research and Development for Innovation will make it possible to increase the capacity of R&D and tertiary education through investments in infrastructure. Those are interconnected with soft interventions under the OP Education for Competitiveness and with support to the follow-up stages of the OPEI innovation process. Two OPs, which are limited to Prague and funded within the objective Competitiveness and Employment, having a generally lower rate of support, stand aside.

Chart F.3: Operational Programmes Supporting R&D&I and Their Structure (2007–2013)

					Structural funds
OP RDI	OPEC	OPEI	OPPC	OPPA	Operational programme
PA1 - PA4	PA2	PA4 - PA5	PA3	PA1	Priority axis
European centres of excellence	Human sources in R&D	Innovation	Development of innovative environment	Development of human sources in R&D	Area of intervention / objective / theme
Regional R&D centres	Partnership and networking	Potential			
Commercialisation		Prosperity			
Popularisation		Cooperation			
Infrastructure in higher education					
MoEYS	MoEYS	MIT	Prague	Prague	Managing authority

Source: Own work

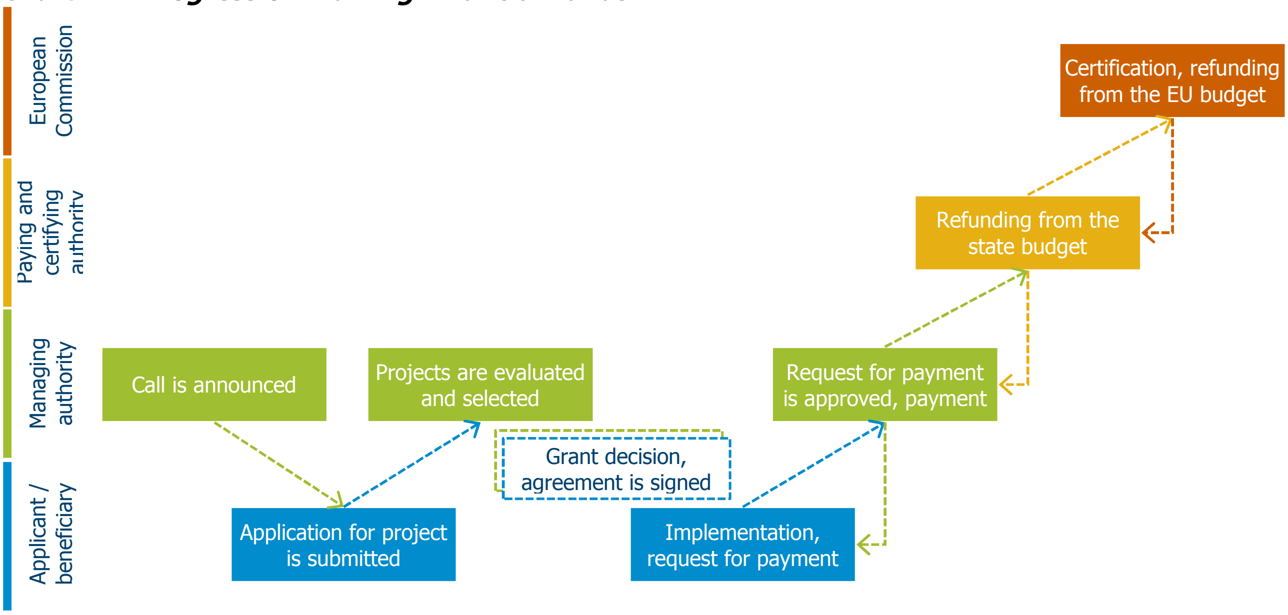
The main stages of the project cycle commence with the call for project proposals. Every submitted grant application is subject to approval process, during which it is checked and evaluated in terms of compliance

[60] R&D&I were not explicitly supported in the Czech Republic in the preceding programming period.
[61] According to the n+2 rule the allocated support for the n-th year should be used in the subsequent two years.

with the condition of the call and other predefined criteria. After the project application passes the entire approval process, a grant decision is issued and a contract between the grantor and beneficiary is signed. After the decision is issued, the stage of factual and financial implementation of the project begins. The beneficiary submits on a regular basis applications for payment. After the factual and financial implementation of the project is completed and the expenditures are certified, the sustainability period follows up.

All SF finances are integrated in the state budget and beneficiaries are prefinanced their grants. The paying and certifying authority (National Fund of the Ministry of Finance) then claims the funds from the European Commission. This system provides for accelerated flow of funding to beneficiaries – the whole process is depicted in Chart F.4.

Chart F.4: Progress of Drawing Financial Funds



Source: Adapted according to the Ministry for Regional Development 2013

Summary Evaluation of SF Drawing for R&D&I

The presented data summarises the development of drawing from five OPs or selected OP priority axes (see Chart F.3) related directly to R&D&I. The data cover the period of time from June 2008 (the first grant decision issued) to June 2013. Managing authorities of the programmes were used as the main sources of information. The data uploaded by beneficiaries to the R&D&I IS can be used in a limited way only – those data do not cover all OPs or supported projects (in particular, data from the business sector are missing). The sources data to the charts and large tables are attached in separate files. The total support indicates the volume of funding from the SF or state budget[62] (in addition to the solver's own sources) for the projects with issued decisions. The places of project implementation are described on the level of regions; the grant beneficiary's address is to be used to localise the project more specifically. However, the address can differ (this is mainly the case of Prague-based entities).

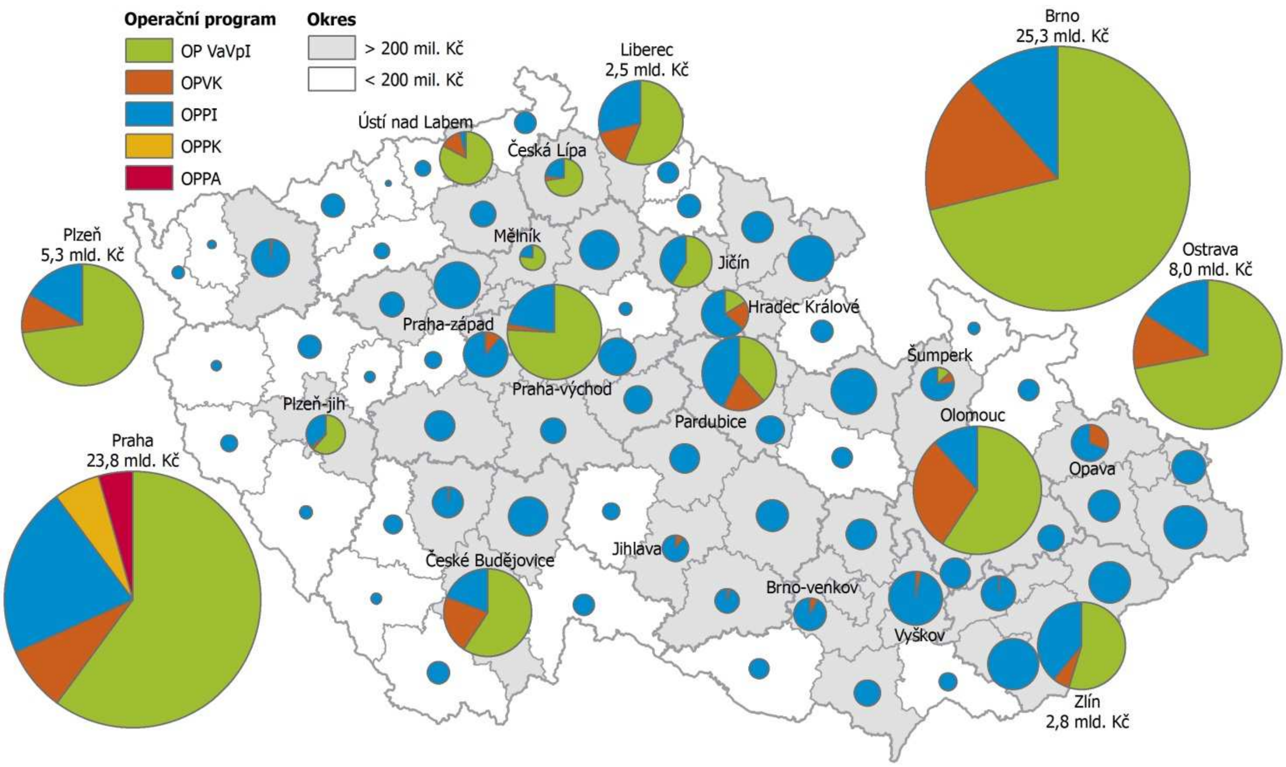
The geographical differentiation of the flow of funding by the beneficiary's seat (Chart F.5 – on the level of regions in this case) confirms the crucial role of major cities in the knowledge-based activities. In particular, the funding for R&D outside businesses (OPRDI, OPEC) flows practically only to the cities or their close backgrounds where detached research organisations are located. The trend corresponds to the existing distribution of research capacities, except for Brno that has been strengthening considerably its position. The districts outside major cities receive mainly the funding under the OPEI, i.e. to the business sector and to so-called downstream activities (the closing stages of the innovation process relating the market use). The entities based in Morava are more active in drawing; districts receiving grants lower than CZK 200 million are concentrated mainly along the western and northern borders of Bohemia.

[62] In some cases (support to research) the support from the SF is increased by the state budget funding (see the OPRDI).

The money paid to the beneficiaries (from the state budget – see OPs for information on the funds certified by the European Commission) amounts to about 46% of the support. The refunding rate differs considerably in the districts; however, there is no visible pattern – only a relatively low rate of refunding can be seen in the districts where the OPEI is represented more. As regards cities, Prague lags behind with a third of refunded support, while other cities are just above a half (Chart F.6).

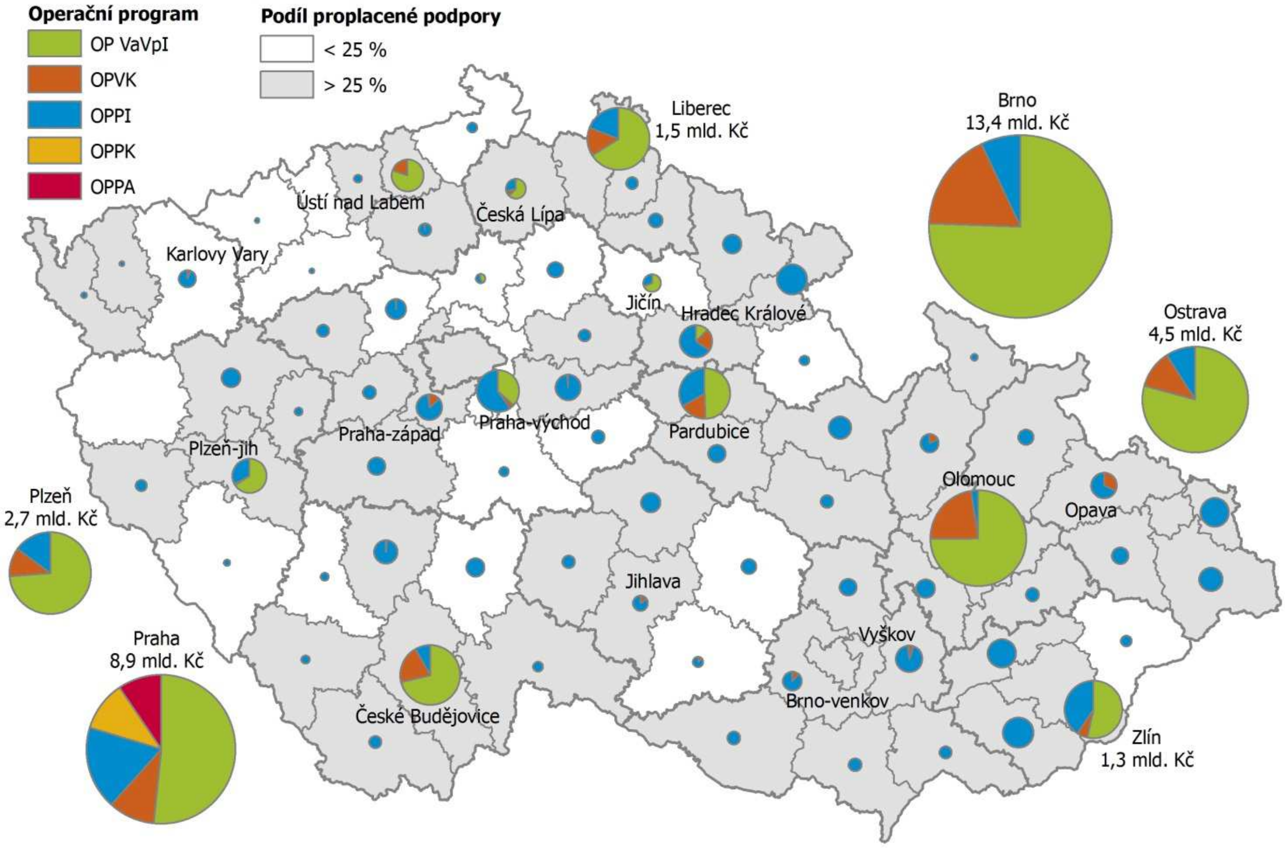
The actual place of project implementation (Chart F.7 – on the level of regions) confirms the leading role of Brno / Region of South Moravia. However, this fact also indicates that considerable part of support with beneficiaries seated in the capital city is actually directed to the Prague background in the Region of Central Bohemia. This is the case in particular of the R&D centres built under the first two priority axes of the OPRDI and, to a limited extent, also of the grants to the business sector (however, the Prague-based businesses implement their projects all over the Czech Republic – typically large science-technology parks). Prague is an exclusive place for implementation of OPPC and OPPA projects; the total volume of funding for Prague (almost CZK 3 billion of 103 billion) is in a sharp contrast with the fact that Prague concentrates almost a half of the Czech research capacities.

Chart F.5: Amount of Support by the OP and Beneficiary's Seat (Czech districts; 2008–2013)



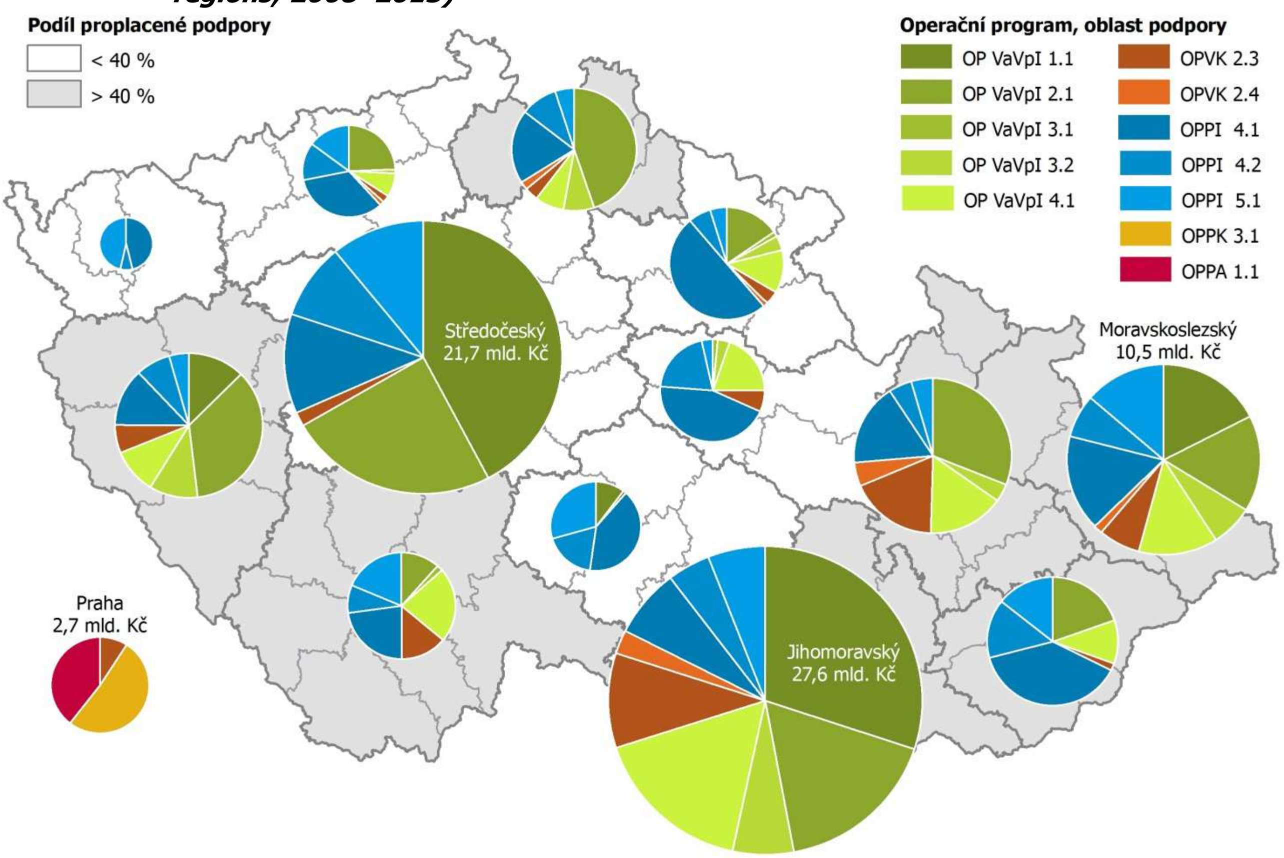
Source: Respective managing authorities; own work

Chart F.6: Refunded by the OP and Beneficiary's Seat (Czech districts; 2008–2013)



Source: Respective managing authorities; own work

Chart F.7: Amount of Support by the Area of Support and Place of Implementation (Czech regions; 2008–2013)



Note: The OPEI projects with more regions of implementation are not included (included separately in the attached table).

Source: Respective managing authorities; own work

In addition to geography of support, the structure of beneficiaries is also important, either in terms of headcount or age or legal form of the entity. Small enterprises / institutions with less than 50 employees are very seldom among beneficiaries in the OPRDI, OPEC and OPPC; on the contrary, those beneficiaries have a significant share in the OPEI and OPPA (Tab. F.2). This can be explained in general by higher frequency of R&D activities in larger entities, but mainly by the rules determining eligible applicants for respective priority axes.

The situation in the division of beneficiaries by year of their origin is similar. The area of intervention 3.2 OPRDI is exceptional; its beneficiaries include transformed research organisations or special-purpose entities operating the so-called science learning and visitors centres (financially large projects). This is also the case of clusters, technology platforms and science-technology parks in area of intervention 5.1 OPEI.

A combination of two characteristics of the beneficiary – the legal form and institutional sector – reveals that approximately 28% of support (CZK 9.4 bn.) in the OPEI is directed to the entities under foreign control. Public administration units – municipalities, regions, public administration bodies, contribution organisations - are relatively significant beneficiaries across the OPs. Although area of intervention 3.1 OPPC deals with the development of innovative environment and partnership between the R&D base and practice, there are practically no businesses among beneficiaries.

Table F.2: Amount of Support by the Beneficiary's Headcount (2008–2013, mil. CZK)

	OPRDI					OPEC		OPPI			OPPC	OPPA	Total
	1.1	2.1	3.1	3.2	4.1	2.3	2.4	4.1	4.2	5.1	3.1	1.1	
Not stated	0	0	0	536	0	0	61	320	458	2 893	0	22	4 290
No employee	0	0	0	0	0	0	0	34	42	39	0	2	117
0-9	0	0	0	0	0	27	197	902	805	2 777	0	138	4 846
10-49	0	1 364	0	973	0	61	29	2 528	1 812	968	15	254	8 003
50-249	883	6 930	0	599	0	599	163	6 886	2 854	481	135	402	19 932
250-999	9 100	2 136	67	824	899	1 324	236	3 901	1 102	817	636	97	21 138
1000-4999	4 945	8 756	448	851	7 180	4 815	2 046	2 394	666	1 144	363	96	33 702
5000+	5 246	1 189	109	238	2 478	1 578	703	9	49	99	249	59	12 005
Total	20 175	20 374	625	4 021	10 558	8 403	3 435	16 938	7 744	9 178	1 396	1 070	103 918

Source: Respective managing authorities; own work

Table F.3: Amount of Support by the Type of Beneficiary (2008–2013, mil. CZK)

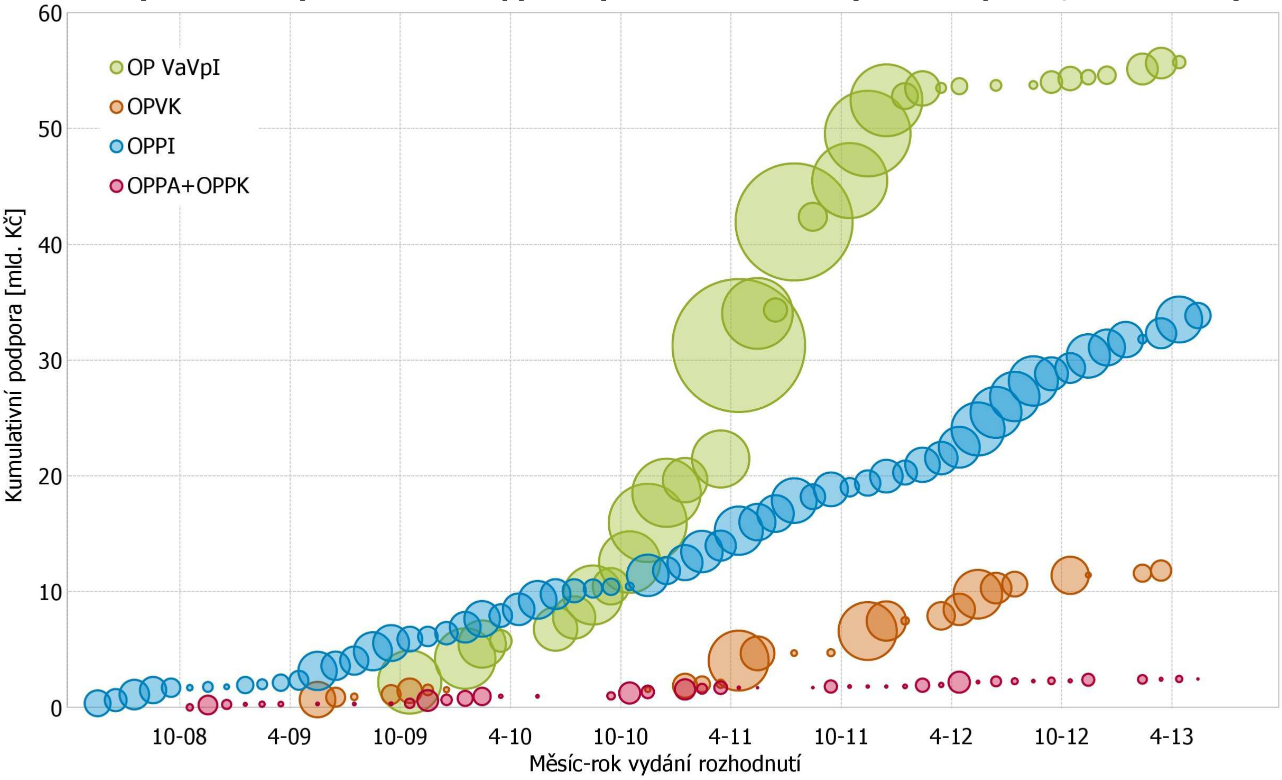
	Natural persons	Other forms			Ltd. / joint-stock			Public administration	HE	PRI	Total
		National	Foreign	Non-profit	Public	National	Foreign				
OPRDI	0	599	0	2 113	0	4 516	592	4 640	30 722	12 570	55 753
1.1	0	0	0	0	0	0	0	2 365	7 827	9 984	20 175
2.1	0	0	0	655	0	4 465	592	1 253	10 873	2 536	20 374
3.1	0	0	0	0	0	0	0	57	518	51	625
3.2	0	599	0	1 458	0	51	0	819	1 094	0	4 021
4.1	0	0	0	0	0	0	0	147	10 411	0	10 558
OPEC	0	37	0	280	0	193	8	290	9 527	1 503	11 839
2.3	0	13	0	28	0	130	8	243	6 629	1 352	8 403
2.4	0	24	0	252	0	62	0	47	2 898	152	3 435
OPEI	225	898	127	1 620	547	19 040	9 248	1 267	878	8	33 860
4.1	149	22	73	0	72	10 154	6 455	0	5	8	16 938
4.2	77	16	55	0	311	5 024	2 260	0	0	0	7 744
5.1	0	860	0	1 620	163	3 862	533	1 267	874	0	9 178
OPPC 3.1	0	0	0	54	0	36	0	416	286	603	1 396
OPPA 1.1	13	20	8	89	9	497	233	147	44	9	1 070
Total	239	1 555	135	4 156	556	24 283	10 082	6 761	41 458	14 694	103 918

Note: Public administration = municipalities, regions, state administration bodies, contribution organisations; HE = higher education; PRI = public research institutions

Source: Respective managing authorities; own work

Chart F.8, which shows a cumulative increase in the funds for OPs in every month (related to date of the decision), offers a dynamic view of drawing support for R&D&I from the SFs. The OPEI with its first projects supported as early as in June 2008 and a consistent growth, features the most balanced progress of drawing. The OPRDI began selecting projects for implementation one year later; however, large projects quickly fulfilled the allocation. From 2012 considerably smaller projects are approved. Drawing from the OPEC is very uneven (irregular) – only three minor projects were decided in 2010.

Chart F.8: (Cumulative) Amount of Support by Date of Decision (Czech Republic; 2008–2013)



Note: The bubble size corresponds to the volume of projects with grant decision in the respective month and year.
Source: Respective managing authorities; own work

OP Research and Development for Innovation (OPRDI)

The OPRDI strategic framework consists of two pillars and three transversal objectives. The first pillar supports a limited number of interdisciplinary research centres of top quality equipped with the unique research infrastructure. Centres of excellence emphasise concentration and internationalisation of R&D capacities. Support in the second pillar is directed to application-oriented and, frequently, sector-focused research institutions that have the potential to develop strong partnerships with the application sector and deepen technology specialisation of the region (regional centres). Both types of the centres are characterised by emphasis on their orientation on performance. The newly emerging capacities should be complementary to the existing R&D infrastructure and financially sustainable.

Three transversal objectives are interlinked with two strategy pillars. The leading transversal theme consists in the transfer of technologies and strengthening of capacities to protect and use R&D results. Popularisation of sciences and technologies in society is also of crucial importance. The third transversal theme responds to the need to increase the numbers of duly trained human resources, in particular researchers in natural sciences and technical branches. Both types of centres and projects from other OPs are fully financed from public funds (85% from the ERDF, 15% from the state budget).

Table F.4: Basic Characteristics of the OPRDI

Global objective / fund / allocation	Strengthen the R&D&I potential of the Czech Republic to contribute to the growth, competitiveness and creation of highly skilled jobs	ERDF	CZK 62.6 bn.
Priority axes / allocation	PA1 European centres of excellence PA2 Regional R&D centres PA3 R&D commercialisation and popularisation PA4 Infrastructure for instruction in higher education associated with research PA5 Technical assistance		CZK 20.8 bn. CZK 20.7 bn. CZK 6.5 bn. CZK 12.5 bn. CZK 2.2 bn.

Focus	Supporting the offer of R&D activities, in particular those of universities and research institutions, production of high-quality and relevant R&D results and graduates with specialisations corresponding to the labour market, strengthening the transfer of knowledge to the application sphere
Character of support	Investments in infrastructure, support to the high-quality R&D activities
Eligible regions	Czech Republic except for Prague
Managing authority	Ministry of Education, Youth and Sports [http://www.msmt.cz/strukturalni-fondy/op-vavpi]

Note: Highlighted = relevant
Source: OPRDI programme documentation [http://www.msmt.cz/strukturalni-fondy/dokumenty-op-vavpi]

Table F.5: Drawing under the OPRDI

Section	Total allocation [mil. CZK]	Submitted applications			Projects with issued decisions			Certified costs	
		Number	Volume [mil. CZK]	Volume [% of allocation]	Number	Volume [mil. CZK]	Volume [% of allocation]	Volume [mil. CZK]	Volume [% of allocation]
PA1	20 766,9	15	23 945,0	115,3	8	20 175,4	97,2	1 001,2	4,8
PA2	20 666,7	103	50 674,3	245,2	40	20 373,9	98,6	4 466,4	21,6
PA3	6 457,6	134	10 681,3	165,4	40	4 646,5	72,0	594,8	9,2
PA4	12 502,9	61	15 829,8	126,6	41	10 565,4	84,5	2 574,4	20,6
Total OP	62 581,6	329	102 618,3	164,0	143	57 033,8	91,1	8 905,7	14,2

Source: Monitoring report May 2013 - MRD 2013 [http://www.strukturalni-fondy.cz/cs/Informace-o-cerpani]

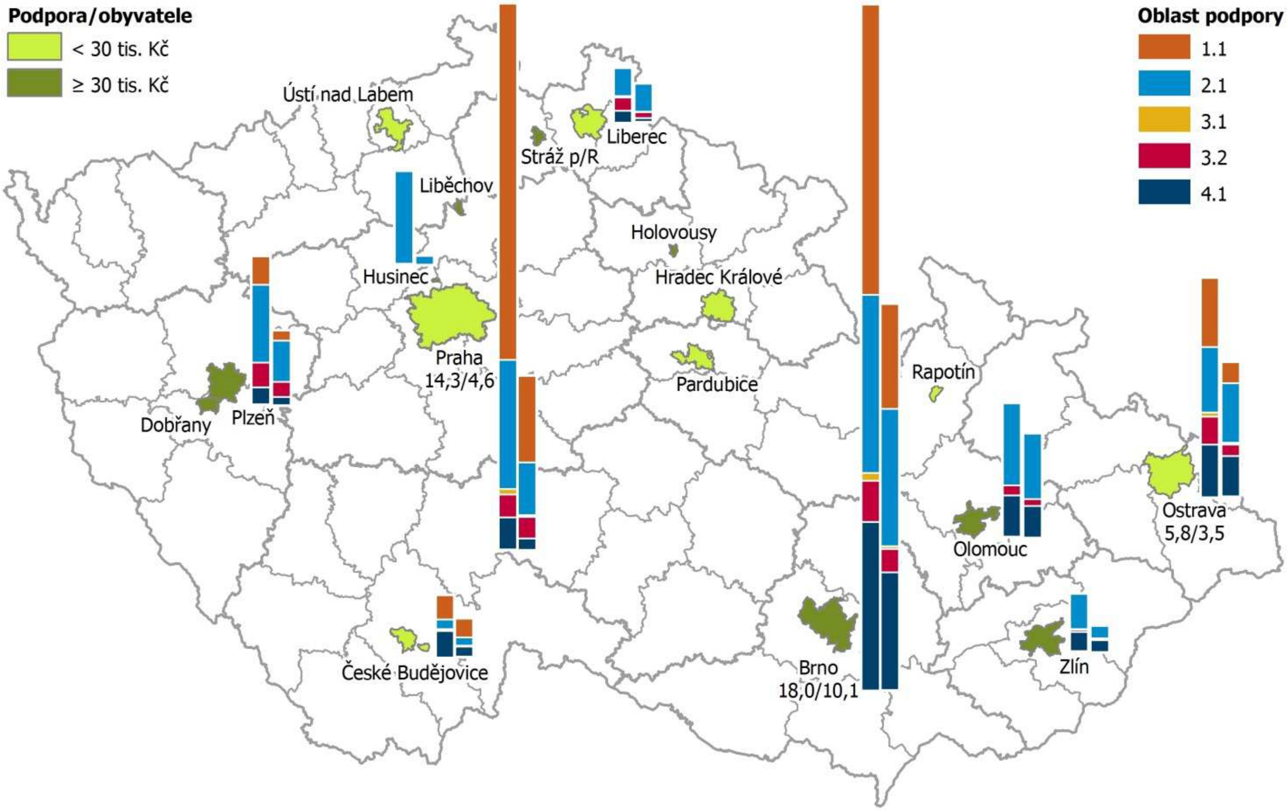
Low drawing of funds is due to the later approval of the OP and to the character of implementation – major projects over EUR 50 million with a specific approval process. Approving of submitted applications was considerably delayed in PA1. Infrastructure projects are under time pressure also because of complications during construction works (procurement, appeals against results of tender). As regards its financial progress, the BIOCEV project lags considerably behind; its fulfilment in the year end was only 7% of the approved budget (approx. 35% in the case of most major projects). Potential threat identified in PA2 consists in the deadlines of four projects, which are to be completed by 2015 (including the major project SUSEN). In terms of the funding covered by the decision, the project is satisfactory. The demand for investments in R&D infrastructure and higher education is quite high in Czech regions.

Assumed fulfilment of the indicator target values is realistic (commitments above the assumed targets), except for the numbers of researchers in PA1 (the commitments are 75% of the target value), as beneficiaries stated lower than expected numbers of researchers in their applications for projects because of the obligation to finance the jobs. They are fulfilled to date only to a minimum extent, because most projects began recently (in particular from 2012)[63]. Therefore, the stage of origin of the physical infrastructure should be differentiated from the origin of respective R&D teams and commencement of their activities, and the subsequent time delay in R&D research should be taken into account. Fulfilment of indicator values will have to be monitored on an individual basis by stage of projects, however, in a longer time interval[64].

The OPRDI finances extensive infrastructure projects implemented mostly by universities (practically only in PA4) and public research institutions. The general concentration of R&D activities and, naturally, of seats of key institutions results in a pattern where grants go to the beneficiaries based only in 17 Czech municipalities, Brno and Prague being the most important centres. The two cities differ not only in the ratios of paid support (1/3 for Prague, 2/3 for Brno), but also in their internal structures – there are almost no grants to infrastructure for instruction at universities in Prague, while CZK 4.4 bn. was allocated (and mostly paid) to this purpose in Brno. The difference from the first two priority axes is that R&D centres are built on the green field and can be "moved" outside the capital's borders. This is not possible in the development of the existing higher education infrastructure.

[63] MoEYS (2013): Interim evaluation of the OPRDI, version 1.2
[64] Topicality of monitoring indicators is low – the information is collected in the year end and subsequently entered in the system.

Chart F.9: (Paid) Support under the OPRDI by Beneficiary's Seat (Czech municipalities; 2008–2013, bn. CZK)



Note: Charts are given only for municipalities with high values – the amount of support to the left, the paid sum to the right. Support per head converted to inhabitants in productive age (14-65 years). The limit values are arbitrary.
Source: Respective managing authorities; own work

OP Education for Competitiveness (OPEC)

Based on definitions of key moments in education, the OPEC was divided into five priority areas – however, only PA2 Tertiary Education, Research and Development relates directly to R&D. PA2 includes four areas of intervention – in terms of R&D, crucial are areas of intervention 2.3 Human Resources in R&D and Development and 2.4 Partnership and Networking. The purpose of the former area of intervention is to increase attractiveness and improve conditions for R&D researchers, the latter area of intervention focuses on establishing partnership and cooperation in networks connecting educational and R&D institutions, public and private sectors to support efficient transfer of knowledge and its transformation into innovative solutions.

The OPEC features concentration similar to the OPRDI – in 26 municipalities in this case. The ever stronger position of Brno is supplemented with a strong position of Olomouc (practically on the level of Prague). Palacký University in Olomouc is also an entity that implements both the highest number of projects under the OPEC and, in summary, in all five programmes[65].

Table F.6: Basic Characteristics of the OPEC

Global objective / fund / allocation	Develop knowledge society to strengthen competitiveness of the Czech Republic through modernisation of educational systems and improvement of conditions in R&D	ESF	CZK 53.9 bn.
Priority axes / allocation	PA1 Initial education PA2 Tertiary education, research and development PA3 Further education PA4 System framework of lifelong learning PA5 Technical assistance		CZK 20.3 bn. CZK 20.5 bn. CZK 5.7 bn. CZK 5.3 bn. CZK 2.1 bn.
Focus	Support soft projects in the area of attractiveness and efficiency of tertiary education, develop human resources for R&D, strengthen partnership and form networks of cooperation		
Character of	Investments in human resources and development of cooperation		

[65] *The main beneficiaries of R&D&I support under SFs are listed in the attached tables.*

support	
Eligible regions	Czech Republic except for Prague
Managing authority	Ministry of Education, Youth and Sports [http://www.msmt.cz/strukturalni-fondy/op-vpk-obdobi-2007-2013]

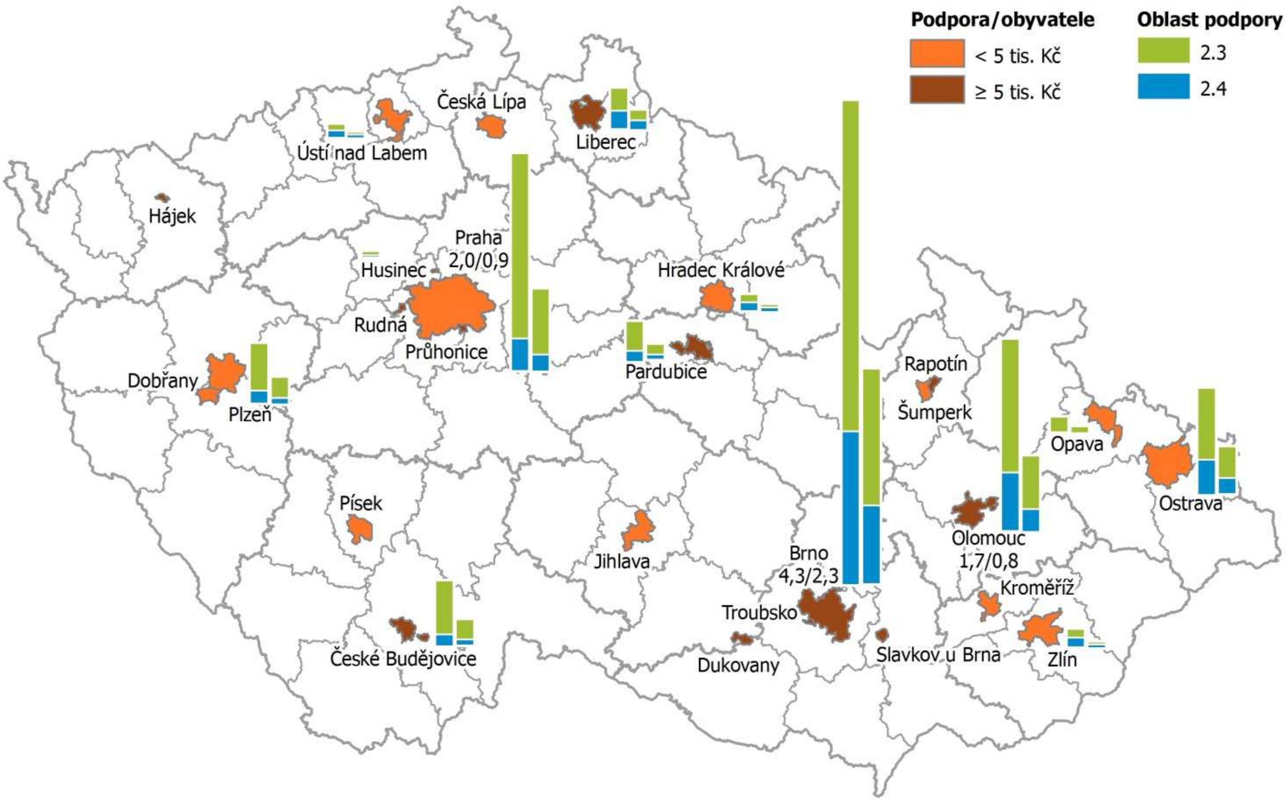
Note: Highlighted = relevant
Source: OPEC programme documentation [http://www.msmt.cz/strukturalni-fondy/zakladni-dokumenty-a-zpracovatele]

Table F.7: Drawing under the OPEC

Section	Total allocation [mil. CZK]	Submitted applications			Projects with issued decisions			Certified costs	
		Number	Volume [mil. CZK]	Volume [% of allocation]			Number	Volume [mil. CZK]	Volume [% of allocation]
PA2	20 539,7	2 685	53 344,0	259,7	1 042	19 563,2	95,2	2 793,2	13,6
PA2 - Area of intervention 2.3	8 418,3	670	16 731,2	198,7	315	8 403,3	99,8	756,8	9,0
PA2 - Area of intervention 2.4	3 742,3	538	14 184,0	379,0	176	3 435,2	91,8	479,9	12,8
Total OP	53 931,8	9 084	143 103,3	265,3	6 423	49 130,6	91,1	11 955,6	22,2

Source: Monitoring report May 2013 - MRD 2013 [http://www.strukturalni-fondy.cz/cs/Informace-o-cerpani]

Chart F.10: (Paid) Support under the OPEC by Beneficiary's Seat (Czech municipalities; 2008–2013, bn. CZK)



Note: Charts are given only for municipalities with high values – the amount of support to the left, the paid sum to the right. Support per head converted to inhabitants in productive age (14-65 years). The limit values are arbitrary.
Source: Respective managing authorities; own work

OP Enterprise and Innovation (OPEI)

The OPEI strives for higher competitiveness of business in the Czech Republic through seven priority axes – PA4 Innovation and PA5 Environment for Enterprise and Innovation are the closest to R&D&I.

PA4 Innovation includes two areas of intervention, which focus on innovation in businesses (Innovation) and own capacities for R&D (Potential). The Innovation programme supports two types of projects – in the case of projects applying new, original solutions the programme will enable firms to buy modern machinery and know-how necessary to implement such solutions; in the latter case, it supports protection of intangible property, for example, in the form of patents. The Potential programme helps firms increase their capacities, which are necessary to implement their own R&D&I activities, through investments in development centres, contributing in this way to the introduction of technologically advanced products.

PA5 Environment for Enterprise and Innovation is implemented through three areas of intervention; only the first one (5.1 Platforms of Cooperation) has a direct link to R&D&I. It includes two programmes. The Cooperation programme supports the origin and development of cooperation branch groupings – clusters and technology platforms. The Prosperity programme finances the establishment and further development of science-technology parks, business incubators, centres for technology transfer and creation of networks of business angel type.

Table F.8: Basic Characteristics of the OPEI

Global objective / fund / allocation	Increase competitiveness of Czech economy and move innovation performance of industries and services closer to the level of leading European industrial countries	ERDF	93.7 bn. CZK
Priority axes / allocation	PA1 Establishing firms PA2 Developing firms PA3 Efficient energy PA4 Innovation PA5 Environment for enterprise and innovation PA6 Services to develop enterprise PA7 Technical assistance		1.2 bn. CZK 24.4 bn. CZK 12.6 bn. CZK 25.6 bn. CZK 24.8 bn. CZK 2.3 bn. CZK 2.8 bn. CZK
Focus	Support innovation activities of enterprises and develop capacities for industrial R&D, strengthen cooperation between industries and R&D entities, improve the quality of infrastructure for industrial R&D and more efficient use of the human potential in industries		
Character of support	Investments in innovation, infrastructure and conditions for cooperation between the application and academic spheres		
Eligible regions	Czech Republic except for Prague		
Managing authority	Ministry of Industry and Trade [http://www.mpo.cz/cz/podpora-podnikani/oppi] CzechInvest – intermediary body [http://www.czechinvest.org/podnikani-a-inovace]		

Note: Highlighted = relevant
Source: OPEI programme documentation [http://www.mpo.cz/cz/podpora-podnikani/oppi/#category368]

The OPEI as a whole lags behind financial drawing in the fulfilment of some indicators; this is, however, due to the nature of interventions when activities are implemented partially using financial instruments with long-term effects and their factual fulfilment is difficult to monitor. The EU money contributed to date to 4,648 projects supporting SMEs (the declared accrued added value in supported firms is 35%). The OPEI beneficiaries had undertaken to support 3,069 innovations, of which 1,648 was actually implemented by June 2013. Because of a higher extrapolated error rate, requests for payment to be refunded by the European Commission are not currently submitted.

The Innovation programme has a high absorption capacity; no problems with implementation and completion of supported projects are expected in spite of the adverse development of domestic economy. The same is true also for the Potential programme where the volume of applications considerably exceeds the available financial sources. Certain problems in this respect appear in area of intervention 5.1 Cooperation; probably because it focuses on the activities, which are not too established among firms in the Czech Republic. The efficient demand in the Prosperity programme is much lower than the absolute demand; the lack of interest among universities and municipalities and the long time needed to secure planning and building permit can be considered as main causes.

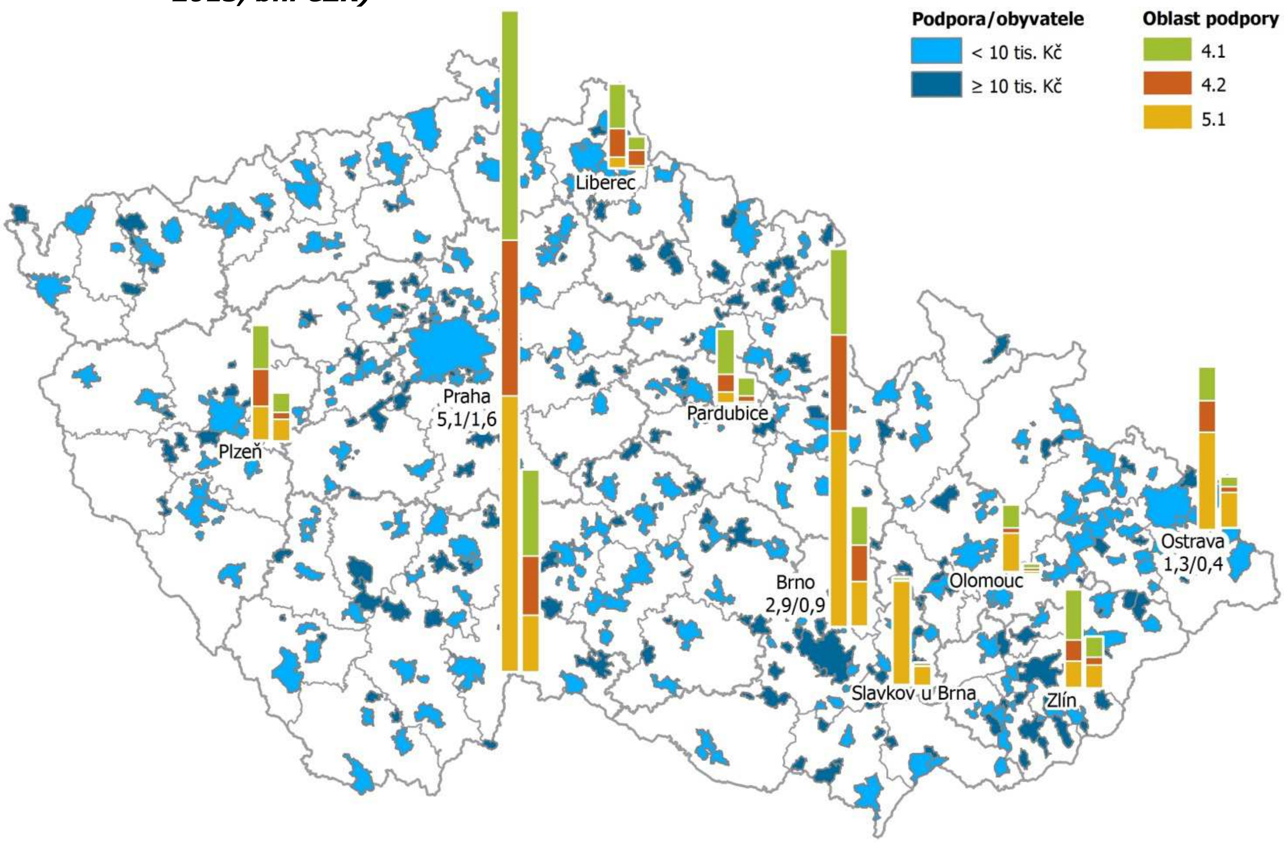
Differences among PAs can be found also in evaluation of the effectiveness of the forms of support. PA4 shows positive results in increasing innovation performance and R&D&I capacities of enterprises – positive effects to the total cost of production were confirmed by 66% of respondents in a questionnaire-based survey[66]. As regards the establishment of science-technology parks and centres for technology transfer, certain unsaturation of the market is probably ascertained. The development of cooperation branch groupings seems to require some modifications of supported activities to achieve more tangible results.

Table F.9: Drawing under the OPEI

Section	Total allocation [mil. CZK]	Submitted applications			Projects with issued decisions			Certified costs	
		Number	Volume [mil. CZK]	Volume [% of allocation]			Number	Volume [mil. CZK]	Volume [% of allocation]
PA4	25 616.1	3 764	62 086.8	242.4	1 727	24 505.7	95.7	6 332.2	24.7
PA4 - OP 4.1	16 892.1	2 662	41 649.0	246.6	1 234	16 986.9	100.6	4 363.9	25.8
PA2 - OP 4.2	8 724.1	1 102	20 437.7	234.3	493	7 518.8	86.2	1 968.4	22.6
PA5	24 840.0	2 377	42 383.6	170.6	1 640	25 516.1	102.7	7 356.1	29.6
PA5 - OP 5.1	8 236.5	292	19 006.7	230.8	146	9 176.4	111.4	1 332.1	16.2
Total OP	93 724.6	16 404	170 323.3	181.7	9 355	87 714.8	93.6	29 633.1	31.6

Source: Monitoring report May 2013 - MRD 2013 [http://www.strukturalni-fondy.cz/cs/Informace-o-cerpani]

Chart F.11: (Paid) Support under the OPEI by Beneficiary's Seat (Czech municipalities; 2008–2013, bn. CZK)



Note: Charts are given only for municipalities with high values – the amount of support to the left, the paid sum to the right. Support per head converted to inhabitants in productive age (14-65 years). The limit values are arbitrary.
Source: Respective managing authorities; own work

OP Prague – Competitiveness (OPPC)

The activities implemented under the OPPC (and OPPA) are supplementary to the activities implemented under OPs within the objective Convergence, for which Prague is not an eligible region. The OPPC strategic vision is fulfilled through four priority axes – PA3 Innovation and Enterprise, in particular the first of its three areas of intervention – 3.1 Development of Innovation Environment and Partnership between the R&D Base

[66] OPEI (2012): Medium-term evaluation of the Operational Programme Enterprise and Innovation 2007-2013

and Practice, is crucial in relation to R&D&I. The area of intervention focuses on projects developing innovation infrastructure and responds to insufficient interconnection between the research base and practice with creating partner links.

Unlike the OPRDI, the infrastructure projects in the OPPC focus in principle only on the purchasing or modernisation of instrumentation for R&D; related building works are also included in certain cases. Projects result, for example, in modernisation of laboratories or in concentration of the formerly fragmented functions in a single complex centre. The character of those OPPC projects is supplementary. In spite of the considerably lower volume of available funds, the allocation in the OPPC has not been fully drawn up and the ratio of certified expenditures in the area of intervention 3.1 is less than one fourth.

CZK 185 million was re-allocated to area of intervention 3.1 to make up for the high excess in demand. The main beneficiaries in area of intervention 3.1 include public research institutions and universities. Business entities are represented to a lesser extent; businesses usually submit minor projects. Evidently, the absorption capacity in this area in Prague has not been used up by far. Project outputs do not sufficiently provide for follow-up activities (jobs in R&D, joint projects), although the scope of modernised capacities for R&D should fulfil the programme objectives. A higher use of the R&D potential is in this respect rather questionable[67].

Table F.10: Basic Characteristics of the OPPC

Global objective / fund / allocation	Increase competitiveness of Prague as a dynamic city through eliminating development barriers, improving the city environment and developing its innovation potential	ERDF	7.2 bn. CZK
Priority axes / allocation	PA1 Traffic accessibility and development of ICT PA2 Environment PA3 Innovation and Enterprise PA4 Technical assistance		2.5 bn. CZK 2.1 bn. CZK 2.4 bn. CZK 0.2 bn. CZK
Focus	Supporting the efficient use of the Prague's innovation potential through developing the innovation environment and partnership between the R&D base and practice		
Character of support	Investments in infrastructure and conditions for cooperation between the application and academic spheres		
Eligible regions	Prague		
Managing authority	The Municipality of Prague [http://www.prahafondy.eu/cz/oppk.html]		

Note: Highlighted = relevant
Source: OPEC programme documentation [http://www.prahafondy.eu/cz/oppk/dokumenty.html]

Table F.11: Drawing under the OPPC

Section	Total allocation [mil. CZK]	Submitted applications			Projects with issued decisions			Certified costs	
		Number	Volume [mil. CZK]	Volume [% of allocation]			Number	Volume [mil. CZK]	Volume [% of allocation]
PA3	2 427.2	691	8 436.8	347.6	137	2 048.2	84.4	506.3	20.9
PA3 – Area of intervention 3.1	1 843.2	186	6 167.8	334.6	40	1 551.3	84.2	441.1	23.9
Total OP	7 211.9	900	16 443.1	228.0	208	6 336.9	87.9	2 222.4	30.8

Source: Monitoring report May 2013 - MRD 2013 [http://www.strukturalni-fondy.cz/cs/Informace-o-cerpani]

OP Prague - Adaptability (OPPA)

The OPPA strategy is divided into four priority axes, of which PA1 Supporting the Development of Knowledge-Based Economy deals with increasing professional mobility and adaptability of employers and with increasing productivity. One of three supported activities focuses on the development of human resources and R&D capacities (the establishment of R&D centres, spin-off firms, etc.), support to cooperation, transfer of know-how and internships.

[67] HOPE-E.S. (2012): Evaluation of the implementation of the Operational Programme Prague – Competitiveness [http://www.prahafondy.eu/cz/oppk/ dokumenty/evaluace.html]

Table F.12: Basic Characteristics of the OPPA

Global objective / fund / allocation	Increasing competitiveness of Prague through strengthening the adaptability and efficiency of human resources and improving the access to employment for all	ESF	3.4 bn. CZK
Priority axes / allocation	PA1 Supporting the development of knowledge-based economy PA2 Supporting the entry to the labour market PA3 Modernising initial education PA4 Technical assistance		1.2 bn. CZK 0.9 bn. CZK 1.1 bn. CZK 0.1 bn. CZK
Focus	Support the increasing of professional mobility and adaptability of workers leading to the growth of productivity		
Character of support	Investments in human resources		
Eligible regions	Prague		
Managing authority	The Municipality of Prague [http://www.prahafondy.eu/cz/oppa.html]		

Note: Highlighted = relevant
Source: OPPA programme documentation [http://www.prahafondy.eu/cz/oppa/dokumenty.html]

316 projects were supported in PA1 in four calls, and the interest in activities was considerably different. In terms of the number of submitted projects, the lowest interest was in activity 4 Developing Human Resources in Sciences and Research (only 5% of PA1), although the activity was defined broadly enough as regards the type of beneficiaries. The requested grants for 26 approved projects accounted only for 8% in PA1. In addition to the low interest, inadequately prepared projects at the beginning of the period was the cause.

Requests for payment for the OPPA were suspended in April 2013 based on the audit results until the revealed discrepancies are corrected.

Table F.13: Drawing under the OPPA

Section	Total allocation [mil. CZK]	Submitted applications			Projects with issued decisions			Certified costs	
		Number	Volume [mil. CZK]	Volume [% of allocation]			Number	Volume [mil. CZK]	Volume [% of allocation]
PA1	1 236.5	1 599	6 544.9	529.3	319	1 069.8	86.5	678.1	54.8
Total OP	3 397.0	3 439	16 327.0	480.6	648	2 812.9	82.8	1 534.2	45.2

Source: Monitoring report May 2013 - MRD 2013 [http://www.strukturalni-fondy.cz/cs/Informace-o-cerpani]

F.3 Financing, Sustainability and Focusing of R&D Centres under the OPRDI

Structural funds present an exceptional opportunity to develop research infrastructures; SFs can cover investments and initial operating costs (non-investment expenditures associated with the project implementation, the so-called start-up grant). However, the use of SFs brings forth certain challenges during the process of applying for and implementing the grants (the strict time limits and rules for public contracts, etc.).

The OPRDI is a quite dominant channel to finance the development of research infrastructures – European centres of excellence and regional R&D centres (see above). The key factors for the OPRDI strategy include also the requirement for financial sustainability of the newly created capacities after the programme completion. Referring to the documents approved by the Government of the Czech Republic, it is expected that almost the entire increase in expenditures on R&D during implementation will be used to provide for intervention under the OPRDI – however, the economic situation at the time of the programme preparation was quite different and public expenditures on R&D were expected to grow continually.

Due to the considerable volume of funds directed to the new R&D centres, the research map of the Czech Republic will change significantly (see the attached table for a list of R&D centres). Most projects will focus on the establishment of infrastructures (installations and buildings), which will result in disproportion between research programmes and facilities. Programme objectives, as well as the setup of internal processes are defined in an excessively general way[68]. Therefore, there is a risk that the current concepts of

[68] *Report on Evaluation and Negotiation of Projects under OP RDI [http://www.msmt.cz/file/16287_1_1/]*

R&D management, human resources and research themes will be moved to new facilities without any qualitative change[69].

The massive development of R&D centres brings forth high requirements for human and, naturally, financial sources to provide for operations and long-term sustainability of those infrastructures. The support for the development of R&D centres should initiate a (quantitative and qualitative) growth of research activities.

Therefore, the following comparison is based on the assumption that the purpose of the new centres is to expand research capacities and that the new centres will actually be staffed with new employees[70]. That means the comparison shows a specific case, since a newly created job, as defined in the OPRDI documents, can be staffed also with an employee who is only formally moved from an existing institution to the new centre.

Almost 87% of capacities of the new R&D centres are concentrated in the government and higher education sectors (Tab. F.14). That is why the existing trends in the development of employment in those sectors should change, because the volume of jobs created in the centres between years 2010 and 2014 is almost thrice as high compared to the growth of employment in the preceding four years. A slower rate of fulfilling capacities of the new centres is expected in the next four-year period, and the current growth trend should saturate it almost exactly.

Table F.14: The Headcount in R&D in the Czech Republic (including in the centres) by sector

Sector	Total Numbers of Employees in R&D			Employees in R&D Centres	
	2006	2010	Change 2006-2010	Change 2010-2014	Change 2010-2018
Business	23 713	26 290	3 285	492	625
Government	11 086	10 926	-160	739	1 398
Higher education	12 775	14 056	1 280	2 158	2 574
Government & higher education	23 862	24 982	1 120	2 897	3 972
Total	47 729	52 290	4 561	3 389	4 597

Source: CSO; MoEYS; own calculations

The situation would be similar when the centres are classified by branch of science (Tab. F.15). The two branches with the strongest representation – natural and technical sciences – concentrate 87% of new employment. Since technical branches report the highest growth of employment in recent years, new employees should suffice to cover the capacities of the emerging research centres providing that the existing trends will persist. The situation is different, however, in the area of natural sciences; their capacities exceed thrice the growth of employment between years 2006 and 2010. Values for social sciences and humanities are intentionally omitted in the table – only one centre with this orientation was created and it is quite marginal with regard to general trends.

Table F.15: The Headcount in R&D in the Czech Republic (including in the centres) by branch of science

Branch of Science	Total Numbers of Employees in R&D			Employees in R&D Centres	
	2006	2010	Change 2006-2010	Change 2010-2014	Change 2010-2018
Medicine	4 008	4 456	449	185	460
Agriculture	2 631	2 848	216	133	141
Natural sciences	12 102	12 754	653	1 973	2 611
Technical sciences	23 092	26 379	3 287	1 059	1 347
Natural & technical sciences	35 194	39 133	3 940	3 033	3 958
Total	47 729	52 290	4 561	3 389	4 597

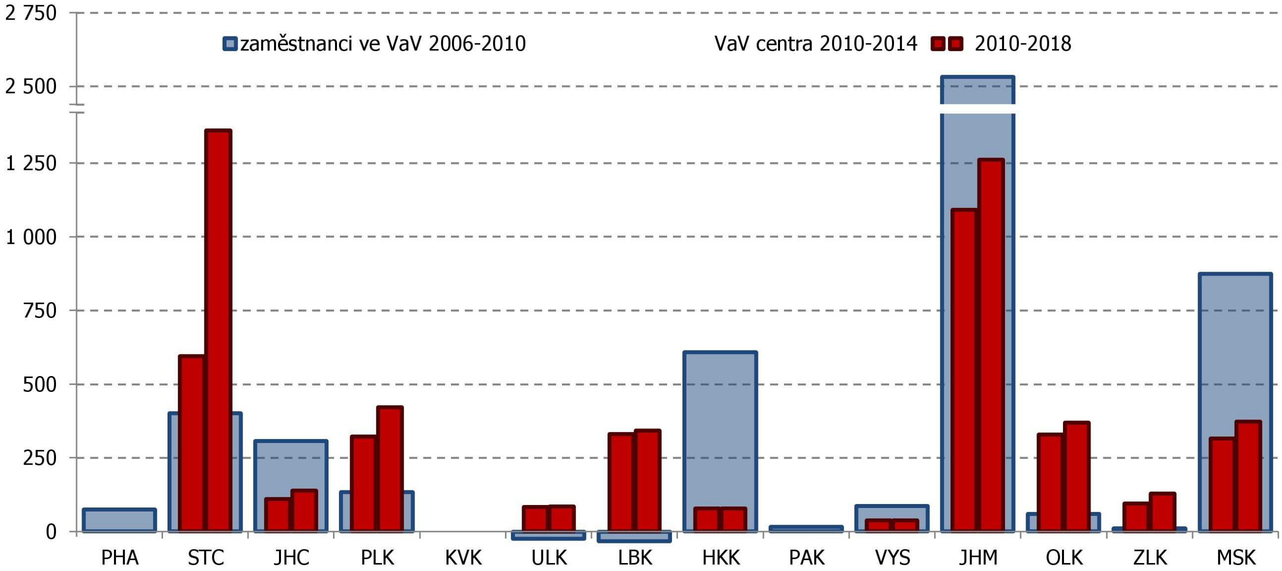
Source: CSO; MoEYS; own calculations

Further disproportions between the former development in employment and capacities of the emerging centres appear on the regional level. Even considering the actual interconnection between Prague and the Region of Central Bohemia, which can be perceived as a single unit, the growth of employment to date would not suffice to fully cover the needs of the new centres in the years to come. The same problem,

[69] A more detailed discussion on sustainability and focusing of R&D infrastructures is contained in the studies prepared by Technology Centre ASCR [http://www.vyzkum.cz/FrontClanek.aspx?idsekce=13634].
[70] The headcount is stated as full-time equivalent (FTE), which reflects the actual working time devoted to R&D.

though of much higher gravity, can be seen also in the regions of Plzeň, Liberec, or Olomouc. The regions of Karlovy Vary and Pardubice, where no new research infrastructures are built, represent an opposite extreme.

Chart F.12: The Headcount in R&D in the Czech Regions (including in the centres)



Source: CSO; MoEYS; own calculations

The basic contours of R&D centre funding are based on the data as contained in the project indicative budgets and on the funding sources of beneficiaries as reported by them in their annual reports. Although the OPRDI primarily does not finance R&D activities proper, the so-called start-up grant is an exception. The start-up grants can be used by the centres during the first years of their operations to cover the costs of their own activities and of their staff.

The state budget through the institutional and special-purpose support is the main source of income for the centres – 63% and 55% for the first and second priority axes, respectively. The institutional support goes to the centres via their parent organisations; certain centres – the ones included in the Roadmap of Large Infrastructures and approved by the government - receive the special-purpose support through the programme for Projects of Major Infrastructures. The origin of the National Sustainability Programme I had high financial requirements for the operation of emerging centres upon completion of the OPRDI. After it was approved, the programme commenced its implementation stage by announcing the first public competition. Out of twenty received project proposals, 17 centres will be supported with CZK 2.3 billion[71]. The support can be up to 50% of the costs of the centre operation in summary for the whole project term. Every project supported under the National Sustainability Programme I should also report international cooperation and cooperation with businesses, in particular with at least five projects lasting for at least one year, and it should apply joint results.

The other group of sources, which are of crucial importance for long-term sustainability of infrastructures, consists of the funds received under contractual research and international grants. Their role is important and in case those sources fail, the pressure on sources from the state budget will increase proportionally. If the state budget cannot saturate the deficit, the activities of the respective R&D centre will have to be reduced. The indicated values of the share of contractual research and, to a lesser extent, the share of international grants show significant disproportion between the amounts received by parent institutions in the preceding years (data from their annual reports) and those expected of the new R&D centres.

Table F.16: The Structure of R&D Centre Funding (the shares in operating income)

	European Centres of Excellence	Regional R&D Centres
Start-up grant	3,6 bn. CZK	4,5 bn. CZK
Total operating income - including	15,3 bn. CZK	19,4 bn. CZK
Institutional funding	34,3 %	21 %
National grants, special-purpose support	29,2 %	34,3 %
Contractual research	10,1 %	27,8 %

[71] For more information see http://www.msmt.cz/vyzkum/narodni-program-udrzitelnosti-i-1

International grants	16,2 %	10,2 %
Other sources	10,2 %	6,7 %

Source: CSO; MoEYS; own calculations

For R&D centres to further develop, it is important to interlink their research focus with the newly determined Priorities of Oriented R&D&I, which are fulfilled through special-purpose support programmes. The information on the research focusing of R&D centres can also be found in technical descriptions of OPRDI projects. It is also possible to compare the results associated with a R&D centre or its leading researchers (some centres do not yet produce their own results) in the R&D&I IS. Their competencies can be expected to be transferred to a certain extent also to the research programmes and their focus will be similar. The focus of R&D centres expressed in this way, as well as the ratio of its compliance with the new Priorities of Oriented R&D&I are indicated in the attached table. The priorities are problem-defined, without a direct association with a branch; that means their classification is general only.

The implementation of projects, their management structures and fulfilment of obligatory indicators are subject to evaluation of R&D centres supported under the OPRDI PA1 and PA2, which began in 2012[72].

[72] *B For more information see http://www.msmt.cz/strukturalni-fondy/prubezna-evaluace-projektu-podporenych-v-ramci-prioritnich*

G Appendices

G.1 Survey methodology and definitions of indicators

Methodological notes to the summary – definitions of selected indicators presented in Table 1

GERD (Gross Expenditure on R&D) is the total internal expenditure on R&D made in the domestic territory during the period in question. It includes R&D performed inside a country and financed from abroad, but does not include payments for R&D performed abroad. GERD is calculated as the sum of internal expenditure of four sectors (business, state, private non-profit and higher education). It is often displayed as a matrix of the operating and financing sectors.
GERD and the GERD matrix form the basis of the international comparison of expenditure on R&D. They also represent an accounting system through which it is possible to apply intuitional classification and functional division.

BERD (Business Enterprise Expenditure on R&D) – expenditure on R&D in the business sector.

GOVERD (Government Expenditure on R&D) – expenditure on R&D in the government sector.

HERD (Expenditure on R&D in Higher Education Sector) – expenditure on R&D in the higher education sector.

GBAORD (Government Budget Appropriations and Outlays for R&D) includes not only state-financed R&D performed in state facilities, but also state-financed R&D in the other three national sectors (business, private non-profit and higher education), as well as abroad (including international organisations). GBAORD of course includes all expenditure that should be covered from taxes or other government budget income.

Methodological notes to the macroeconomic framework of the R&D analysis

GDP per capita in Purchasing Power Standard (PPS)

Gross Domestic Product (GDP) is a measurement of economic performance. It represents the added value of all goods and services (it is necessary to deduct intermediate products that do not participate in added value). The GDP volume index per capita average, expressed in Purchasing Power Parity, is related to the EU 27 average, which is equal to 100. If the index for a certain country is higher than 100, it means that the GDP per capita is higher than the EU 27 average, and vice versa. The data are presented in PPS – a common currency that removes the price level differences between countries and enables comparison between individual countries rather than over time.

GDP growth rate

The calculation of the annual GDP growth rate enables economic comparison over time and between countries of various sizes, regardless of price changes. GDP growth is calculated based on data in prices of the previous year. These volume changes, adjusted to the level of the reference year (so-called chain data), show the growth rate free of price fluctuations.

Purchasing Power Standard (PPS)

Purchasing Power Standard (PPS) is a currency unit used to balance the differences between the purchasing power of currency units of EU Member States after its enlargement to the EU 27 as of 1 January 2007. The sum of all GDP data of all 27 countries converted to EUR (formerly ECU) equals the same amount in PPS.

Labour productivity per person employed

Labour productivity per person employed is calculated as the share of the GDP (in PPS) and the total employment according to national accounts. GDP per employed person is actually the productivity of the national economy and is designed as an index related to the EU 27 average. If this index is higher than 100 for a country it means that the GDP per employed person in that state is higher than the EU 27 average, and vice versa. The basic indicators are shown in PPS – a common currency that removes the differences in price levels of countries and thus enables the comparison of GDP between individual countries. It does not distinguish between part-time or full-time employees.

Government (public) debt

Government debt is defined in the Maastricht Treaty as the total consolidated debt of government institutions (in nominal value as of the end of the year) in the following categories of government liabilities (as defined in ESA95): currency and deposits (AF.2) securities other than shares (AF.3) with the exception of financial derivatives (AF.34) and loans (AF.4). In the Czech Republic the sector of government institutions includes central government institutions, national government institutions and social security funds. Government (public) debt is expressed relatively as a percentage of GDP.

Foreign Direct Investments

Foreign direct investment (FDI) of the international investment category is made by a domestic subject (direct investor) by buying an entity in a foreign economy in order to achieve continuous profit (interest), while the direct investor controls at least 10% of the foreign entity. For comparing economies of various sizes it is expressed as a share of GDP.

Inflation rate

Inflation is generally defined as the growth of the price level, i.e., it characterizes the rate of currency depreciation in a strictly defined time period. The inflation rate is measured by the increase in the consumer price index. Here the inflation rate shows the percentage change of the average price level during the 12 months of a year compared to the average price level of the 12 months of the previous year. The price level is measured using the harmonized indexes of consumer prices (HICP), which are created for international comparisons of consumer prices. HICP is used e.g., by the European Central Bank to monitor inflation within the Economic and Monetary Union and to estimate inflation convergence, as requested by Article 121 of the Amsterdam Treaty.

Comparative price levels

Comparative price levels are relations between purchase power parities and exchange rates of each country. The purchase power parity is established by the monetary convergence rate, which converts the values of economic indicators, expressed in the national currency, to a common currency, which is called the Purchase Power Standard (PPS). By equalizing the purchase powers of individual national currencies this standard enables comparison of indicators of individual states. The rate is designed in relation to the average (EU 27 = 100). If this rate is higher/lower than 100 for a given country, it means that the country is relatively more/less expensive than the EU 27 average.

Employment rate

The employment rate is calculated as a ratio of all employed persons aged 20-64 to all persons in this age group. The indicator is based on the EU Labour Force Survey. The survey targets all persons living in households and does not apply to persons living in collective accommodation such as pensions, dormitories and hospitals. The employed population consists of people who worked at least one hour in a reference week for a wage, salary or other reward or, while not being at work, they had a formal relation to employment.

Unemployment rate

The unemployment rate shows unemployed persons as a percentage of the labour force = the active population. The labour force is the total number of employed and unemployed persons. Unemployed people consist of people aged 15-74, who a) were without employment during the reference week; b) are available for employment, i.e., are ready to begin paid or freelance work (employment in their own company) within two weeks from the reference week; c) are actively seeking employment, i.e., taking steps to find paid work or freelance work within a four-week period ending with the reference week, or those who found employment with a postponed start (maximum of three months).

Long-term unemployment rate

The long-term (more than 12 months) unemployed are people older than 15, not living in collective facilities, who are not employed within a period of 14 days after the survey, are available immediately or within a maximum of 14 days for paid work or freelance work and who are searching for work (they actively searched for work during the past 4 weeks or are not searching for work because they have already found it and are available to start working within 14 days). The total labour force is the total amount of people with a single or primary employment plus the total amount of unemployed people. The unemployment duration is defined as the period of searching for work or the period since the last employment (if this is shorter than the period of searching for work).

Public expenditure on education

This indicator is defined as total public expenditure on education expressed as a GDP percentage. The public sector finances education by covering the operating and capital costs of education institutions or by supporting students or their families via stipends and public loans, or by providing grants for educational activities to private companies and NGOs. Both expenditure types together form the public expenditure on education.

Energy intensity of the economy

The energy intensity of the economy describes the relation between the gross energy consumption in a country and the GDP for the given calendar year. It measures the energy consumption of an economy and its overall energy efficiency. Gross energy consumption in a country is calculated as the sum of the gross consumption of five types of fuel: coal, electricity, liquid fuels, natural gas and renewable sources. GDP values are in chain volumes with the reference year as 2000. The energy intensity is the ratio of the gross energy consumption to GDP. As the gross energy consumption is measured in kgoe (kilograms of oil equivalent) and GDP in EUR 1 000, this ratio is presented in kgoe/EUR 1000.

Methodological notes to chapter A

A.1 Total R&D expenditure

Annual research and development survey

The Czech Statistical Office (CZSO) monitors the R&D characteristics via its Annual Research and Development Survey (VTR 5-01), which includes questions about human and financial resources for R&D activities performed in the Czech Republic in the individual R&D sectors. This survey has been conducted since 1995 and fully respects the OECD and EU principles included in the Frascati Manual (OECD, 2002) and Commission Regulation (EC) No 995/2012.

Since 2005 the VTR 5–01 report has been distributed in two mutations by R&D sector:

- mutation (a) intended for the business and private non-profit sector [VTR 5–01 (a)],
- mutation (b) intended for the government and higher education sector [VTR 5–01 (b)].

The VTR 5-01 survey form is at the address: http://apl.czso.cz/pll/vykazy/pdf113?xvyk=1961&cd=0.

Purpose of the statistical survey

The Annual Research and Development Survey is performed primarily to secure the indicators necessary for the performance of state administration of the Czech Republic in the field of research and development (e.g., the National Research and Development Policy of the Czech Republic for 2009 to 2015) and to comply with the obligations arising from Commission Implementing Regulation (EU) No 995/2012 indicated above. The data from this survey are regularly provided to Eurostat for the needs of the EU and other international organisations, in particular the Organisation for Economic Co-operation and Development (OECD). In 2014 the data will be used through the capitalisation of research and development as well as for the calculation of complete sets of macroeconomic indicators within the framework of the Annual National Accounts.

Reporting units

The annual R&D report is sent to all natural persons and legal entities performing R&D in the Czech Republic as their main (CZ NACE 72: research organisations) or secondary economic activity, regardless of the number of their employees, major economic activity (CZ NACE classification), legal form or institutional sector.

Since 2001 the reporting units are the individual organisations where R&D is performed by the monitored economic entities (R&D organisations)[73]. These are primarily individual faculties at public higher education

[73] The term site used here is based on the methodology of the CZSO for the Annual Research and Development Survey. In the case of the Academy of Sciences of the Czech Republic, however, this is in conflict with the conception of this term pursuant to Act No

establishments, but also some sites of public research institutions. This change occurred as a result of requirements for the possibility of regional classification of research and development indicators and better depiction of monitored indicators by main group of scientific field.

Estimates of data for entities that do not complete the questionnaire have been performed since 2001. Since 2010 a rotational selection at level 1/3 has been applied for small enterprises performing R&D and complying with specific conditions.

In 2012 the VTR 5-01 survey was sent to a total of 2 500 economic entities and, in them, 3 000 research and development sites. The return rate for the survey in that year reached 90% overall, while for the government and higher education sector it was almost 100% and in the business sector 85%.

The database of reporting units performing R&D is regularly updated on the basis of information primarily from the following sources:

- The R&D Information System (Central registry of research and development projects),
- Tax returns of entities using indirect R&D support,
- CZSO statistical surveys that contain a question relating to the performance of R&D,
- The CZSO register of economic entities, which contains records of all economic entities in the Czech Republic and information about their main and predominant economic activity.

<u>Monitored characteristics</u>

The monitored characteristics (indicators) established within the framework of the VTR 5-01 Annual Survey include:

- The number of economic entities performing R&D and their R&D sites according to the expenditure for the R&D performed at them and the number of people working on R&D in them.
- The number of people employed in R&D sorted by activity, education and gender. In 2011 the VTR 5-01 form also included questions about the age and citizenship of the science workers. Since 2011 the number of newly employed researchers has also been established.
- The expenditure on the R&D performed in the monitored units according to type of cost, source of financing, type of research and development activity, and since 2005 also in selected fields (ICT, biotechnology, nanotechnology and nanomaterial) and in the business sector according to the code of the resulting output of the research and development activity (relevant data have been available since 2012).
- The costs for R&D services according to the entity from which these services were purchased (since 2008).
- The revenues from the sale of R&D services according to the entity to which the services were sold. The relevant data have been available for the government and higher education sectors since 2010.

The characteristics indicated above are available in the following classification:

- By sector of performance of R&D (business, government, higher education and private non-profit),
- By prevailing group of scientific disciplines (FOS classification),
- By prevailing economic activity (CZ NACE section classification),
- By region (CZ-NUTS 3) and, in the case of the business sector, also by district (CZ-NUTS 4),
- In the business sector also by ownership type (public enterprises, national private enterprises and private enterprises under foreign control), size (number of employees) and prevailing economic activity (CZ-NACE classification sections),
- In the government and higher education sector also by site type.

Estimates of data for entities that do not complete the questionnaire have been performed since 2001.

Detailed information about the established characteristics of R&D can be established from the VTR 5-01 form indicated above on the website of the CZSO (<u>http://apl.czso.cz/pll/vykazy/pdf113?xvyk=1961&cd=0</u>).

283/1992, on the Academy of Sciences of the Czech Republic. The lack of uniformity in the term is the result of efforts by the CZSO to better capture the regional breakdown and breakdown by group of scientific field. Hence the CZSO uses as reporting units individual sites at which R&D is performed (meaning remote units of an entity operating under a single IČO (business ID No)).

Important definitions of the research and development survey

R&D is a systematic creative activity performed in order to broaden current knowledge, including the knowledge of man, culture and society, to gain new knowledge or its practical use through methods that enable the confirmation, complementation or refutation of the gained knowledge. We differentiate three types of R&D activities:

- *Basic research* – theoretical or experimental activity performed in order to gain new knowledge on the basic principles of phenomena or observed facts, which is not directly aimed at practical use.
- *Applied research* – theoretical and experimental work aimed at gaining new knowledge or skills for the development of new or substantially improved products, methods or services. The results of applied research are directed towards a specific and practical objective.
- *Experimental development* – includes gaining, connecting, forming or using current scientific and technological, business and other relevant knowledge and skills to develop new or substantially improved products, methods or services.

As the line in particular between basic and applied research is not always clear, it is always necessary to proceed with caution when interpreting data sorted by R&D activity.

Sector of performance of R&D is the basic category used in the R&D statistics, which groups all institutional units performing R&D based on their main function, behaviour and goals. The R&D indicators are as standard monitored and published also at the international level in four sectors of R&D performance (hereinafter only "sectors") - business, government, higher education and private non-profit. These sectors were defined based on the Code-list of institutional sectors and subsectors (ISEKTOR) used in the National accounts (ESA system) and definitions provided in the Frascati Manual.

- *The business sector* includes all economic entities whose main activity is the production of market goods or services for sale to the public at an economically significant price. Economic entities belonging to this sector are included in one of the following ISEKTORs:
    - Non-financial companies (ISEKTOR 11),
    - Financial institutions (ISEKTOR 12),
    - Employers (ISEKTOR 141),
    - Self-employed people (ISEKTOR 142).
- *The government sector* includes all state administrative and local government bodies at all levels (ISEKTOR 13: Government institutions) with the exception of higher vocational and higher education (CZ-NACE 854).

  The R&D sites in the Czech government sector mainly comprise individual Academy of Science CR sites and departmental research sites with R&D as their main economic activity (CZ-NACE 72). Since 1 January 2007 most of these entities received new status as public research organizations. The other government sector sites that perform R&D as their secondary activity are mainly public libraries, archives, museums and other cultural institutions with R&D as their secondary activity.
- *The higher education sector includes all public and private universities and other institutions of higher education* (CZ–NACE 854) and also all research institutes, experimental facilities and clinics operating under direct control or managed or connected to organizations of higher education (teaching hospitals).

  R&D sites in the higher education sector is made up mostly of individual faculties of the public and private higher education institutions where R&D is performed, and 11 teaching hospitals.
- *The private non-profit sector* includes private institutions, including private people and households, whose primary objective is not the generation of profit but to provide non-commercial services to households. These are, for example, associations of research organizations, associations, communities, clubs, movements or foundations. Entities belonging to this sector are included in one of the following ISEKTORs:
    - Households (ISEKTOR 14 except for 141 and 142),
    - Non-profit institutions providing services to households (ISEKTOR 15).

Detailed data about the number of economic entities and their R&D sites performing R&D as their main or secondary activity in the individual sectors broken down according to their expenditure on their own R&D and the number of their employees engaged in R&D are available on the website of the CZSO.

R&D expenditure includes all expenditure meant for R&D performed within the monitored entity regardless of the funding source. As regards cost types, the R&D expenditure consists of:

- *Current (non-investment) expenditure,* including:
  - *Wages* of people employed in R&D, including health and social insurance and bonuses for work paid by the employer according to contracts for work done in R&D performed outside an employment relationship,
  - *Other non-investment expenditure* includes the consumption of energy, material and equipment for the performed R&D, fees, depreciation, licencing fees and expenditure on services for the support of the performed R&D, including related administrative and other overhead costs and the share of administrative expenditure directly related to the performed R&D. The share of administrative expenditure primarily includes salary costs for employees of security services, maintenance and others, which are not directly connected to the operation of the R&D sites. *All costs for the depreciation of buildings, machine (technical) equipment and fittings are excluded from the statistical monitoring of R&D expenditure,*

    Note: Other non-investment costs do not include the purchase of R&D services (R&D performed by another entity for the reporting unit) if they are independent projects. This expenditure is included in the costs for R&D services.
- *Investment expenditure*, which includes:
  - *The acquisition of fixed intangible assets* including the capitalisation of own R&D results and the acquisition – for the needs of the R&D performed – of software and/or manufacturing-related technical knowledge (know-how), subjects of industrial rights (e.g., the purchase of patents, industrial and utility models) and other intangible results of research, development or other intellectual creative activity, irrespective of whether they are or are not the subject of valuable rights,
  - *Land, buildings and structures* including the acquisition of land (e.g., land for experiments, locations for laboratories, respectively pilot facilities), buildings and structures, including their technical improvement for the needs of R&D performed in the monitored entities,
  - *The acquisition of other fixed tangible assets* including technical and other equipment essential for the performance of R&D activities (e.g., machines, devices, equipment, means of transport, perennial crops, and so on).

Note: The reporting unit should try to include in its investment expenditure only that part that will be used for R&D. If e.g., one-third of a newly purchased building will serve for R&D activity and the remaining space (time) for other activities (e.g., training, lectures, etc.), only one-third of the acquisition price of that building should be reported into expenditure.

The amount of R&D expenditure is measured:

- *In current prices –* prices of goods and service in the current year
- *In constant prices,* which eliminate inflation-related depreciation.

The structure of the expenditure on performed R&D according to the institutional perspective. The amount of expenditure on performed R&D at the individual monitored entities or sectors performing R&D is monitored according to the following characteristics:

- *Sources of R&D funding –* we differentiate three main sectors of R&D funding:
  - Business sector – private business sources, which form monitored enterprises' own resources for the R&D activities performed by them and business sources of entities operating in the territory of a given state meant for R&D in other enterprises or higher education institutions or public research organizations. *For the government and higher education sector this funding from business sources primarily includes income from the sale of R&D services (R&D commissions) and income from licencing fees for intangible results of R&D.*

- Government sector without higher education institutions – *public resources* (institutional or project) coming from the state or regional budgets meant for R&D activities in the Czech Republic.
- Foreign countries – *foreign resources* including all financial R&D resources coming from abroad. In the case of the Czech Republic this includes resources from international organizations (European Union, NATO etc.) including their facilities in Czech territory and the resources from parent companies directed to their affiliations in the Czech Republic.

Apart from the above-mentioned main sources there are also *other national sources*, such as incomes of higher education institutions or private NGOs not coming from the state budget, business sector or abroad. These sources are negligible in terms of total expenditure on R&D in the Czech Republic.

– *Functional aspect of resources allocated to own R&D, which includes*:
  - *Type of R&D costs* (salary, other current and investment)
  - *Type of R&D activity* (basic, applied and experimental R&D)
  - *Prevalent group of scientific disciplines* (natural, technical, agricultural, medicinal, social sciences and the humanities)

Purchases of R&D services from other entities has been monitored since 2008 as part of the VTR 5-01 survey. Purchases of R&D services include all expenditure on R&D services performed by a different entity upon commission. Expenditure is broken down according to the entities from which the R&D services were purchased and according to the territory where the expenditure was directed (Czech Republic, abroad).

In 2013 there was an extraordinary revision of data from the field of research and development. This meant in particular a retroactive control of the correct methodological differentiation of costs for performed R&D and costs for R&D services (expenditure on R&D performed for the monitored unit by a different entity). For this reason some of the data for the 2005–2011 period differ from the data given in preceding years.

Detailed information is available in a press release issued by the CZSO for this revision: http://www.czso.cz/csu/redakce.nsf/i/mimoradna_revize_udaju_o_vydajich_na_vyzkum_a_vyvoj_za_roky_2005_2011

A.2 Direct R&D support from the state budget

Data about direct support for research and development from the state budget of the Czech Republic have been processed by the CZSO within the framework of the annual GBAORD statistic (Government Budget Appropriations or Outlays for R&D) or the Czech equivalent "State Budget Expenditure and Subsidies on R&D". The goal of this statistic is to provide data about the state support of R&D arising from public budgets broken down according to socioeconomic targets, i.e., the identification of key R&D areas to which the state support is directed. These data also serve as a support tool when EU countries are deciding which R&D areas should receive investments in the coming years.

The GBAORD statistic is organised in the EU as a compulsory report according to Commission Regulation (EC) No 995/2012, implementing the decision of the European Parliament and Council No 1608/2003/EC, concerning the production and development of Community statistics on science and technology. The valid methodology related to this statistic is described in detail in the international manual "Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development" known under its abbreviated name the Frascati Manual (OECD, 2002 – 6th issue). The code list of the socioeconomic goals can be found in the NABS classification (EUROSTAT, 1992, 2007): Nomenclature for the Analysis and Comparison of Science Budgets and Programmes.

Implementation of the GBAORD statistic in the Czech Republic

The GBAORD statistic is prepared annually by the CZSO in cooperation with the Council for Research, Development and Innovation (RVVI) via the Information System of Research, Experimental Development and Innovations (R&D IS) and its integrated databases. The two integrated databases used for the GBAORD statistic are the CEP (Central Registry of Projects) and CEZ (Central Registry of Research Intents). Data from the RVVI budget preparation department are used in a supplementary manner.

More information about the R&D IS available at: http://www.isR&D.cz/, http://www.vyzkum.cz/FrontClanek.aspx?idsekce=610

As the R&D IS does not contain all financial amounts provided from the state budget to R&D, the detailed data on fees and contributions to international programmes must be gathered from the CZSO in cooperation with the Ministry of Education, Youth and Sports (MoEYS) and data on specific R&D at higher education institutions classified by scientific fields directly from the individual higher education institutions.

The actual processing of the data and allocation of socioeconomic objective codes (SEO) according to the NASB code list is performed by CZSO personnel at the level of three-figure SEO classification. The processing is performed systematically for running projects that will continue in the following year and manually for newly registered programmes based on a previously prepared classification key created from the basic structure of the CEP and CEZ databases.

When determining the total direct R&D support from public budgets, the basic data are the expenditure approved by the Act on the State Budget for the given fiscal period (preliminary data) and R&D expenditure in the Final State Account (final data), provided by the Ministry of Finance (MF). The public budgets in this case are the state budget and regional budgets. The state budget is always included, but regional budgets only if their contribution is significant. The local level budgets (towns and municipalities) are always excluded. According to the valid international methodology, R&D support via returnable loans, pre-financing of EU programmes covered by EU funds and innovation support are excluded from the public R&D funds.

All the data about total direct support of R&D from the state budget, unless stated otherwise, is based on data included in the final account of the state budget of the Czech Republic for R&D. It is thus expenditure that was genuinely drawn from the state budget in the year in question for R&D and not only planned.

Monitored characteristics

Apart from socio-economic targets, data about direct support for R&D from the state budget are also available in the Czech Republic broken down according to the form of the support (institutional and targeted), main providers, groups of supported scientific fields, and the type and registered office of the beneficiaries.

Data on the total institutional support broken down according to groups of supported scientific fields also include, for public higher education institutions and Academy of Science CR institutions, data on specific research at the higher education institutions and the support of Academy of Science CR infrastructure, which are not part of the R&D IS but have been obtained by the CZSO from these institutions.

The above-listed characteristics of state budgetary R&D expenditure and support from the R&D IS, and data on the socioeconomic objectives processed within the GBAORD statistic were further interconnected with the Registry of Economic Entities (RES). Based on the following code lists included in the RES: legal form, institutional sector (ISEKTOR) and prevailing economic activity (OKEČ/CZ-NACE), the following main types of R&D support beneficiaries were identified:

- *Public higher education* (ISEKTOR 13 Governmental institutions and legal form 601 Higher education institutions)
- *Public research institution* (legal form 661), which is further divided into: Academy of Science CR institutes and other (departmental) research institutes,
- *Government, public and non-profit organisations* (ISEKTOR 11001 and also CZ NACE 71+72, ISEKTOR 13 Government institutions without legal form 601 and 661, ISEKTOR 15 Non-profit institutions serving households and legal form 116, 141, 331, 701, 731, 745 and 751 irrespective of ISEKTOR) which is further divided according to legal form and prevailing economic activity (CZ-NACE classification),
- *Business* (non-financial enterprises: ISEKTOR 11001 [without NACE 71+72] and ISEKTOR 11002 +11003; financial institutions: ISEKTOR 12 and Employers and Other self-employments: ISEKTOR 141+142 without legal form 116, 141, 331, 661, 701, 731, 745 and 751) which is further broken down according to ownership (public enterprises, domestic private enterprises and foreign-controlled enterprises), legal form, size (number of employees) and prevailing economic activity (CZ-NACE classification).

The above-listed classifications might be provided based both on current data on monitored entities included in the RES, and also data valid at the time the R&D support was provided.

Important definitions used in the GBAORD statistic

Total state budget expenditure and subsidies for research and development include all financial resources (common and capital) provided from the public budgets to support R&D, including funding directed to R&D abroad.

As the GBAORD statistic is based on the analysis and identification of all amounts flowing to R&D from public budgets obtained from administrative sources, it differs from the data obtained directly from the beneficiaries of this support (VTR 5-01 survey). The main reason for this is the differing approach to the monitoring of the amounts, as GBAORD monitors allocated amounts of public support in the year in question, while VTR5-01 on the contrary monitors genuinely invested amounts in the year in question (including entitlements from previous years or without amounts deferred to other years). Another difference is the territorial perspective, when GBOARD also includes amounts flowing abroad to international programmes and fees for international research institutions, whereas VTR5-01 only monitors amounts invested in R&D in the Czech Republic. The international comparability of data from the GBAORD statistic is, in the majority of countries, generally lower than for data obtained directly from the entities performing R&D, which are however available for the majority of countries with a significant delay compared to GBAORD data.

The state budget expenditure and subsidies for research and development are provided in two basic forms, namely:

- *Targeted support* (information available in the CEP database) is awarded based on public tenders for R&D to proposed R&D projects applying for support within research programmes with accurately defined goals and focus (programme projects) or within a broader spectrum of scientific fields, predominantly basic research (grant projects).
- *Institutional support* (information available in the CEZ and CEA databases), which is provided especially for the long-term conceptual development of research organizations based on the evaluation of their achieved results.

  Note: the institutional support in GBOARD outputs includes the following R&D items, which are not part of the R&D IS:

  - *Specific research at higher education institutions,* which includes research done by students within their accredited master or doctoral programs and which is directly connected to their education,
  - *Support of the Academy of Science CR infrastructure*
  - *Support of the international R&D,* which includes fees for the Czech Republic's participation in international R&D programmes, membership in international R&D organizations or financial contributions to international cooperation projects, if this contribution can be paid from public sources or if the projects are supported from other states' budgets or from EU budgets or from funds of international organizations.
  - *Other items connected to administration and awards:* costs of the R&D support system for organizing public tenders and project evaluation, evaluation of R&D results, costs related to the operation of RVVI, Grant Agency CR, Technology Agency CR and Academy of Sciences CR.

The beneficiaries of public R&D support - all legal entities and natural persons, organizational units of the state and ministries that received support for their R&D activities.

Providers of R&D support are an organizational unit of the state or a territorial unit, which decides whether to grant the support and which provides it. In 2012 there were 14 providers of public support in the Czech Republic (Ministry of Education, Youth and Sports, Academy of Sciences CR, Ministry of Industry and Trade, Grant Agency CR, Ministry of Health, Ministry of Agriculture, Ministry of Defence, Ministry of the Environment, Ministry of Culture, Ministry of Labour and Social Affairs, Ministry of the Interior, Ministry of Justice, Office of the Government and Technology Agency CR). 13 of these provided institutional support and 12 provided targeted support in the same year.

The data obtained from the R&D IS does not include pre-financing or co-financing from EU Structural Funds.

Detailed information is available at: http://www.czso.cz/csu/redakce.nsf/i/statistika_vyzkumu_a_vyvoje

A.3 Indirect support for research and development from the state budget

Indirect support for research and development (R&D) through tax deductions for R&D costs from the tax base is a secondary tool for the research and development support policy in the Czech Republic.

An entity performing R&D can deduct eligible costs for research and development from its tax base only if it has not already obtained direct R&D support for the R&D project in question. A taxpayer (legal entity) can write off up to 100% of the expenditure invested during the implementation of research and development projects. It is not important whether it is basic research, applied research or experimental research. It is only possible to write off the eligible costs indicated below named in a Ministry of Finance instruction (Instruction D288/2005):

- *Personnel costs* for research and development employees, academic workers, technicians and auxiliary staff of the taxpayer, including administrative employees or blue-collar professions participating in the implementation of the project,
- *Write-offs* (or their part) of tangible movable assets and intangible assets used in direct connection with the implementation of a R&D project,
- *Other operating costs* incurred in direct connection with the implementation of a R&D project such as costs for material, inventory and low-value tangible and intangible assets, expenditure on books and magazines, on electricity, heat, gas, telecommunications charges and water and sewage payments, maintained in separate records in accordance with the law,
- *costs for the certification of the results of research and development,*
- *travelling expenses* provided by an employer to employees in the field of research and development, only if they are incurred in direct connection with the resolution of a project.

No deduction can be made for services and intangible results of research and development.

The possibility for entities performing research and development to deduct eligible costs for R&D from their tax base has existed since 2005. According to the international OECD methodology, the CZSO only monitors the indirect support of R&D in the business sector, and this in a detailed breakdown since 2007. According to the system of national accounts, indirect support for R&D in the remaining sectors is insignificant in terms of the total amount. Similarly, the indirect support of R&D for natural persons – self-employed - is not statistically monitored. Data about deductions of eligible costs for research and development are obtained from administrative sources. The source of these data is the General Financial Directorate. The data published by the CZSO differ from the data published by the MF on the one hand because according to the international OECD methodology the CZSO published data about indirect support for R&D only for enterprises, and also because of the updating of the data, which is performed by the MF after the publication of the data by the CZSO.

CZK millions

Sectors	2007	2008	2009	2010	2011
Business sector*	1 210.1	1 022.1	1 052.2	1 320.4	1 846.4
Public sector	0.7	0.7	0.3	0.2	0.2
Private non-profit sector	0.1	0.1	0.1	0.2	0.5
Total	1 210.9	1 023.0	1 052.7	1 320.8	1 847.2

*only enterprises, no self-employed people

Source: General Financial Directorate

Monitored characteristics

Data about indirect support for R&D in enterprises are monitored according to ownership and size of enterprise, the amount of indirect support and the CZ-NACE branch.

Detailed information is available at:

http://www.czso.cz/csu/redakce.nsf/i/neprima_podpora_vyzkumu_a_vyvoje_v_podnikatelskem_sektor

Methodological notes to Chapter B

B.1 Employees in R&D

Information about the VTR 5-01 survey, which contains the base data on R&D employees, can be found in chapter A.1

Employees in R&D are, according to working activity:

- *Researchers,* who manage or work in projects including concepts or the creation of new knowledge, products, processes, methods and systems. Researchers are considered the most important group of R&D employees, as they form the pillar of science and research activities.

  Researchers consist mostly of employees belonging to the main class 2 (Specialists) and subclass 1223 (Research and development managers) according to the valid employment classification - expanded (CZ-ISCO).
- *Technical and equivalent employees,* who perform scientific and technical tasks, apply concepts and methods, usually under supervision by researchers.

  Technical and equivalent employees consist of employees from class 31 (Technicians and expert workers in science and technology) according to CZ-ISCO.
- *Other R&D personnel who participate in R&D activities* (e.g., craftsmen, secretaries and clerks). This also includes managers and administrative workers, whose activities are direct R&D services.

The number of R&D employees is measured as:

- *Headcount (HC),* which shows the number of people working part-time or full-time in R&D activities, employed as their main or secondary employment relationship as of the end of the given year in the monitored entities.

  Particularly in the higher education and also in the government sector, a large number of people working in R&D – especially researchers – have an employment relationship with more than one entity. Therefore this indicator is overvalued in these sectors and does not show the real number of R&D employees.
- *Full Time Equivalent – (FTE),* which is the best indicator for showing the real amount of time dedicated to R&D by R&D employees in the monitored entities. This indicator only counts the working time dedicated to R&D. One FTE equals one year of full-time work in R&D.

  In 2005 the method of calculation of this indicator changed in line with OECD requirements in order to make it more accurate and more suitable for international comparisons. Due to different methods of FTE calculation, particularly in the higher education sector of individual countries, the data on the converted amount of R&D employees are not fully internationally comparable.

Apart from the data on the number of R&D employees expressed in HC and FTE, since 2005 the CZSO has also monitored the number of people working in R&D based on a contract for work done. These data, converted using methodology valid for FTE, are part of the converted number of R&D employees.

The number of people employed in R&D is monitored according to the following characteristics:

- Gender,
- Activity type (researchers, technicians or other),
- Highest achieved level of education according to the ISCED 97 classification, divided into tertiary (doctoral – ISCED 6, master or bachelor – ISCED 5A, and college - ISCED 5B) and secondary and lower (ISCED 1-4).

The number of researchers for 2011 is also available sorted by age and nationality.

The listed characteristics of R&D employees are available in mutual combinations.

Detailed information is available at: http://www.czso.cz/csu/redakce.nsf/i/statistika_vyzkumu_a_vyvoje

B.2 Wages of specialists in science and technology

Specialists in science and technology are defined based on the CZ-ISCO classification as employment group CZ-ISCO 21.

The data concerning the wages of R&D specialists come from the structural statistics of employee wages, which is published by the CZSO in cooperation with the Ministry of Labour and Social Affairs.

More information is available at: http://www.czso.cz/csu/redakce.nsf/i/lidske_zdroje_ve_vede_a_technologiich.

B.3 Higher education

B.3.1 People who have completed higher education

For the purpose of this analysis this category includes people older than 25 who have successfully completed their higher education studies (bachelor – ISCED 5A, master – ISCED 5A, and doctoral - ISCED 6) in all study programmes.

The source of data relating to people with completed higher education is the Labour Force Survey, with households and individuals being the basic reference units. The data is presented as annual averages and if their value is less than 3 000 people, then they are considered low-reliability data.

Detailed information is available at: http://www.czso.cz/csu/redakce.nsf/i/lidske_zdroje_pro_vedu_a_technologie

B.3.2 Higher education students and graduates

A law from 1998 changed the legal standing of existing higher education institutions to public institutions. The only exceptions are the military and police universities, which are still state schools under the Ministries of Defence and Interior. This law also enabled the establishment of private higher education institutions. It also established an obligation to maintain student registers, the data from which are centrally united in SIMS (United Information of Student Registers). Only the two above-mentioned state schools operate in this different mode and do not have the obligation to submit data to the SIMS register. Hence they are not included in the presented data.

In 2001 a three-layer structure of higher education studies was strictly implemented, with the former characteristic four- to six-year study at higher education institutions transformed into usually three-year bachelor programmes and into master programmes. The master programmes are of two types – the follow-up master programme, which enables bachelor graduates to continue their studies, and the so-called long master programmes, where the division was not possible. The long master programmes are e.g. medicine, veterinary or architectural studies. After successful completion of the master programme the students may continue in doctoral programmes (three to four years), after which they receive the title PhD and their studies focus more on scientific activity. The PhD title was established in the Czech Republic in 1998 through Act No 111/1998, on higher education institutions.

Methodological notes

The published data come from data sources of the Institute for Information in Education (IIE), which is a contributory organization directly controlled by the MoEYS. Specifically, the data come from the SIMS database.

Due to the methodological comparability over time and the availability of data from the SIMS database, the data are presented in a time series starting from 2002.

Inclusion in a study programme is based on the code of the study programme, which in some cases does not reflect the affiliation of individual study programmes to the main programme groups. Due to difficulties with classifying students into the relevant programme groups, qualified estimates made by the MoEYS are used for classification by programme.

Due to the increase of the number of students studying at more than one higher education institution or faculty at the same time, the numbers of students are presented in terms of physical people in summary indicators. In the case of programme classification, the data show the number of studies, i.e., one student may be counted in several programmes. Due to this the number of students by programme does not correspond to the summary values presented in the time series. Our primary target was to show which programmes are studied with the highest intensity and the numbers of students in the natural and technical sciences, which are crucial for the development of highly qualified human resources.

The number of students is presented as of 31 December of the given year.

The number of graduates – the presented numbers are per calendar year, i.e., numbers of students who successfully completed their studies at a higher education institution between 1 January and 31 December of the given year.

Note: The date of completion of the studies is the date of the last state examination was passed. It is necessary to bear in mind that not all graduates go directly into employment. Some continue in master or doctoral programmes and analogously some graduates of master programmes continue in doctoral studies. Therefore the number of graduates significantly increases over time, as e.g., a graduate from a follow-up master programme was also registered as a graduate from a bachelor programme two years before.

The education programmes are defined based on the ISCED 97 classification.

Higher education study programmes:

The bachelor study programme focuses mainly on preparation to perform a job, using current tools and methods; it also contains selected theoretical knowledge. The standard length is at least three but no more than four years.

The master study programme focuses on gaining theoretical knowledge based on the current state of scientific knowledge, research and development, on mastering its application and on developing creative activity; in art it focuses on demanding artistic preparation and talent development. The standard length at least four but no more than six years.

The doctoral study programme focuses on scientific research and individual creative activity in research and development, or on individual theoretical and creative work in art. The standard duration is four years.

Students by nationality:

A student with Czech nationality is a Czech citizen registered at a Czech higher education institution in a bachelor, master, follow-up master or doctoral study programme as of 31 December of the given year. All students are included (whether they already completed a higher education study programme in the past or not) with the exception of students who had interrupted all their studies as of 31 December

A foreign student is a citizen of a foreign nation registered at a Czech higher education institution in a bachelor, master, follow-up master or doctoral study programme as of 31 December of the given year. All students are included (whether they already completed a higher education study programme in the past or not) with the exception of students who had interrupted all their studies as of 31 December

Detailed information is available at: http://www.czso.cz/csu/redakce.nsf/i/lidske_zdroje_pro_vedu_a_technologie

Methodological notes to Chapter C

C.3 Patents, utility models and their licensing

Patent statistics

Patent statistics provide information about the results and success of R&D activities in the selected fields of technology. Patent protection in the Czech Republic is provided by the Industrial Property Office of the Czech Republic (IPO).

In cooperation with the IPO, the CZSO gathers and publishes detailed patent data in various classifications according to the OECD Patent Manual (OECD, Paris 2009) with the aim of making the patent activities of entities active in the Czech Republic available to the general public through statistical data.

The CZSO processes detailed data on the number of patents awarded for the territory of the Czech Republic, the number of patent applications filed at the IPO, and patents valid as of 31 December for the territory of the Czech Republic. Similar data were processed for utility models.

Some key information gathered from the IPO patent documentation follows:

- The year of the patent application, patent award or patent priority – time aspect
- The domicile of the inventor and/or the applicant – territorial aspect. The basic classification system is patents awarded to domestic and foreign applicants for the territory of the Czech Republic. In the case of domestic applicants there is further information available in the regional classification by regions (CZ-NUTS 3) and classification by country for foreign applicants.

Patent data sorted by territorial aspect are calculated using the so-called fraction method, i.e., if for example four inventors with different nationalities file an application together, one quarter of this patent is counted for each country.

- How the patent is awarded. The basic classification is into patents awarded via the national route by the IPO, and European patent applications validated for the territory of the Czech Republic by the IPO. *The second option has existed in the Czech Republic since 2002, but was only put to practice in a significant manner in 2004.*
- The field of technology which is the subject of the claim in an awarded patent, is defined according to the International Patent Classification (IPC). Apart from the basic classification by main IPC sections, the CZSO, according to the OECD methodology, also processed data on selected technology areas such as high-tech, ICT, biotechnology and renewable resources – for more see the appendix Classification – International Patent Classification. If a patent covers more than one technology area, it is counted according to the IPC class specified in the first position.

The listed characteristics are available in mutual combinations.

Data on the number of patents belonging to domestic entities are also available in the following classification:

- *By applicant type* (higher education institutions, public research institutions, businesses, natural persons etc.) defined based on the legal form of the organization, institutional sector (ISEKTOR) and prevailing economic activity (CZ-NACE).
- *Legal entities and natural persons registered in the RES* belonging in the business sector, also by *ownership* (public companies, private domestic companies and private foreign-controlled companies), *size* (number of employees) and *field/prevailing economic activity* (CZ-NACE).
- In the government and higher education sector also by facility type.

The classifications listed above were performed based on the data from the RES valid as of 31 December 2012, i.e., it might not match the real situation at the time of the patent award. The patent data in these classifications are calculated using the fraction method mentioned above. Aggregated patent data processed by the CZSO in the classifications listed above may slightly differ from the data published by the IPO in its annual reports due to methodological reasons.

<u>Important definitions used in patent statistics</u>

Patent – a public document issued by the relevant patent office, which provides legal protection of an invention for up to 20 years (if the maintenance fees are paid) in the territory for which it has been issued by the patent office (e.g. the IPO awards patents via the so-called national route valid for the territory of the Czech Republic). A patent is applied for via a patent application at the appropriate patent office. Patents are awarded for inventions that are new, are a result of scientific activity, and are industrially usable. Patents can be provided not only for products and technologies, but also for chemically produced substances, pharmaceuticals, industrial production microorganisms as well as microbiological methods and products created by these methods. *Patents cannot be awarded for discoveries or scientific theories, computer programs, new plant varieties or animal breeds, or methods of surgical or therapeutic treatment of the human or animal body and diagnostic methods used on the human or animal body.*

The technical solution *of a utility model*, which forms its core and is protected by it after registration, does not have to reach the creative level of a patentable invention. However, it is required that it would surpass the framework of expert skill, was not just an external alteration of a product and was industrially usable. In the case of the utility model the eligibility for protection is not examined, i.e., a utility model is always registered provided it meets the legal requirements. A utility model cannot protect production processes. Utility model protection is provided by around 40 states.

The author of a patented invention is the person who created it through his creative work. The originator or co-originator may only be a natural person. This person has the right to authorship (a personal right, not transferable to a third party). The author is stated in the patent application and in the patent certificate and information about the author is entered into the patent register.

A patent applicant can be either the author or his legal representative. The patent applicant is also stated on the patent application and certificate, and information about the applicant is entered into the patent register.

After the award of a patent the applicant becomes the owner of that patent. The patent owner has the exclusive right to use the invention, to provide consent with its use by other people (licenses) or to transfer the patent by written agreement.

The priority year is the year of the first filing of the application in any country.

After its validation by the national patent office, *a European patent* provides its owner with the same rights as he would obtain from a national patent granted via the national route in all contractual states for which it was designed. A European patent application can be filed by any person at the European Patent Office (EPO), and if the law of the contractual state allows, even at the central industrial property office or other appropriate body of the contractual state. Since 1 July 2002 it has also been possible to file a European patent application at the IPO.

The International Patent Classification (IPC) is the key for storing and searching patent documents according to fields. It was established in 1968 through the merger of the national classification systems for patent documents. It contains around 60 000 field groups and subgroups and has been continuously updated since 2006 – new groups or subgroups are added while others are removed or merged. There have been 8 versions since 2006. The IPC classifications can be found at the IPO website.

Detailed information is available at: http://www.czso.cz/csu/redakce.nsf/i/patentova_statistika

Statistical survey on licences in the field of industrial property protection LIC 5-01

Since 2005 the CZSO has monitored data on industrial property protection licences valid in the territory of the Czech Republic via the Annual Survey on Licenses (LIC 5-01).

The aim of this survey is to determine the number of active (provided) licenses for any of the industrial property protections, and the value of license fees received by economic entities active in the Czech Republic in the monitored year.

Regarding the dissemination of R&D results and their financial appreciation, the most important license agreement entities are licenses for patents or utility models, which are also the focus of the CZSO survey.

Reporting units – the Annual Survey on Licenses is sent to all legal entities and natural persons registered in the Register of Economic Activities which are known to have or expected to have a valid license agreement concluded for the provision or acquisition of some kind of industrial property protection, regardless of the number of their employees, prevailing economic activity, legal form or institutional sector. Between 2008 and 2010 the LIC 5-01 had only been sent to legal entities, therefore the results are not fully compatible with other years (since 2011 the reporting units include natural persons again).

The basic characteristics examined through this survey are:

- *The number of valid licenses* in the Czech Republic in the monitored year, further characterized by:
  - whether it is a newly concluded licence or a licence concluded in a previous period,
  - the type of license according to the subject of the industrial property protection (patent, utility model, know-how, new plant varieties and animal breeds),
  - the country of the contractual partner,
  - the code of the production that is the subject of the license agreement defined by the CZ-CPA classification.
- *The financial value of the license fees received by economic entities operating in the Czech Republic* in the monitored year in the same classification as with the number of licenses.

The listed characteristics are available in mutual combinations. Detailed information on the established licence characteristics can be found in the annual LIC 5-01 report published on the website of the CZSO.

The characteristics listed above are available in the following classifications:

- By applicant type (higher education institutions, public research institutions, businesses, natural persons etc.) defined based on the legal form of the organization, institutional sector (ISEKTOR) and prevailing economic activity (CZ-NACE).
- By region (CZ-NUTS 3),

- In the business sector also by ownership (public companies, private companies and foreign-controlled companies), size (number of employees) and field/prevailing economic activity (OKEČ/CZ-NACE),
- In the government and higher education sector also by facility type.

An additional survey was conducted for entities with patent licenses, which identified the patents which are the subject of the license. This made it possible to determine the number of patents for which a license agreement was concluded.

There are several criteria for license differentiation. The basic classification is based on whether the subject of the license is provided (active) or acquired (passive).

Based on the subject of the license we can differentiate:

- *Patent licenses;* their subject is the provision of the right to use the valid patent in the licensee's country or in countries where the licensee is planning to export the licensed product,
- *Model licenses* whose subject is an industrial or utility model,
- *Licenses for know-how* whose subject is the provision of unprotected production-technological knowledge, experience or skills. The transfer of the appropriate production-technological knowledge is the prerequisite and guarantee of the mastery of practically any licensed production, and therefore a large part of the license agreements concluded at the current time contain some degree of the appropriate know-how. This license is also called a false license,
- *Trademark licenses* whose subject is the use of trademarks.

A license agreement is defined as the provision of the right to a type of industrial property protection within the agreed scope and in the agreed territory. License agreements are concluded in writing for patented inventions or registered utility models, industrial models, semiconductor product topography, new plant varieties and animal breeds, or trademarks. The licensor grants the licensee the right to enjoy the industrial property rights within the agreed scope and in the agreed territory, and the licensee undertakes to provide some sort of payment (license fee) or other pecuniary value. License fees can be paid in regular instalments (e.g. annual) or the payment can be made in a lump sum after the conclusion of the license agreement. There are also cases when the license is granted for free.

International comparison

The LIC 5-01 survey is not conducted in other countries, therefore the base for the international comparison of income and expenditure from economic transactions abroad is the data sources of Eurostat, obtained within the balance of payments statistics, which are based on the International Monetary Fund Balance of Payments Manual (BPM5, 5th issue). The actual definition of services in the area of license fees and royalties is based on the EBOPS (Extended Balance of Payments Services) classification.

EBOPS code 266 includes international payments and incomes for authorized use of patents, copyrights, technological processes, industrial models, created originals or prototypes based on license contracts. Note: does not include the purchase and sale of these rights (EBOPS code 640).

In the case of an international comparison, code 266 also includes data for incomes and payments related to the use of copyright rights, and therefore the data for international comparison are not comparable with the LIC 5-01 results, which only focus on the value of received or paid license fees for provided or acquired industrial rights.

Detailed information is available at: http://www.czso.cz/csu/redakce.nsf/i/licence

Methodological notes to Chapter D

Survey of innovation activities of enterprises

The statistical survey on the innovation activities of enterprises (TI200X) is a selective statistical investigation conducted by the CZSO in order to gather internationally comparable statistical information to determine the quantitative and qualitative characteristics of the innovation environment in the business sector of the Czech Republic. This survey was conducted for the first time in the Czech Republic in 2001, then again in 2003, 2005, 2006, 2008 and 2010. The frequency of this survey is currently set at two years with a three-year reference period. The last survey, conducted in 2010 (TI2010), monitored the 2008-2010 period and was conducted via the harmonized CIS 2010 (Community Innovation Survey 2010) questionnaire for EU Member States.

This survey is conducted according to Commission Regulation (EC) No 1450/2004 of 13 August 2004, implementing Decision No 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on innovation. The survey thus fully respects the principles of the EU and OECD listed in the Oslo Manual (OECD 2005). The national legislation framework for the area of innovation support from public resources is stated in Act No 211/2009, on support of R&D, which defines technical innovation. The document Innovation Strategy of the Czech Republic 2004 includes all basic definitions of innovation and an evaluation of the Czech Republic's innovation environment.

The characteristics gathered from this survey include:

- General information about the monitored enterprise (turnover, number of employees)
- Product innovation
- Process innovation
- Marketing innovation
- Organizational innovation
- Source of funding of innovation projects
- Innovation cooperation
- Barriers to innovation activities
- Other information regarding e.g., knowledge management, ecological innovation, human resources in innovation, purchase and sale of licenses, registration of utility models, etc.

The investigated characteristics are classified as follows:

- According to CZ-NACE (two-digit)
- According to company size (number of employees)
- According to regional classification (CZ-NUTS 3).

<u>Important definitions of the TI survey</u>

Reporting units – economic entities from the business sector from selected areas of industry and services (financial and non-financial) with at least 10 employees, which have been selected from all economic entities registered in the RES through a combination of global and stratified random sampling in appropriate fields with adjustment for the CZ-NUTS 2 regional dimension.

Note: Within the TI2010 survey a total of 6 229 questionnaires were sent with an 83% return rate. The data gathered through the survey were calculated to the whole basic set with the application of mathematical-statistical methods.

Innovation – represents the implementation of a new or a significantly improved product (goods or services) or process, a new marketing method or a new organizational method into business practice, workplace organization or external relations.

Innovation has to meet the following criteria:

a) To be designated as an innovation, a product, process, marketing or organizational method must be new (or significantly improved) for the enterprise. This includes products, processes and methods that enterprises are the first to develop and those that were adopted from other enterprises or organizations.

b) The common trait of any innovation is that it had to be implemented. A new or improved product is considered implemented if it was placed on the market. New processes, marketing methods or organizational methods are considered implemented at the time they are actually used in the operations of an enterprise.

Innovating enterprise – according to the updated Eurostat methodology of 2010, innovating enterprises are those that in the selected period implemented a product or process innovation, or had innovation activities (technical innovations) running or interrupted, or had implemented a marketing or organizational innovation (non-technical innovations). Starting with the CIS 2008 survey, the non-technical innovations have been made equal to technical innovations.

Chart of innovating enterprises:

1) Enterprises with technical innovations
    a. Product innovations
    b. Process innovations
    c. On-going or interrupted innovation activities
2) Enterprises with non-technical innovations
    a. Marketing innovations
    b. Organizational innovations

A product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, software, user friendliness or other functional characteristics. Unlike a process innovation they are directly sold to customers.

A process innovation is the implementation of a new or significantly improved production or delivery method. This includes significant changes in technology, equipment and/or software and distribution systems. These also include a reduction in the threat to (burden on) the environment or safety risks.

A marketing innovation is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

An organizational innovation is the implementation of a new organizational method in an enterprise’s business practices, workplace organization or external relations with the goal of improving the innovation capacity of the enterprise or its performance characteristics.

Detailed information is available at: *http://www.czso.cz/csu/redakce.nsf/i/statistika_inovaci*

G.2 Manuals, metadata, regulations and classifications to science, technology and innovation statistics

Organisation for Economic Co-operation and Development (OECD) - manuals

Frascati Manual 2002: Proposed Standard Practice for Surveys on Research and Experimental Development
http://www.oecd.org/document/6/0,3343,en_2649_34451_33828550_1_1_1_1,00.html

Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition
http://www.oecd.org/document/23/0,3343,en_2649_34273_35595607_1_1_1_37417,00.html

OECD Patent Statistics Manual (2009)
http://www.oecd.org/document/29/0,3343,en_2649_34409_42168029_1_1_1_1,00.html

Canberra Manual 1995: Manual on the Measurement of Human Resources devoted to S&T
http://www.oecd.org/dataoecd/34/0/2096025.pdf

TBP Manual 1990: Proposed standard method of compiling and interpreting. Technology Balance of Payments data
www.oecd.org/dataoecd/35/13/2347115.pdf

OECD Handbook on Economic Globalisation Indicators
http://www.oecd.org/document/44/0,3343,en_2649_34443_34957420_1_1_1_1,00.html

European communities Statistical Office (EUROSTAT) - metadata

Statistics on research and development
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/rd_esms.htm

Government budget appropriations or outlays on R&D statistics
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/gba_esms.htm

Community innovation survey
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/inn_esms.htm

High-tech industry and knowledge-intensive services statistics
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/htec_esms.htm

Patent statistics
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/pat_esms.htm

Statistics on Human Resources in Science & Technology
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/hrst_st_esms.htm

European Union regulations

Decision No 1608/2003/EC of the European Parliament and of the Council of 22 July 2003 concerning the production and development of Community statistics on science and technology
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003D1608:EN:HTML

COMMISSION IMPLEMENTING REGULATION (EU) No 995/2012 of 26 October 2012 laying down detailed rules for the implementation of Decision No 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on science and technology.
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:299:0018:0030:EN:PDF
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:299:0018:0030:CS:PDF

Classification

FOS (Field of Science and Technology Classification, 2002 version) – Science and Technology
http://www.oecd.org/dataoecd/36/44/38235147.pdf

NABS – Nomenclature for the analysis and comparison of scientific programmes and budgets
http://www.czso.cz/csu/redakce.nsf/i/metodika_ulohy_gbaord

IPC (International Patent Classification)
http://www.wipo.int/classifications/fulltext/new_ipc/
http://www.upv.cz/cs/publikace/tridniky/tridnik-vynalezy.html

ISCED 97 (International Standard Classification of Education)
http://www.uis.unesco.org/ev.php?ID=7433_201&ID2=DO_TOPIC
http://www.czso.cz/csu/klasifik.nsf/i/mezinarodni_standardni_klasifikace_vzdelavani_isced_

ISCO-08 (International Standard Classification of Occupations) (CZ-ISCO)
http://www.ilo.org/public/english/bureau/stat/isco/index.htm
http://www.czso.cz/csu/2010edicniplan.nsf/p/0011-10

ISIC (International Standard Industrial Classification)
http://unstats.un.org/unsd/cr/registry/regct.asp?Lg=1
http://www.czso.cz/csu/klasifik.nsf/i/klasifikace_ekonomickych_cinnosti_(cz_nace)

G.3 CSO outputs science, technology and innovation statistics

Web pages

Research and development
http://www.czso.cz/csu/redakce.nsf/i/statistika_vyzkumu_a_vyvoje

Government budgetary expenditure and research and development subsidies
http://www.czso.cz/csu/redakce.nsf/i/statni_rozpoctove_vydaje_a_dotace_na_vyzkum_a_vyvoj_gbaord

Human resources in science and technology
http://www.czso.cz/csu/redakce.nsf/i/lidske_zdroje_ve_vede_a_technologiich

Students and graduates of tertiary education
http://www.czso.cz/csu/redakce.nsf/i/studenti_a_absolventi_terciarniho_stupne_vzdelavani

Innovation
http://www.czso.cz/csu/redakce.nsf/i/statistika_inovaci

Patents
http://www.czso.cz/csu/redakce.nsf/i/patentova_statistika

Licences
http://www.czso.cz/csu/redakce.nsf/i/licence

Bibliometrics
http://www.czso.cz/csu/redakce.nsf/i/bibliometrie

Technology balance of payments
www.czso.cz/csu/redakce.nsf/i/technologicke_platebni_bilance_zahranicni_obchod_s_technologickymi_sluzbami

Publications

CSO publications are freely available at the appropriate link or may be purchased in the CSO store or from objednavky@czso.cz.

Statistical yearbook of science, technology and innovation; code 1005-10
http://www.czso.cz/csu/2010edicniplan.nsf/p/1005-10

Research and development indicators for 2012; code 9601-13
http://www.czso.cz/csu/2013edicniplan.nsf/publ/9601-13-r_2013

Innovation activities of enterprises in the Czech Republic in the years 2008 to 2010; code 9605-12
http://www.czso.cz/csu/2012edicniplan.nsf/publ/9605-12-n_2012

Licences in the Czech Republic in 2012; code 9607-13
http://www.czso.cz/csu/2013edicniplan.nsf/publ/9607-13-r_2013

Government budgetary expenditure and research and development subsidies (GBAORD) in the Czech Republic; code 9611-13
http://www.czso.cz/csu/2013edicniplan.nsf/publ/9611-13-r_2013

Other publications containing sections relating to science, technology and innovation

Statistical yearbook of the Czech Republic 2013 - Section 22. Science and Research; code 0001-13
http://www.czso.cz/csu/2013edicniplan.nsf/publ/0001-13-r_2013

Regional yearbooks - Section 19. Science and Research
http://www.czso.cz/csu/edicniplan.nsf/aktual/ep-1#10a

Focus on Women and Men 2013 - Section 8. Science and Technology; code 1413-12
http://www.czso.cz/csu/2012edicniplan.nsf/publ/1413-13-r_2013

G.4 Supplementary tables

Complete supplementary tables are published exclusively in electronic form at www.vyzkum.cz.

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Main macroeconomic indicators - CR

Tab.0.1a	Population, GDP, public budget, foreign trade and prices
Tab.0.1b	Labour market
Tab.0.1c	Education, science and research

Main macroeconomic indicators - international comparison

Tab.0.2	GDP per inhabitant in purchasing power standards (PPS)
Tab.0.3	Growth rate of real GDP
Tab.0.4	Labour productivity per person employed
Tab.0.5	Government (public) debt
Tab.0.6	Direct foreign investment
Tab.0.7	Rate of inflation
Tab.0.8	Comparative price levels

A.1 Cooperation between sectors in the field of R&D in the Czech Republic during 2012

A.2 Direct support for research and development from the state budget - CR

A.2 Direct support for research and development from the state budget - international comparison

A.3 Indirect support for R&D from the state budget - CR

SECTION B HUMAN RESOURCES FOR RESEARCH AND DEVELOPMENT

Section B.1 Employees in research and development - CR

Section B.1 Employees in research and development - international comparison

Section B.3 University education - CR

Section B.3 University education - international comparison

SECTION C RESULTS OF RESEARCH AND DEVELOPMENT

C.1 Bibliometrics

C.3 Patents, utility models and licensing