SECTION OF DEPUTY
PRIME MINISTER
FOR THE SCIENCE,
RESEARCH AND INNOVATION

**Government of the Czech Republic**


# Analysis of the Existing State of Research, Development and Innovation in the Czech Republic and a Comparison with the Situation Abroad in 2015

# SUMMARY

SECTION FOR THE SCIENCE, RESEARCH AND INNOVATION | 2016

# INTRODUCTION

The material for an analysis of the state of research, development and innovation in the Czech Republic and comparison with situation abroad for 2015 (the "Analysis" is submitted annually by the Research Development and Innovation Council in accordance with Section 35(2)(g) of Act 130/2002, on Support for Research, Experimental Development and Innovation from Public Funds, and a change to an amendment to certain other laws, (the Act on Support for Research, Experimental Development and Innovation), as amended. The author of the Analysis is the Science, Research and Innovation Section.

In compliance with the government's plan for non-legislative tasks, the Analysis was submitted to the government on 9. 1. 2017, and taken by the latter under consideration. The full version of the document is available for download at the **www.vyzkum.cz** website.

The material represents the result of a systematic analytical approach to the processing of comprehensive information on the research, development and innovation (RDI) system in the Czech Republic, which subjects the data obtained to a thorough analysis, maps and describes contexts, detects trends and presents recommendations. The Analysis presents a detailed, objective and critical evaluation of the current situation in the area referred to. It reveals the potential and options for improving the current situation on the basis of and interpretation of information from own sources and Czech Statistical Office data. From the processing perspective, the material is the most up-to-date document analysing CZSO data from the research, development and innovation area for 2015, published at the end of October 2016. However, the material also points out the limits of analytical activity relating to the availability of certain source of data and in this respect proposes optimisation steps.

Based on a careful evaluation of many indicators, the analysis reveals the strong and weak aspects of the RDI system and proposes certain measures leading to their long-term stabilisation.

**POLARITY OF THE RESEARCH, DEVELOPMENT AND INNOVATION SYSTEM IN THE CZECH REPUBLIC:**

**Strong aspects of the research, development and innovation system in the Czech Republic:**

- Qualified human resources and a strong academic background.
- A background of developed research infrastructure.
- The high economic potential of the Czech Republic.
- A high-quality culture of publication activity and a gradually developing internationalisation with the potential for excellence in certain fields.
- High volume of EU resources which can be used for RDI system development.

**Weak aspects of the research, development and innovation system in the Czech Republic:**

- Complexity and fragmentation of the funding system.
- Apparently positive position of the Czech Republic in international terms, caused by temporary funding from European sources which will terminate after 2023.

- Private RDI system expenditure is incurred primarily in the private sector which means a low level of co-operation efficiency of the public and private sectors in this area.

- Shortcomings in the results evaluation system. The current evaluation system favours basic undirected research, the result of which is an improvement in publication activity but at the same time a low level of collaboration with the private sector.

- Inadequate use of human resources and infrastructure to perform beneficial applied research.

- Inadequate coordination of national and European resources.

- A significant reduction in European resources after 2023 will cause a marked reduction in public resources, in the extreme case of up to approx. 0.3% of GDP. These missing resources can be partially replaced from national public funds, the remainder will need to be made up from private funding. The only possible long-term solution to the problems of the RDI system at the 2023 horizon remains setting up a central authority for research and development with the competencies of a ministry and timely and materially relevant legislative support in the form of a new Act on support for research, development and innovation.

**For the needs of planned system changes in the management of research, development and innovation at national level, the structure of the document was therefore augmented with primary information of an entirely new type:**

- An analysis of the current Evaluation method for research organisations, including a detailed commentary on the points calculation and an analysis of the impact of the evaluations on the research, development and innovation system.

- The planned value and the method of funding the operation and further developments of major research infrastructure.

- A presentation of social science and humanities research and development and their benefits, as a separate topic for specific analyses.

# DOCUMENT STRUCTURE

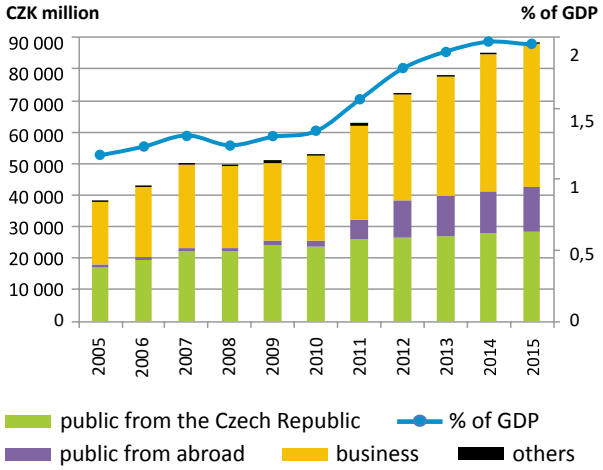
The Analysis document is divided into 11 chapters focusing on the basic components of the research, development and innovation system, in which particular attention is devoted to the key topics of their management.

1. Financial flows in research and development
2. The funding of research and development from the state budget
3. Support for research, development and innovation in the Czech Republic from European funds
4. Human resources in research and development
5. Research infrastructure and research and development centres
6. Research and development results
7. Evaluation of research organisations
8. The innovation performance of the Czech economy and international comparison
9. Branches of the national economy in relation to research, development and innovation
10. Society-wide challenges related to research and development in social sciences and the humanities
11. Data sources in RDI

## FINANCIAL FLOWS IN RESEARCH AND DEVELOPMENT

In 2015 gross expenditure on research and development (GERD) in the Czech Republic exceeded CZK 88 billion which represents 1.95% of gross domestic product (GDP). The GERD share of GDP in 2015 did in fact fall slightly for the first time since 2008, but in absolute terms it has grown over the long-term. Research and development expenditure has in recent years in fact grown markedly faster than the number of people working in this area. In R&D funding, business sources have grown the most intensively; over the last four years these have exceeded all other funding sources for research and development.

**Total research and development expenditure**




*Source: CZSO*

*The category "Others" is made up of the income of universities and non-profit institutions not from the state budget, the business sector or from abroad.*

The target in terms of annual investment of public funds into research and development at the 1% of GDP level, set for itself by the Czech Republic in the Europa 2020 strategy document, is met thanks to the contribution from EU structural funds, which make up approx. 0.3% of GDP. And above all it is thanks to support from European structural funds that the Czech Republic achieves the European average in an international comparison, both in terms of overall R&D expenditures, as well as on the basis of public expenditure. Concerning the investment of public funds into research and development, the Czech Republic appears in a group which includes countries with strong economies, such as the Netherlands, Belgium and France. The Czech Republic has even come ahead in research and development expenditure of Great Britain, Norway and Ireland.

In 2017 it is to be expected that the proportion of R&D expenditure from domestic public funds will reach 0.7% of GDP, to which has contributed significantly the already approved and historically highest national RDI budget for 2017 (Act No 457/2016, on the Czech Republic state budget for 2017). In connection with the slow start to the new programme period, in the statistical data for 2016 there will however be a clear and distinct decline in foreign public funds for R&D. The growth in R&D expenditures from business sources stopped in 2015 and a slight decline in its relative share is taking place. From a long-term perspective going beyond 2023 one may therefore consider it a failing that business sources are once more almost exclusively being used to finance R&D in the business sector. Similarly, support for public research and development from domestic business sources is very weak, totalling CZK 1.4 billion in 2015 for both the university and government sectors.

The business sector in the Czech Republic is supported both directly by public funds (CZK 3.2 billion in 2015) and indirectly in the form of tax deductible items against corporation tax (CZK 2.3 billion in 2014). This indirect support is mainly used however by large companies. The financial flows of public funds towards companies significantly outweigh the funds going from companies to research organisations of a public nature (universities, Czech Academy of Sciences institutes), so that an imbalance is being established in the distribution between sectors of individual sources of finance. Such a state is the consequence of the inadequate coordination of research and collaboration of companies with the public sector. A certain improvement can however be seen in the growing share of domestic company funds in the university sector's expenditure on R&D (a year-on-year increase of CZK 0.5 billion).

## THE FUNDING OF RESEARCH AND DEVELOPMENT FROM THE STATE BUDGET

Public domestic sources intended for the implementation of research, development and innovation in the Czech Republic are made up primarily of the state research, development and innovation budget, which in 2015 was CZK 26.9 billion Arranging for the preparation of a draft of state budget expenditure and for a medium-term outlook falls within jurisdiction of the Research, Development and Innovation Council. The draft is structured into the 11 budget chapters: Ministry of Education, Youth and Physical Education; Czech Academy of Sciences; Ministry of Industry and Trade; Ministry of Health; Ministry of the Interior; Ministry of Defence; Ministry of Agriculture; Ministry of Culture; the Czech Republic Grant Agency; the Czech Republic Technology Agency and the Office of the Government of the Czech Republic.

Four different working groups shared in the development of the draft budget for 2015, coordinated by the Science, Research and Innovation Section of the Office of the Government of the Czech Republic. The members of the working groups are representatives of the ministries and agencies, with representation in addition for departments which do not have research, development and innovation expenditure in their budget chapters, as well as representatives of selected research and development centres. Seven financial instruments of varying kinds are used for the distribution of state budget funds in accordance with the Act on supporting research, experimental development and innovation.
Institutions conducting research and development are funded from multiple sources, with the share of earmarked financial instruments predominating in the long term over the institutional, including in the public sectors (government and university).

Institutional support is mainly provided in the Czech Republic by the Ministry of Education, Youth and Physical Education (in 2015 it assigned approx. CZK 6.6 billion to universities) and the Czech Academy of Sciences (CZK 3.2 billion in 2015 for Czech Academy of Sciences Institutes).

Earmarked support is provided mainly by the Czech Republic Grant Agency (being used principally by universities and Czech Academy of Sciences Institutes), the Czech Republic Technology Agency (with support going mainly to companies and universities) and the Ministry of Education, Youth and Physical Education (which allocates most support to universities). Earmarked support for other departments in addition to organisations set up by them is also successfully used by universities.

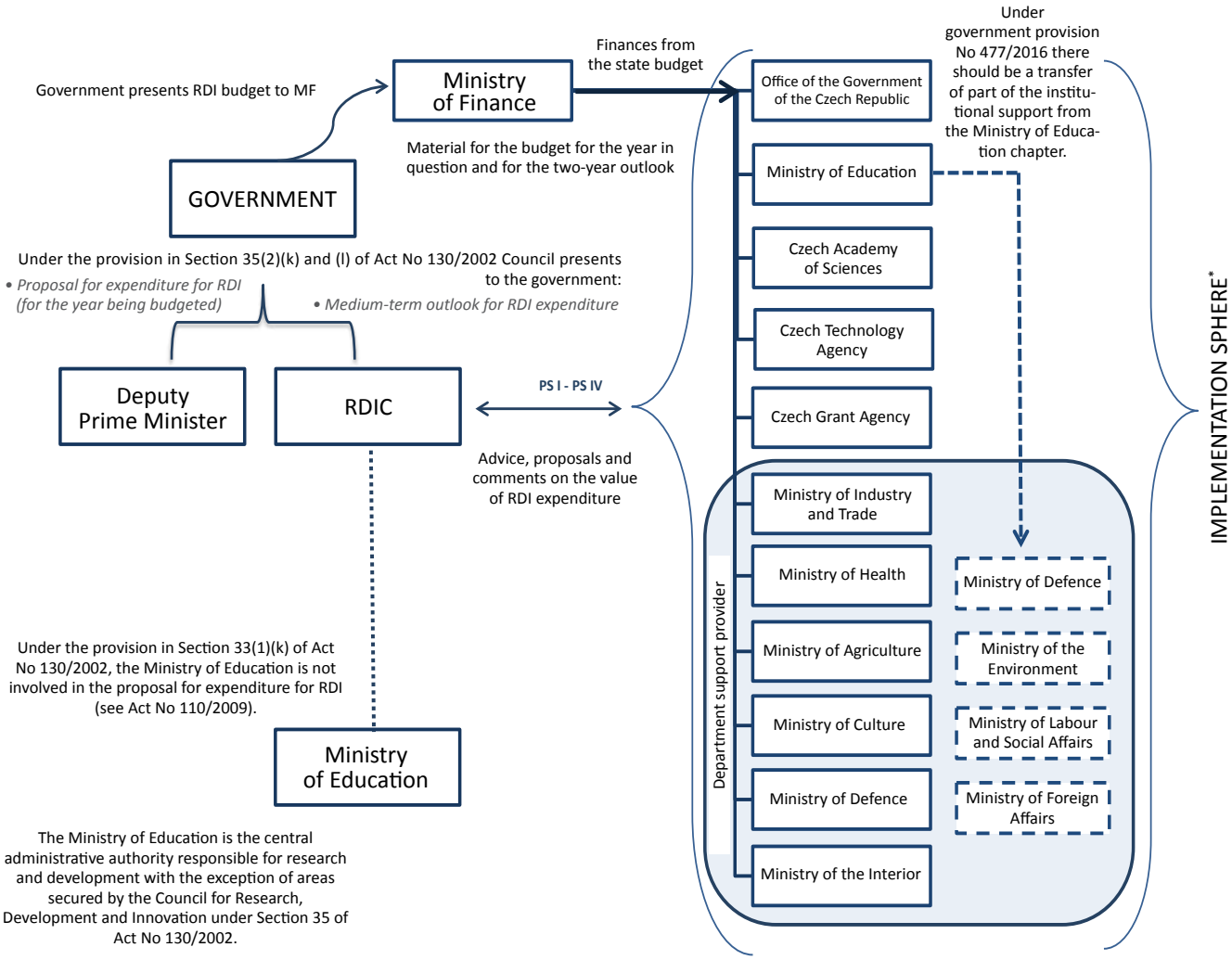
The state budget support system is fragmented because of the large number of providers and financial instruments.

From the perspective of fields of study, earmarked support in the Czech Republic goes mainly to Industry, the Social Sciences and Humanities, Biosciences and Medical Sciences (in 2015 the support for each of these exceeded CZK 1 billion).

Of the individual science fields the most supported were the biology fields of Genetics and Molecular Biology, of the industrial fields, it was Electronics and Optoelectronics, Electrical Engineering; Non-nuclear energy, of the social sciences and humanities Documentation, Library Science, information studies; Art, Architecture, Cultural Heritage and of the medical fields Oncology and Haematology.

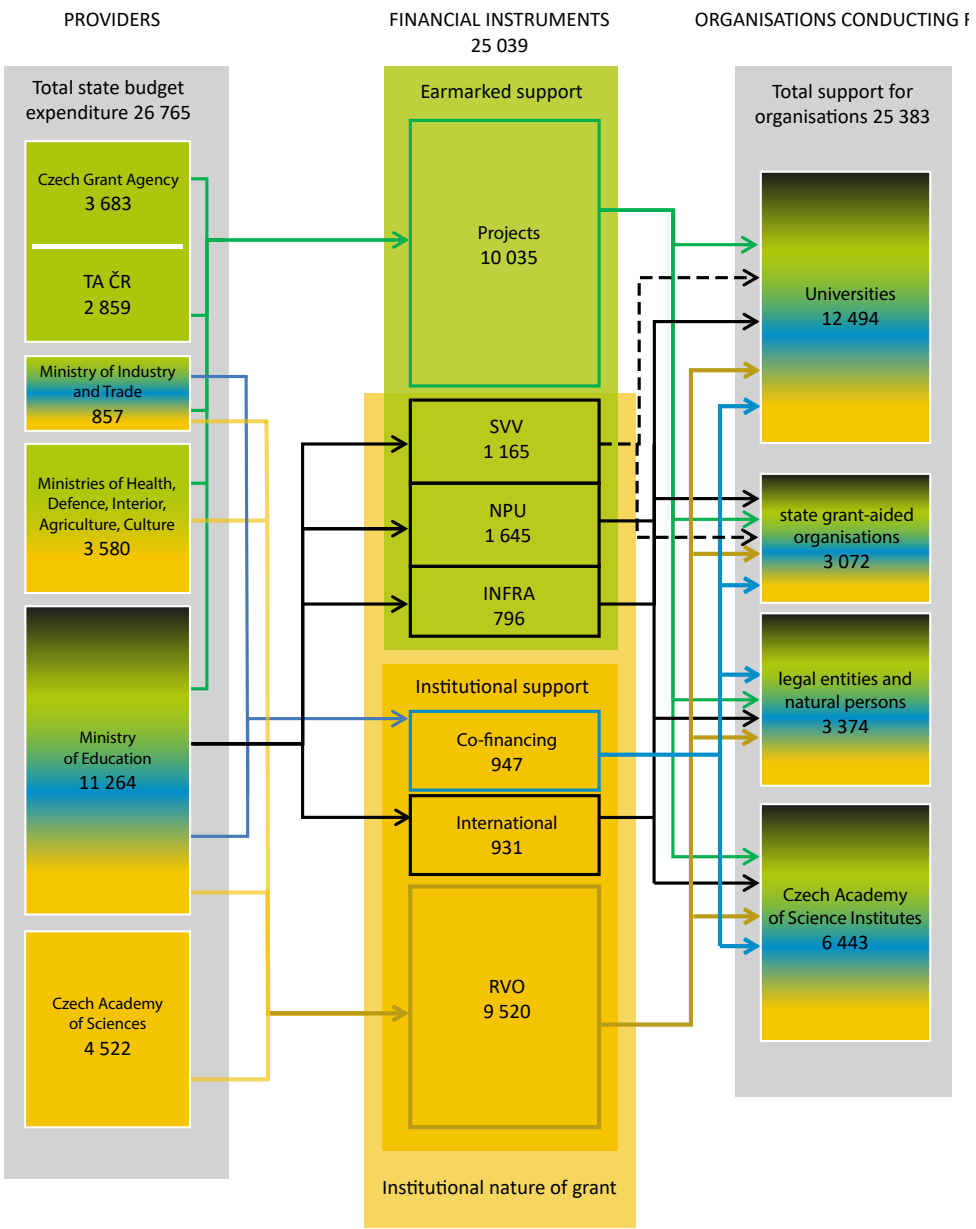
Currently, institutional support cannot be analysed reliably by field because of a lack of data on distribution within organisations, and within universities in particular.

**Chapter responsibility, role of central authority and financial flows (without European financial sources and their co-financing from the state budget**




*RDI organisations, infrastructure, direct users of applied research

## Chart of RDI funding methods from the state budget, with value of funds expended in 2015




*Finances are given in CZK million, without the Office of the Government of the Czech Republic chapter.* | *The sizes of the fields in the chart do not correspond exactly to the financial values.* | *The funds in the right-hand column (organisations conducting RDI) do not contain:*

- *finances intended for co-financing of EU SF projects of the Ministry of Industry and Trade provider (approved to a total value of CZK 350 million) since the data were not put into the RD&I IS by the Ministry of Industry and Trade, in spite of the fact that this an obligation on a provider pursuant to Section 31 of the Act on support for research, development and innovation.*
- *finances intended for fees for the Czech Republic's involvement in international R&D programmes and for membership of international R&D organisations (to a total value of CZK 913 250 thousand), since they were paid out directly to the international organisations from the Ministry of Education and Ministry of Defence chapters.*

*SP – state grant-aided organisation, organisational units of the state and public research institutions outside Czech Academy of Sciences Institutes.*
*PF – legal entities and natural persons outside the universities, SP and Czech Academy of Sciences Institutes.*

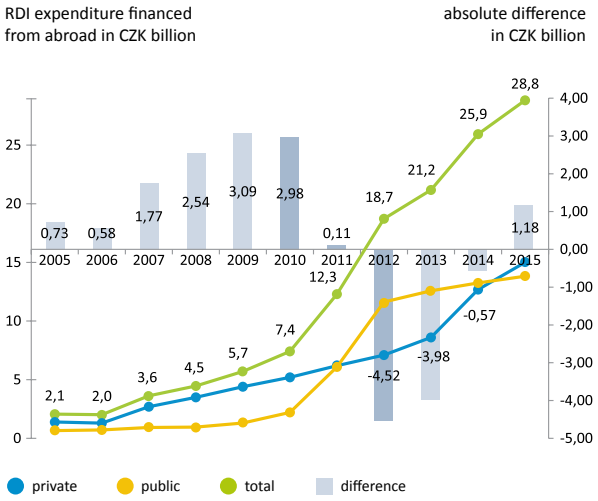
## SUPPORT FOR RESEARCH, DEVELOPMENT AND INNOVATION IN THE CZECH REPUBLIC FROM EUROPEAN FUNDS

Public foreign funds represent a major component of research and development financing in the Czech Republic (almost CZK 13.25 billion in 2014 and CZK 13.82 billion in 2015). In 2015, when the draw-down of EU structural fund funds within the 7th programme period ceased, there was a significant slow-down in the growth trend of public funds from abroad.

In selected areas of support for five Operational Programmes with a direct link to research, development and innovation, decisions were issued up to the end of 2015 on 3 546 projects with a financial value of CZK 95.18 billion The greatest share of support (a total of CZK 56.26 billion) were jointly for the Research and Development for Innovation Operational Programme (OP RDI) and the Education for Competitiveness Operational Programme (OP EC), followed by the Enterprise and Innovation Operational Programme (CZK 33.99 billion).

The National Policy on Research, Development and Innovation for 2016–2020 is the umbrella strategic document for research, development and innovation. Subject to it is the Czech Republic National Research and Innovation Strategy for Intelligent Specialisation (RIS3), an update of which was approved by the government and then by the European Commission in 2016. This is intended for efficient targeting of financial funds on areas which have been established as being of strategic significance. In order to secure its correct implementation an Entrepreneurial Discovery Process (EDP) was initiated, targeting the linkage of state budget and EU structural funds funding to specific topics.
Of the approved budget of the Horizon 2020 EU Framework Programme for Research, Development and Innovation, which is more than EUR 77 billion, the Czech Republic has so far accessed financial support to the value of approx. EUR 84 million, with an overall project success rate of 12.3%.

**Expenditure on research and development from foreign sources in the Czech Republic, 2005–2015 (in CZK billion)**




*Source: CZSO*

## HUMAN RESOURCES IN RESEARCH AND DEVELOPMENT

Human resources for research and development are of key significance, as demonstrated by the quantity of accumulated statistical data. However there is a lack of data on the labour market for research and development and on employee turnover.

At the end of 2015 more than one hundred thousand (100.1 thousand) people were working in the Czech Republic in R&D, pursuing research and development either in full or in part as part of their employment. In comparison with the preceding year this was growth of 2.9%. The majority of employees is made up of researchers (approx. 55%), followed by technical staff (approx. 30%) and other staff (15%).

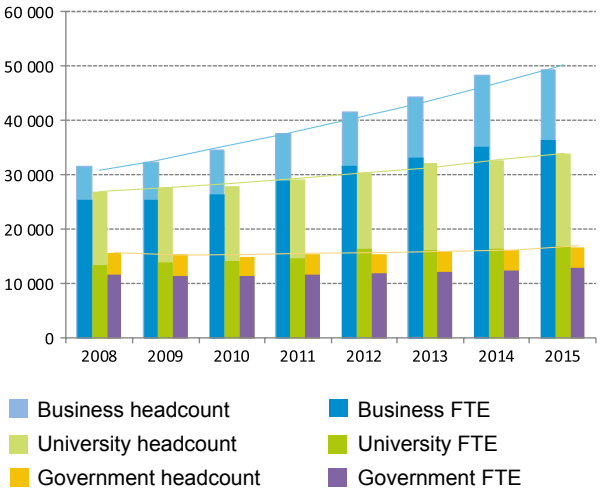
The largest number of employees in R&D is reported by the business sector (with an almost 50% share of overall employment in R&D), with the most research staff working in the university sector (24 thousand in 2015). In an international comparison of the number of employees in R&D per thousand of the population, the Czech Republic comes close to Belgium and France, where a slight excess of staff in the business sector over the public (university and government) sectors is also apparent, just as in the Czech Republic.

The number of researchers in the Czech Republic has grown over the last few years in the university and business sectors, but has on balance stagnated in the government sector. The university sector is clearly dominated by researchers with doctorates (67% in 2015), whereas in the business sector researchers with doctorates make up only about 10% of the total number of researchers and their proportion is not increasing significantly.

In the technical and natural sciences there is a markedly higher relationship between the number of currently employed researchers and the number of doctoral programme students (in both cases greater than 2:1), than in the social sciences and particularly the humanities, where the number of doctoral students exceeds the number of researchers.

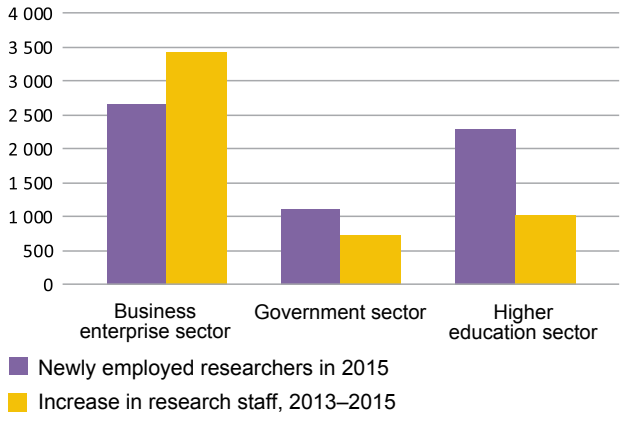
There continues to be a gender imbalance in research staff in all sectors. The largest is in the business sector, where 87% of research staff are men. The fewest women work in research in the more numerous natural and technical sciences, by way of contract the relatively highest representation of women is in the medical and social sciences within the government and university sectors.

**Number of research and development staff in the Czech Republic by sector, 2008–2015**




*Source: CZSO | Gives the recorded staff numbers and a calculation of full time employment equivalents (FTE) dedicated only to research and development. The regression curves depict the trend for recorded staff numbers*

**Changes in the numbers of research staff and new positions created in 2015**




*Source: CZSO | Shows the recorded numbers of research staff*

## RESEARCH INFRASTRUCTURE AND RESEARCH AND DEVELOPMENT CENTRES

Research infrastructure is made up of locations at which there is an effective linkage of all segments of the innovation chain and interaction between organisations involved in education, public research and the business sector, bringing about an effect in the form of high value-added goods or services.

Research infrastructure is represented by research, development and innovation centres in the Czech Republic which do not however have legal personality. In the Czech Republic, they are financed from multiple sources, from public and business, domestic and foreign funds, just like organisations performing research, development and innovation. The relatively significant quantity of research infrastructure constructed in the Czech Republic with the contribution of European money creates the potential both to improve the quality of research, development and innovation, and the competitiveness of the economy, but places high demands not only on funding but also on qualified human resources.

In the Czech Republic, unique research infrastructure is part of specialised research and development centres developed gradually since 2005, with financial support from the state. From 2005 to 2015 almost CZK 100 billion was spent on supporting four hundred projects linked to research infrastructure; of this, more than CZK 43 billion was from the state budget. The largest value of funds was aimed at organisations or parts of organisations focused on the natural sciences, technical sciences and medical sciences.

Resources from the EU structural funds served as the largest source of funding for building and initial development of research and development centres, in particular the Research and Development for Innovation Operational Programme (OP RDI), with the further development of these centres possibly being financed through the Research, Development and Education Operational Programme (OP RDE). The operation of the most important, the so-called Major Research Infrastructure, is being supported from the state budget using financial tools defined for it, from the Chapter entitled Ministry of Education – Major Research Infrastructure Projects.

For the period 2016 to 2019, planned and approved funding for a total of 63 major research infrastructure projects comes to CZK 5.8 billion, with 58 of these projects to continue after 2016. From this amount 25% of the total allocation will support beneficiaries from universities, the Czech Academy of Sciences Institutes should receive approx. 40%, with the remaining 35% going to other beneficiaries.

For the period from 2016 to 2022, the planned total value of support from the Research, Development and Education Operational Programme for the further technological development of major research infrastructure, including essential operating costs, is approx. CZK 4.4 billion It is to be expected that drawdown by the principal beneficiaries, that is the universities, will be variable over the years, with a significant decline in drawdown by Czech Academy of Sciences beneficiaries after 2018.

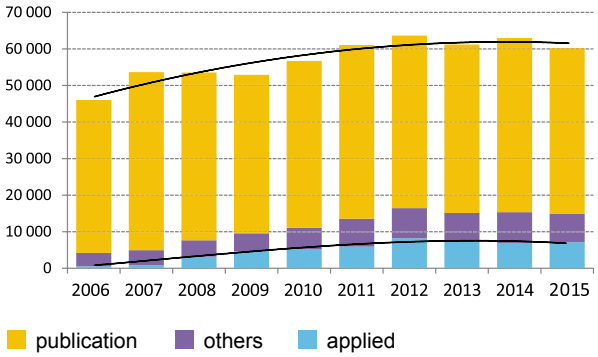
## RESEARCH AND DEVELOPMENT RESULTS

In the Czech Republic result types are defined; these are gathered centrally in a Research, Development and Innovation Information System (RD&I IS).We divide these into publication and non-publication result groups, which are then further divided into applied results and others.The generation of results in the Czech Republic shows a long-term growth trend, with approx. 60 thousand being created each year, with an increase both in published results and in the number of applied results.The peak was achieved in 2012.

The unequivocally largest number of results is generated in the Social Sciences and Humanities.These are mainly publications, the second largest group of fields in terms of the total number of results is Industry.The largest share of the number of results in individual groups of fields is reported by the universities, principally in technical and natural sciences.However over the long term we have recorded a low share of applied results in relation to the overall number of results (currently just under 12%).Moreover, there are very few patents within the applied results.The highest proportion of applied results in relation to the total number is reported by the industrial fields, but even here it does not reach 50%.

From the perspective of publication and its quality there is a clear increased in the proportion of publications in periodicals indexed in the Web of Science. The greatest number of such publications is reported by the universities, and the highest ratio in relation to other publications by the Czech Academy of Sciences Institutes.The greatest number of high-quality works of this kind is generated in the fields of Biological Sciences, Chemical Sciences, Physical Sciences and Astronomy, and Clinical Medicine.In addition, published contributions in Clinical Medicine and in Physics and Astronomy are significantly more cited in comparison with the global average.

**The numbers of publication, applied and other types of results in the Czech Republic, 2006–2015**




*Source: RDI IS, database as at 31.5.2016, data export 18.11.2016*
*The result numbers for 2015 are not final, since at the time of preparation the verification and elimination process had not been completed. The final results number will probably differ only slightly, by single % points.*

From the perspective of international collaboration, in the measured numbers of collaborative publications the Czech Republic fluctuates around a level comparable for example with Germany and Slovenia. It comes slightly ahead of Italy and Spain, but falls some way behind countries such as Denmark, Belgium, Austria and Switzerland. Most joint publications are created by Czech scientists in collaboration with US, Germany, French and British colleagues.

So far, there has not been a satisfactory resolution of result quality evaluation and its relationship to the provision of state budget funding to organisations which have generated them, particularly in applied research. The benefits of applied research and experimental development are not quantified.

## EVALUATION OF RESEARCH ORGANISATIONS

In the Czech Republic, the Research Development and Innovation Council is responsible for the preparation of the evaluation methodology and its implementation. In the Czech scientific environment, there has for over ten years been an evaluation of research organisations based exclusively on results; this however does not take into account the differences in roles and mission of individual organisations, nor the differences in financing methods. It is precisely this kind of evaluation of individual results, based on bibliometric data, their points assessment and their subsequent transfer to financial amounts on a cross-multiplication basis, that has ruled since 2010 on the allocation of support on the long-term conceptual development of research organisations.

In 2013 the evaluation methodology was modified. This modification consists of three pillars, but still makes use of machine (automatic) calculation, simply with modified inputs. The first pillar introduces as an input peer-review for certain scientific fields and result types, but is however inappropriately set up. The second pillar gives organisations a points bonus based on a panel evaluation of a small number of their best results. The third pillar is based predominantly on an evaluation of financial inputs. The evaluation methodology works with an a priori points allocation for groups of scientific fields and introduces a specifically Czech indicator – corrected Results Information Index points. It is however constructed on confusing, often mathematically unsuitable and ambiguously defined calculations. For these reasons, it is not transparent and public audit of it is very difficult.

In the evaluation, a specific division into fields in the Czech Republic is used; this does not correspond to the international standards currently in use. For example, unusual attention is paid to the natural sciences, and a markedly different structure is demanded by the Social Sciences and Humanities.

## THE INNOVATION PERFORMANCE OF THE CZECH ECONOMY AND INTERNATIONAL COMPARISON

Simple indicators or indicators composed of several dozen sub-indicators are used for the assessment of the innovation performance of the economy. Based on the knowledge intensity derived from the overall research and development expenditure, the Czech Republic is ahead of countries such as Poland and Hungary, but trails significantly behind the stronger economies of Germany and Austria. A more credible comparison is provided by the compound indicators, of which the most respected are the Summary Innovation Index (SII), the Global Innovation Index (GII) and the Innovation Output Indicator (IOI). <0} These indicators differ between them particularly in their approach to investment by the public sector in research, development and education.

Based on the compound SII indicator, EU Member States are divided into four groups according to the level of innovation in their economies - Innovation Leaders, Innovation Followers, Moderate Innovators, and Modest Innovators. According to this indicator, the Czech Republic belongs to the „Moderate Innovators" group. The Czech Republic is at a comparable level to Italy, but trails significantly behind Sweden, Germany, Denmark, the Netherlands, Belgium and Austria. Based on year-on-year growth a significant improvement in the Czech Republic's position is not be expected, nor a move into the higher „Innovation Followers" group, e.g. to the level of Austria.

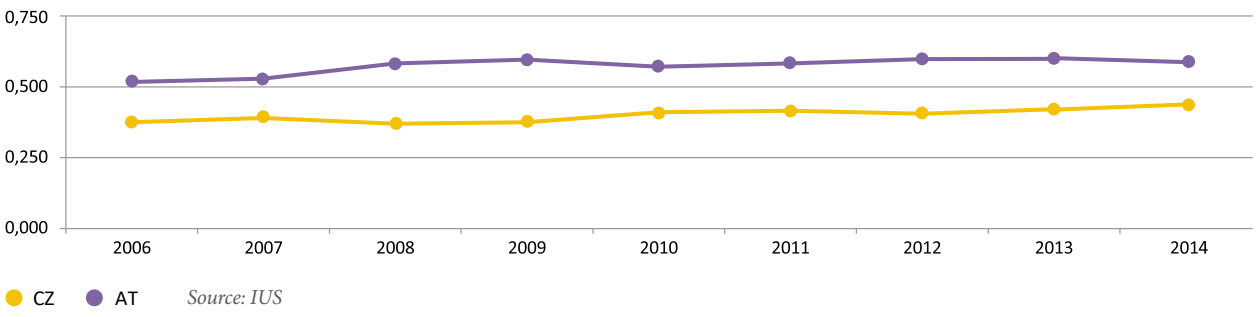
The Czech Republic trails behind Austria particularly in risk capital investment, the number of international patents and in collaboration between innovating small and medium-sized companies. In contrast, expenditure on research and development (both public and business) is growing rapidly in the Czech Republic.

According to the GII in 2015 the Czech Republic placed 24th among 143 countries (in 2014, 26th). In the component pillars of the GII the Czech Republic achieved a relatively high position in environmental sustainability, in trade and competition, import of high-end technology without re-imports, in knowledge and technology outputs and in creative goods and services. Weak points can be seen in investment, in the use of the Internet for communication with the public, in the number of female employees with higher education, and in the possibilities for facilitating entrepreneurship and market capitalisation.

According to the IOI indicator the Czech Republic achieves one-third to one-half lower values than countries which regularly place in the leading places in the innovation and competitiveness rankings. Of the IOI sub-indicators the Czech Republic exceeds the European average and the level of Austria in the innovativeness of growing companies and in the export of high-tech and medium-tech goods. In contrast, it is most markedly behind in the number of international patent applications.

From 2012 to 2014 there were 9 063 companies in key branches in the Czech Republic, i.e. 42% of the total number reporting innovation activities. In countries with relatively high innovation performance, such as Denmark, the Netherlands, Austria and Belgium, the proportion of companies with innovation activities is higher than in the Czech Republic. Higher innovation activity is reported in the Czech Republic by companies under foreign control,

**Value of the Innovation Index in the Czech Republic and its year-on-year changes in comparison with Austria**

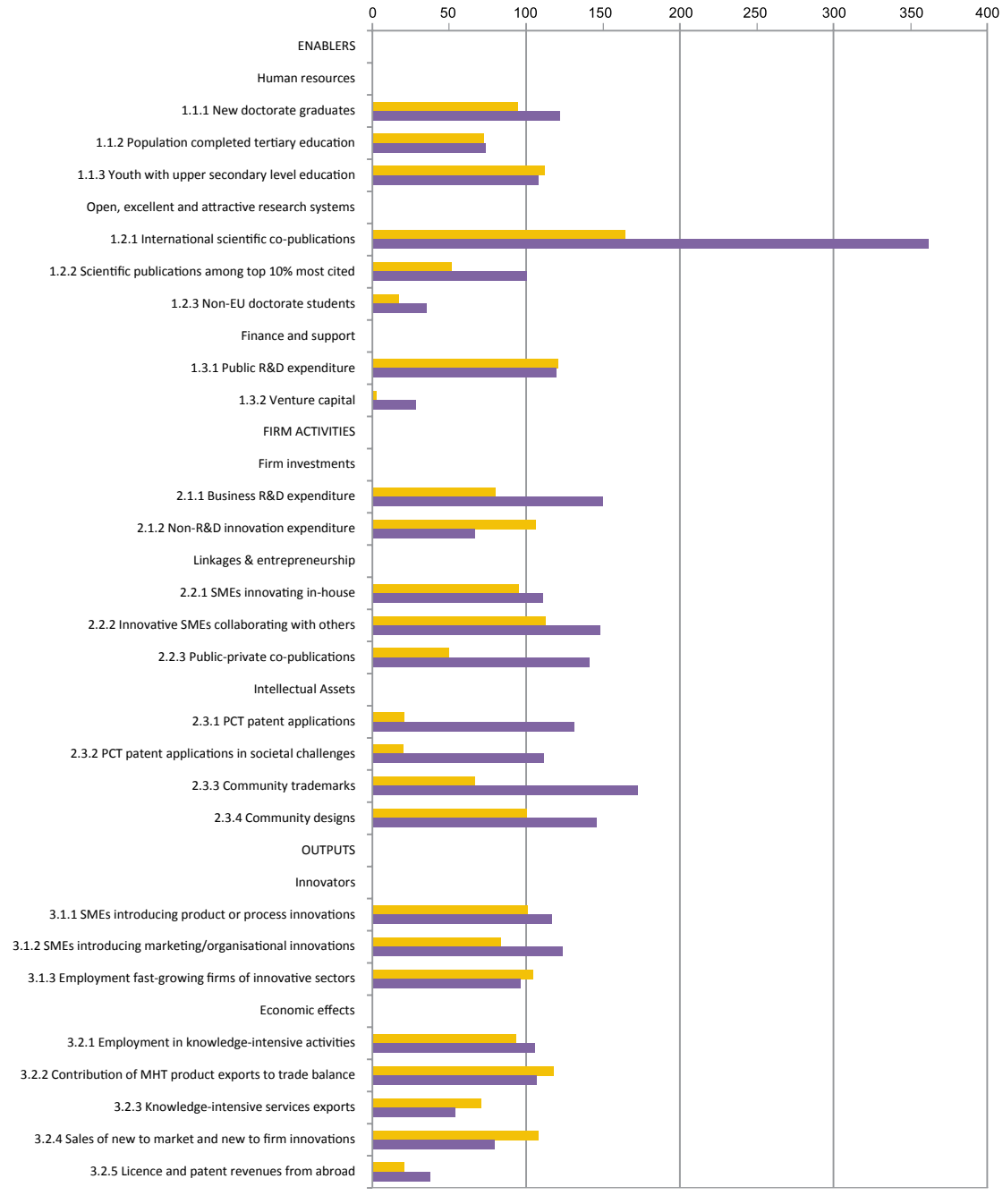



*Source: IUS*

roughly at every other foreign affiliate, whereas for domestic companies this is true in only 39% of cases.

But it continues to be true that in the majority of branches of manufacturing industry the largest share of revenue is held by unchanged or only minimally modified products. An exception to this is Manufacture of computer, electronic and optical products (NACE 26) and Manufacture of motor vehicles (NACE 29), with a relatively high share of revenue of products new to the market.

**Sub-indicators of the Innovation Index in the Czech Republic in comparison with Austria in 2014**




*Source: IUS report 2015* | *Values are expressed as a % of the EU average (100 = EU 28)*

## BRANCHES OF THE NATIONAL ECONOMY IN RELATION TO RESEARCH, DEVELOPMENT AND INNOVATION

Companies which manufacture high value added products, and which invest large amounts in their own research, development and innovation are key to the growth of the national economy and improvement in the economic level of the Czech Republic, including growth in average earnings. The main instrument for supporting them in these efforts is the document entitled The National Policy for Research, Development and Innovation (NP for RDI), which defines the fields and research topics on which applied research should focus, or more precisely the Czech Republic National Research and Innovation Strategy for Intelligent Specialisation (RIS3), which is to secure the most efficient direction of European, national and private funds to specific strategic research, development and innovation areas at a national and regional level.

On the basis of selected socio-economic parameters one can characterise the significance of a given branch of the Czech economy at national level; a more detailed analysis of these parameters in the national and the regional dimension is then contained in the Underlying analytical material to support implementation of RIS3 publication, prepared by the Office of the Government of the Czech Republic, Section for Science, Research and Innovation. Knowledge specialisation is based on information about which scientific knowledge (depending on the structure of fields) is essential for the growth of a branch, and thereby its competitiveness and improved economic benefits. From an analysis of the interventions made to date in research and development (both national and from EU structural funds) it follows that most industrial branches make use of scientific knowledge across fields of science, with the links between branches and fields of science not being susceptible to analysis only from aggregate statistical data.

As part of the work of the so-called Sector Platforms coordinated by the Office of the Government of the Czech Republic, Section for Science, Research and Innovation, an initial list was established of priorities and key research and development topics for individual sectors / branches. This list was further clarified in the National Innovation Platforms and became part of the updated RIS3, approved by the government and then later by the European Commission.

## SOCIETY-WIDE CHALLENGES RELATED TO RESEARCH AND DEVELOPMENT IN SOCIAL SCIENCES AND THE HUMANITIES

Research in the social sciences and humanities can respond to dynamic changes in man's society and environmental space at both a global and local level in social, cultural, economic, environmental and technological areas. Targeted support on the part of the state is as a consequence essential to sustain and improve the quality of life in the Czech Republic in harmony with society's economic, environmental and cultural values. Whereas the research needs of industry and other significant parts of the national economy are continuously secured and financed using the RIS3 tools, a similar platform at national level for the society-wide challenges and needs of social sciences and humanities research has hitherto not existed.

The social sciences and humanities and their benefits for society is presented in the Analysis as an independent topic which will be analysed systematically from next year.

## CONCLUSION

From looking at the basic indicators it is clear that the environment for RDI is relatively favourable. Research and development expenditure is growing, with a growth trend also for the number of research staff. The year-on-year growth in research and development expenditure was approx. 4.2% (from CZK 85.1 billion in 2014 to CZK 88.7 billion in 2015). This is an index comparable to the growth in GDP and the export of goods and services (growth from 2014 to 2015 of 4.5% and 6.2% respectively). The more detailed growth of the given indicators is shown in Table 1. The Czech Republic is a country whose economy is industrially based. A full 30% of the Czech Republic's GDP is from the industrial sector. For this reason it is significant that of the expenditure on research and development, more than 50% is from business sources (more than CZK 45 billion in 2015).

Although the level of total expenditure flowing into the science, research and innovation system in the Czech Republic is comparable with the EU average, we are significantly behind in the international patents category.

In spite of the numbers of research and development results showing a growth trends, the proportion of applied results (only 12%) remains low. Similarly, the situation in respect of collaboration between the public and private sectors is also less than encouraging.

In spite of this, based on analyses and international comparisons it can be stated that the RDI system in the Czech Republic is developing in the desired direction and in a favourable climate. The greatest threat to the RDI system remains its continuing fragmentation. Optimising the RDI system at the 2023 horizon can be achieved by setting up a central authority for research and development with the competencies of a ministry and timely and materially relevant legislative support in the form of a new Act on support for research, development and innovation. In the near future there is a need to reconfigure the evaluation system for research organisations towards a greater motivational appeal, which should as a consequence bring about a higher quality of delivered research and development and an intensification of applied research.

**Table 1: Year-on-year changes in basic macroeconomic indicators in comparison with research and development expenditure (in %)**

| | 2009/08 | 2010/09 | 2011/10 | 2012/11 | 2013/12 | 2014/13 | 2015/14 |
|---|---|---|---|---|---|---|---|
| Gross Domestic Product | | | | | | | |
| real | -4.84 | 2.30 | 2.00 | -0.80 | -0.48 | 2.72 | 4.54 |
| *in current prices* | *-2.33* | *0.81* | *2.03* | *0.65* | *0.94* | *5.26* | *5.58* |
| Export of goods and services | -9.39 | 13.57 | 9.89 | 7.43 | 1.95 | 13.05 | 6.21 |
| Total research and development expenditure | 2.01 | 4.13 | 18.46 | 15.31 | 7.59 | 9.31 | 4.18 |
| of which, business sources | -4.93 | 8.52 | 11.71 | 11.96 | 13.05 | 14.35 | 5.42 |
| of which, public sources | 9.87 | 0.58 | 25.31 | 18.49 | 3.62 | 4.20 | 2.65 |
| of which, public sources from the Czech Republic | 8.77 | -3.14 | 11.22 | 1.67 | 1.61 | 3.66 | 1.88 |

*Source: CZSO – Research and Development Indicators, National Accounts, Main Economic Indicators for the Czech Republic Year-on-year changes indexes given in %*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