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Executive Summary

Along with the socio-economic transformation of the country after 1990, the Czech research and development (R&D) system underwent a substantial size reduction. In recent years, the Czech Republic is slowly catching up with advanced European countries; however, the lag is still significant, especially in the field of R&D outcomes. The Czech Republic has a strong public research system based on a developed network of public universities and research institutes. However, one of the main weaknesses of the public research sector can be seen in a low production of commercially applicable results related to the R&D evaluation system which does not motivate researchers to cooperate with the business sector (see more on this in chapter 3.4). This problem is addressed by the R&D Reform (2008) and National Research, Development and Innovation Policy 2009-2015, which also include a new system of evaluation.
The Czech Republic's trailing behind highly developed European countries in most R&D indicators is addressed by a number of currently implemented strategy documents. Thus, R&D expenditures have been increasing as have the numbers of researchers, students and graduates even though they still have not yet reached the EU average.
The massive inflow of foreign direct investment into the business R&D sector during the past 10 years has created the conditions for the development of business R&D and knowledge intensive services. The share of S&T graduates (both masters and PhD) on the total number of university graduates exceeds the EU-27 average (Eurostat). However, they are still less numerous than graduates of social sciences and humanities and moreover, the growth of their number is much slower (Czech Statistical Office). Thus the lack of highly qualified labour force with technical research skills remains a challenge for Czech R&D system. Based on the latest economic trends, on the national innovation performance tendencies as well as on national strategic documents dealing with research, development and innovation (RDI) policy, and identified strengths and weaknesses, the following main structural challenges in the Czech national RDI system and related policy measures were identified:

- *Lack of cooperation between research and business sector* - on one hand, the Operational Programme Research and Development for Innovation (OP RDI) supports building of the infrastructure for excellent fundamental and applied research, and infrastructure for transfer of R&D knowledge. On the other, the new R&D programmes motivate enterprises to cooperate with research organisations in common projects. Also clustering activities are supported through the Operational Programme Enterprise and Innovation (OP EI);

- *Lack of availability of financial resources for improving innovation performance* - The realisation of the Reform of R&D has contributed to a clarification of the R&D support system, particularly by reducing number of R&D support providers and simultaneously by establishing the Technology Agency (TA CR) as the dominant supporter of applied research. Two programmes of the OP EI, Progress and Guarantee, serve SMEs (particularly start-ups and micro enterprises) to overcome barriers to get external financing. Both programmes are very successful in terms of a number of supported projects;

- *Insufficient use of instruments for the protection of intellectual property rights* - Among the objectives of the Reform of the RDI System is also "utilisation of R&D results in innovation processes". New R&D programmes (such as Competence Centres, Alpha) require creation of research results and also their

utilisation, thus motivating the utilisation of IPR. Also one sub-programme of the OP EI called Innovation enables beneficiaries to spent the grant on the use of IPR;

- *Lack of venture capital to support innovative business* - Utilisation of venture capital in the Czech Republic is the lowest among European countries. The situation could improve with the establishment of a seed fund (planned for 2012), operated by the Ministry of Industry and Trade and financed from the OP Enterprise and Innovation;
- *Insufficient use of public funds for R&D and innovation* - The main task to effectively solve this problem is the introduction of a complex methodology for evaluation of R&D results that would replace the current one based predominantly on quantitative indicators. The updating of the evaluating methodology has been discussed in the International Audit of Czech R&D. However, changes in the current methodology would require the consensus of all key players in the national R&D system.

Recently identified Czech policy mix routes and their recent development include the following:

1. *Promoting the establishment of new indigenous R&D performing firms* - New measures (e.g. pre-seed fund supported by the OP Research and Development for Innovation) should be launched in 2012 with the implementation of the Strategy of International Competitiveness. Tax measures to maintain the company conducting the R&D has not been extended on buying external R&D yet;
2. *Stimulating greater R&D investment in R&D performing firms* - Through the Tip programme allocates Ministry of Industry and Trade (MIT) support to companies that carry out R&D. More interest to this route has been devoted through the Alpha programme (by Technology Agency of the CR) requiring co-financing by enterprises, which is a traditional mean how to stimulate private investment to R&D. Also parts of the OP EI are relevant to this issue;
3. *Stimulating firms that do not perform R&D yet* - the TIP programme as well as the Alpha programme are open to enterprises that have never performed R&D;
4. *Attracting R&D-performing firms from abroad* - The investment incentives run under the MIT through CzechInvest Agency have recently oriented to attract more R&D intensive investments. Foreign enterprises settled in the Czech Republic are allowed to source funds from national and European programmes as well. Tax incentives for the implementation of R&D activities can be also used by foreign firms operating in the Czech Republic;
5. *Increasing extramural R&D carried out in cooperation with the public sector or other firms* - There are large support measures (such as TIP or Alpha programme) supporting co-operation of public and private research institutions and firms. Especially new programme called Competence Centres launched by the TA CR focuses on a long-term partnership of research organisations and business sector. Also large R&D infrastructures currently built through the OP RDI will require some private co-financing for their sustainable functioning;
6. *Increasing R&D in the public sector* – The utilisation of OP RDI represents significant bulk of money that could enhance R&D performed in the Czech public sector. A number of new large R&D infrastructures projects have only recently been realised, thus their real impact is not yet evident.

The Czech Republic has joined Europe 2020 initiative, and has set its national objective of investing annually at least 2.7% of GDP in R&D by 2020. The share of R&D

expenditures of total GDP (i.e. R&D intensity) grew during the last three years in spite of the economic slowdown in 2008-2009. What is more important, the R&D expenditures also increased every year in absolute figures to almost CZK60b in 2010 (e.g. €2.3b). This growth was implied by higher R&D expenditures in the business sector (except in the crisis year of 2009), in spite of seemingly growing absolute values of government budget appropriations on R&D (GBAORD). This contradiction is due to movements of the currency exchange rate. The same values in CZK would show decreases of absolute GBAORD in 2010. A clear trend of the last year is a growing share of foreign R&D investment, but there could be found two different components. While public foreign R&D expenditures were steadily growing last three years (mainly EU structural funds), and with a high probability will be in several next years, private foreign R&D expenditures decreased in 2010 due to the economic crisis (Eurostat, Czech Statistical Office).

Generally, the above-mentioned challenges, policy mix routes and measures reflect the European Research Area's (ERA) pillars and objectives. The RDI policy mix in the following years will concentrate on the support of innovative companies, RDI human resources development including the mobility issues, international as well as inter-sectoral co-operation in research, securing the sustainability of the large research infrastructures and new evaluation methodology of R&D results leading to more effective distribution of RDI funds.

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1 Introduction

The Czech Republic is a small Central European country covering 78,864 square kilometres surrounded by Germany, Poland, Austria and Slovakia. Its population counts approx. 10.5 million inhabitants, and the capital city Prague concentrates 1.3 million (Czech Statistical Office, 2011). Relatively high economic growth recorded until 2007 had been disturbed by unfavourable external economic conditions, which fully displayed in 2009 when the economy declined by 4.7% (see table in chapter 3.2). According to the Eurostat data, gross domestic product (GDP) per capita in purchasing power standards has grown to 83% of the EU-27 average until 2007, but recently dropped to 80% in a post-crisis year 2010.

In 2010, total Czech intramural R&D expenditure (GERD) amounted to CZK59b (approx. €2.3b). The increase compared to the previous year — despite the economic crisis — was 11.5 % mainly due to rising R&D expenditures in the business sector. When we look at the absolute amount of R&D expenditure in business enterprise sector (BERD), it however, decreased to €1257m in 2009 compared to €1342m in 2008, but continued growing to €1448m in 2010, and even exceeded pre-crisis year 2008. The increase in a relative figure of BERD as % of GDP has been continual since 2008 (0.87% in 2008, 0.89% in 2009 and 0.97% in 2010) due to the decrease of GDP in 2009. The same value for the EU average was 1.23% in 2010. R&D expenditure in the government sector (GOVERD) was growing continually (except the decrease in 2009) and reached €454m in 2010 (0.3 % of GDP). Accordingly, the share of government budget appropriations or outlays for R&D (GBAORD) on GDP has been also growing (to 0.69% in 2010), and is close to the EU average (0.75% in 2009). The overall R&D intensity continued increasing in the previous two years after a decrease in 2008 (to 1.41% of GDP) and reached 1.56% of GDP in 2010, slowly approaching the EU-27 average of 2% (Eurostat).

Knowledge production in the Czech Republic is strongly concentrated into the public sector represented mainly by the Academy of Sciences of the Czech Republic (consisting of 53 research institutes) and 23 public, 2 state and 39 private universities. Unlike in west European countries, a higher share of research activities is performed within the Academy of Sciences (predominantly dealing with the basic research), while Czech universities are less research-oriented and more focused on education. There are several excellent research fields concerning both publication and patent activity. The highest number of Czech (Industrial Property Office – IPO) and foreign awarded patents (European Patent Office – EPO, United States Patent and Trademark Office – USPTO) is in the field of medicine & veterinary medicine and organic chemistry. High number of patents was also awarded in the field of measuring & testing (at IPO, EPO and USPTO) and machine components (IPO and EPO). Czech researchers are international very successful in the research of textile materials, namely in the subfield of natural & chemical fibers. Excellent research fields with the highest publication activity (but low patent activity) comprise nuclear physics and technology, general and internal medicine and rheumatology (Thomson Reuters Web of Science). The bearers of excellence in these research fields are mostly academic (public) research institutions. On the other hand, applied R&D is the most successful in vehicles & transport, electrical engineering, glass & glassware, i.e. in the strong industrial branches (IPO, EPO). Greater synergy between excellent basic and applied research would undoubtedly lead to higher innovation activity in the Czech Republic. However, in contrast to above mentioned excellent research fields, the Czech Republic still lags behind the EU15 countries in the production of scientific publications, but the publication activity is slowly catching up with the EU-27 average. Further improvement of the research excellence should be reached through newly built large research infrastructures supported within the Operational Programme Research and Development for Innovation (OP RDI). The list of projects supported through the operational programme is available on the webpage of the R&D&I Information System of the Czech Republic. In addition to the enhancement of science-industry links these infrastructures should provide outstanding conditions for basic research and attract researchers from abroad.

R&D specialisation patterns and expenditures correspond to specialisation of the Czech economy to some extent. The highest share of R&D expenditures has been registered in the automotive and related industries, followed by electrical and optical industries. There are also significant R&D expenditures in (petro) chemical and pharmaceutical industry. The majority of companies performing R&D in the Czech Republic are however foreign-owned, which has certain implications and limits to deeper cooperation in R&D between the private and public sector. On the other hand, current GBAORD percentage shares of socio-economic objectives

(Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets, i. e. NABS) shows that the largest share recently (2000-2009) falls on the Non-Oriented Research (NABS 11) with 30.5% in 2010, on Research financed from general university funds (GUF – NABS 10) with 26.3% and on Industrial production and technology (NABS 7) with 13.4%. Other NABS shares are smaller than 6% (Czech Statistical Office, data on GBAORD).

Competences of particular governmental bodies (ministries) in the Czech Republic are defined by the Competence Act. In addition, competences in research, development and innovation policy are given by the Act No. 130/2002 Coll., on the support of research and development from public funds.

The following three main governmental bodies play the lead role in the research and innovation governance: Council for Research, Development and Innovation (CRDI) is an expert and advisory government body for research, development and innovation. At the political level, the Council plays the main strategic and coordinating role in the research and innovation governance system.

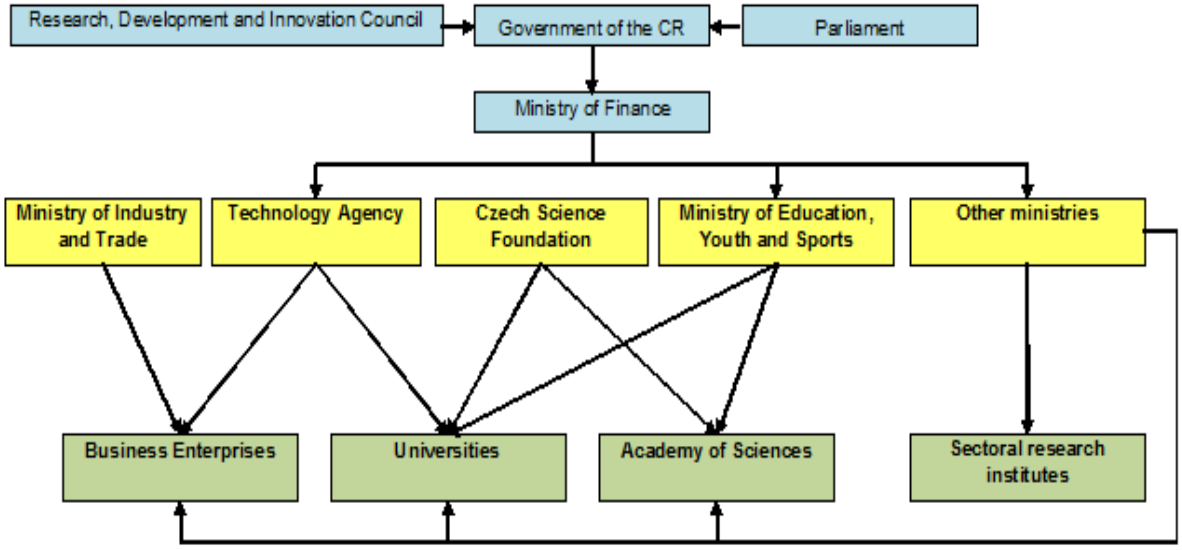
Ministry of Education, Youth and Sports (MEYS) is a central administrative authority responsible for research and development, although (based on the amendment of the Act No. 130/2002 Coll. approved in July 2009) "with the exception of areas that are covered by the Council for Research, Development and Innovation". By this amendment MEYS has lost its position of strategy maker in science and technology policy and this role has been taken over by the CRDI.

Ministry of Industry and Trade (MIT) is responsible for industrial research and development and for innovation in the business sector. The ministry prepares and implements programmes of industrial research and manages the EU Structural Funds through Operational Programme Enterprise and Innovation (OP EI).

In addition to MEYS and MIT, there are five other ministries responsible for preparation and implementation of research, development and innovation concepts: Ministry of Health, Ministry of Agriculture, Ministry of Culture, Ministry of Defence and Ministry of Interior. These ministries provide support from their own budgetary chapters and also establish and operate their sectoral research institutes. Also the Technology Agency of the Czech Republic (TA CR) was established in 2009, and complements the Grant Agency of the Czech Republic (GA CR), which is the Czech Science Foundation (CSF) supporting basic research. TA CR focuses on the implementation of applied research programmes. Some of the public research institutes have begun dividing their activities between the applied and the basic research area. Apart from the governmental institutions there are also other organisations and associations (e.g. Association of Innovation Entrepreneurship, Chamber of Commerce) involved in the RDI system of the Czech Republic.

Innovation policy in the Czech Republic is carried out dominantly at the national level. At the regional level, the role of innovation policy is focused just on coordination activities and the implementation of regional development policies. Regional authorities (Czech self-governing regions – NUTS III level) do not have any legally binding responsibilities in the field of RDI. These lie exclusively on national bodies. Nonetheless, the law does not prevent them from being active in launching their own initiatives, though only a very few have.

Figure 1: Overview of Czech Republic's research system governance structure



Source: ERAWATCH Research and Innovation Inventory

2 Structural challenges faced by the national system

Though the Czech Republic has kept clear of severe economic swings, its openness and strong export orientation to European market have contributed to a steady economic slowdown. The pressure on businesses during the economic crisis forces entrepreneurs to reduce excessive costs and strive for higher efficiency. At the beginning, there was seen decrease of the RDI investments in business sector and orientation to short-term survival, but afterwards the activities in the field of RDI reached its pre-crisis level. Public sector, due to its stronger resistance and predominant long-term funding, has gone through minor changes. However, the pressure towards essential reforms and efficiency has amplified.
A number of analyses was carried out in effort to boost competitiveness of Czech economy as well as national research and innovation system – Strategy of International Competitiveness of the Czech Republic, National Innovation Strategy, and International Audit of Czech RDI. Based on their findings, previously identified weaknesses and international comparisons main structural challenges faced by the Czech national research and innovation system are further identified. Besides general political instability and frequent changes of ministers that makes difficult to implement consistent RDI policy and the lack of trust persisting among different actors in the RDI system pointed out especially by the International Audit, four broader challenges are described – in the field of:

- funding and governance – mostly related to resources management
- structure of research and innovation system – mostly related to knowledge demand
- performance – mostly related to knowledge production

Funding and governance
At the present time national research and innovation system is undergoing profound changes introduced by the new National RDI Policy for 2009-2015. It has placed emphasis on **simplifying of RDI funding system in order to increase efficiency of the resources used**. The realisation of the reform has contributed to a clarification of the R&D support system, particularly by reducing number of R&D support providers and simultaneously by establishing the TA CR as the dominant supporter of applied research. However, **the Czech Republic is still lagging behind EU-27 average in amount of public expenditure on RDI in proportion to gross domestic product (GDP)** – 1.56 % in 2010 (Eurostat).
The distribution of resources available constitutes a long-lasting issue in the policy debate. **The main task to effectively solve this problem is the introduction of a complex methodology for evaluation of R&D results** that would replace the current one based predominantly on quantitative indicators and build a suitable cornerstone for performance-based research funding system. The evaluation methodology involves reallocating the entire flow of institutional funding annually, based on outputs generated in the preceding five years. Due to its exclusive reliance on quantitative indicators the current evaluation system has become increasingly narrow – it fails to address differences in quality of outputs or take into account national thematic priorities – and is not fit for purpose (see International Audit of Czech RDI).
The National RDI Policy for 2009-2015 introduces important changes in governance, reducing the role of ministries in defining priorities and setting up a new priority-setting system based on committees of experts cooperating with the CRDI. The CRDI which, in addition to previously mentioned, effectively sets the entire national research budget is de facto becoming a science ministry while formally being an advisor to government. The CRDI has centralised principal activities, taking responsibility for micro-management (and at the same time missing adequate executive administration) at the expense of concentrating its effort to covering long-term strategy development. It is also a weak coordination and cohesion of operation under jurisdiction of three most important actors at the level of policy making, namely CRDI, MEYS and MIT, what complicates strategic approach to innovation (see National Innovation Strategy).
The Czech Republic has intended to shift national research and innovation system from the current system traditionally rather focused on science to the one more inclusive of innovation. The current Priorities for the applied research (2009-2011) are too broad and general and they do not put a sufficient focus on areas important for the economic growth and on existing and future needs of Czech society. Consequently, the connections of research programmes have been of rather formal character. Reformulation of the oriented research priorities is actually being in progress (for more details see chapter 3.1).
Structure of research and innovation system
According to the Innovation Union Scoreboard 2011, the Czech Republic comes within the “moderate innovators” category with an innovative performance below the EU-27 average. The Czech Republic

ranked on 17th place among the European countries. Nevertheless, the growth rate of innovation performance was higher than in the EU-27 (average growth rate of aggregate innovation index of the Czech Republic increased by more than 3% in the period of 2007-2011).

The increasing performance of Czech innovation system is mainly driven by diffusion and absorption of technologies that are new to the firm or new to the country. Enhancement of top end research and concentration of resources in favour of achieving excellence is needed. The share of foreign-controlled businesses of the total private R&D investments is very high (57 % in 2010) which makes the Czech business R&D sector one of the most internationalised in the EU (Czech Statistical Office). Significant share of private R&D investments has its origin in multinational companies (MNCs). Nevertheless, at the same time, MNCs in the Czech Republic are largely doing low-added value work within high-tech industries and tend to keep its core research activities close to their headquarters localised abroad. There is therefore an urgent need to make MNCs embedded in national supply chain and upgrade the activities they perform nationally. Simultaneously the prevailing position of domestic firms in lower tiers of the production networks hierarchy contributes to poor demand for challenging solutions and lagging service sector. Another weakness undermining competitiveness of the Czech economy is a poor quality of institutional environment. According to the World Economic Forum and the Strategy of International Competitiveness of the Czech Republic public service performance is distinctively lower than the one of private sector. Corruption and ineffective administrative processes burden businesses and along with mistrust the motivation for any public intervention and negative attitude of industry or academy towards mutual collaboration effectively inhibit collaboration (see below). Currently, the work of **industry and the research system appear too polarised to support adequately catch-up innovation**.

Performance

According to various indicators compared in the Innovation Union Scoreboard, the Czech Republic has a relatively strong position in groups of indicators in the field of Human resources (youth aged 20-24 upper secondary level education, new doctorate graduates), Firm investments (non-R&D innovation expenditures); Innovators (small and medium enterprises introducing marketing or organisational innovation), or Economic effects on innovation outputs (medium and high-tech manufacturing exports, sales of new to market and new to firm innovation). On the other hand, **the Czech Republic is lagging behind the indicators of the Open, excellent, attractive research system; Finance and support of R&D and innovation; and Intellectual assets**.

When considering human resources, the lack of skilled personnel is one of the factors seen as hampering innovation in general. The stagnation of PhD graduates growth, the decrease in proportion of science and technology graduates in comparison to those of social sciences and humanities, and the overall inflation of formal university graduates (without quality improvement) goes hand in hand with uncompleted reform of tertiary education (National Innovation Strategy, Czech Statistical Office). The approach to human resources development remains rather unsystematic as well as management of research groups which tend to be very small, locked into existing research trajectories and lacking interdisciplinarity (see International Audit of Czech RDI), partly because of weak bottom-up incentives, lack of internationalisation strategies and poor mobility among researchers.

Formal **intellectual property right (IPR) instruments, notably patents are little used** (see Innovation Union Scoreboard) in spite of the constant effort (e.g. Reform of the RDI System) to improve utilisation of R&D results in innovation processes, support measures and the state of the art IPR legislation. Still, few experts and little experience can be found in this field, especially in public research institutions. Poor commercialisation of R&D outcomes in general requires systematic attention as well as support to research excellence to produce high valuable research outcomes being worth of patenting costs.

Cooperation

Given the historical separation of research and industry and the prevailing differences in culture or attitudes in spheres, **lack of cooperation between research and business sector** is one of the main issues in innovation policy discussion in the Czech Republic. In spite of the constant effort to strengthen science-industry links, deficiencies are present on both sides – poor commercialisation endeavour and lack of for-industry-valuable results in academy on the one hand and low ability to look outside the firm, identify and exploit knowledge in among companies on the other hand. Poor mobility of professionals and sometime too rigid setting of support measures only reinforce the weaknesses mentioned above.

Utilisation of venture capital to support innovative businesses and spin-off firms trying to commercialize research outcomes is in the Czech Republic one of the lowest among European countries

in the long term (see the Innovation Union Scoreboard). Public support measures in this field were completely missing until almost recently. Accompanying lack of experience among potential clients and rather traditional entrepreneurial culture do not form an environment favourable to venture capital utilisation. However, this situation should be improved by interconnected measures directed to research organisations, start-up companies and private equity investors.

3 Assessment of the national innovation strategy

3.1 National research and innovation priorities

The goals of Czech research and innovation policy have not been formulated in one single document, which stems from scattered competencies between the MIT, the MEYS and last but not least the CRDI. There have been at least three relevant documents dealing with goals and priorities by the year 2011. The Economic Growth Strategy and the terminated National Innovation Policy 2005-2010 are two closely linked documents which deal with R&D from the broader perspective of national competitiveness and contain a number of concrete both short- and long-term goals and objectives. The Economic Growth Strategy is rather a framework document for other partial and horizontal economical concepts and policy documents (e.g. National Reform Programmes) are derived from it.

The more recent document – the National RDI Policy for 2009-2015 (NRDIP) deals with RDI in the narrow sense, and is also closely linked to further funding mechanisms and priority setting for the allocation of funds. The elaboration of NRDIP has reflected a growing need to possess a strategic document in the Czech Republic, which would fully encompass the entire sector of research, development and innovation, and which would be substitute for various partial strategies concerning RDI. NRDIP is a part of implementation of The Reform of the RDI system in the Czech Republic, which was approved by the Government in 2008.

NRDIP consists of nine main objectives:

- Establish a strategic management of RDI at all levels based on systematic impact assessment of the National Policy as well as analyses of RDI;
- Target the public support to RDI in line with demands of sustainable development;
- Increase the efficiency of the public support to R&D;
- Utilize the R&D results in innovation processes and enhance the co-operation of the public and private sector in RDI;
- Intensify the Czech Republic's involvement in the international RDI co-operation;
- Provide qualified human resources for RDI;
- Create an environment stimulating RDI in the Czech Republic;
- Ensure the compatibility and linkages of the National Policy with other sectoral policies;
- Ensure consistent evaluation of the RDI system.

Part of the NRDIP is also the proposition of the Priorities of the Applied Research, Development and Innovation for 2009-2011. New R&D programmes should be based on these priorities, but the reality seemed to be rather different. The identified priorities have been considered to be too broad; their set up had covered almost all science and research fields and their application into the subsequent research programmes had not functioned well. The wide and vague priorities for 2009-2011 are currently being actualised, and the National Priorities of Oriented RDI should take place from 2012. The upcoming Priorities of Oriented RDI have been based on a large socioeconomic analysis defining strong research fields and industrial branches that are highly competitive on a global level and have strong potential for applications. At the end of 2011, the set of specific priority research fields was identified by panels of experts within six broader areas: Knowledge Economy, Energy, Natural Resources, Social Sciences, Health and Security Research. The identified set of priority research fields has to be approved by an interdepartmental committee and finally by the Government in June 2012 before coming into force. The Priorities of Oriented Research (unlike the previous Priorities of Applied RDI) reflect major societal challenges and needs of the

Czech society as concrete goals solvable through RDI in available capacities and are set for the 15-20 years time horizon. They should be respected in providing public RDI support (including designing new programmes and providing institutional support). Responsibility for the process of priority setting lies with the CRDI. More information is available on www.priority2030.cz (Czech only).

The necessary updating of the ineffective evaluating methodology, strictly relying on quantitative indicators for evaluation of R&D programmes and R&D organisations, as discussed i.a. in the International Audit of Czech RDI requires the consensus of all key players involved. A project (as a part of the OP RDI) intended to methodology revision is in preparation now. Initiation of the project is anticipated in the first half of the year 2012.

In respect to the competitiveness of Czech research and innovation system the Government adopted a comprehensive long-term Strategy of International Competitiveness of the Czech Republic in 2011. There is a noticeable effort to address different issues having impact on the growth of competitiveness and innovation performance by improving the environment (regarding institutions, infrastructure, education, financial market etc.) rather than by a simple financial support to innovation. The core of the Strategy called "3i" deals with institution, infrastructure and innovation – the three pillars which are frequently indicated as the main weaknesses of the present system (see e.g. lack of trust among actors, insufficient support to excellence in research, poor commercialisation effort and unavailability of venture capital). Concrete goals of the Strategy in respect of innovation are:

- to increase the demand for innovation;
- to increase awareness and motivation for cooperation between research institutions and the business sector;
- to create financial, material and personnel conditions for the development of excellent research;
- to target the public support to business and research primarily in respect to the identified key technology areas; and
- to create a functional system for effective management of development policies and support instruments for innovative businesses and R&D.

In parallel to the Strategy of International Competitiveness of the Czech Republic the National Innovation Strategy (NIS) was coproduced by the MEYS and the MIT and approved by the Government in 2011. It develops in more comprehensive way the innovation pillar (described above) of the Strategy of International Competitiveness. The NIS provides an overview of the innovation field and contains various measures divided into four main priority axes: excellent research; cooperation between business and research sector and knowledge transfer; innovative entrepreneurship; and human resources for innovation (people as bearers of new ideas and initiators of change).

All of the documents mentioned above are multi-annual and follow up previous policy documents. Therefore, it is not possible to expect radical near-term changes in the national RDI policy priorities as the documents are set for several years. The only actual document dealing narrowly with RDI policy is the National RDI Policy 2009-2015.

Nevertheless, some measures have been implemented in the way National RDI Policy proposes through realisation of operational programmes, in particular the OP RDI and OP EI. Two sub programmes of the OP EI, Progress and Guarantee, serve SMEs (particularly start-ups and micro enterprises) to overcome barriers to get external financing. Both programmes are successful in terms of the number of supported projects. Same is true of the Start programme that provides a form of subsidised loans to innovative businesses (see Annual Report OP EI 2011, Czech only). None of these programmes is actually a venture capital initiative. However, there are measures targeted directly to venture capital providers and recipients in the final phase of preparation. The project called CzechEkoSystem (under the OP EI) will seek and lead potential recipients of financial resources from seed fund. Seed fund itself will be created in cooperation of state and private investors as consecutive measure to CzechEkoSystem project. The insufficient commercialisation of research results is (among others) addressed by the OP RDI that is going to (from the beginning of 2012) support so called pre-seed activities at higher education institutions and research organisations. In the way to strengthen commercialisation and cooperation with industry, OP RDI supports building the infrastructures for excellent basic and applied research and infrastructure for transfer of R&D results.

The ERAWATCH Country Report 2009 for the Czech Republic also identified the following policy mix routes covering the major ways of increasing public and private R&D expenditures in the country:

1. promoting the establishment of new indigenous R&D performing firms;
2. stimulating greater R&D investment in R&D performing firms;
3. stimulating firms that do not perform R&D yet;
4. attracting R&D-performing firms from abroad;
5. increasing extramural R&D carried out in cooperation with the public sector or other firms; and
6. increasing R&D in the public sector.

Each route is associated with a different target group, though there are overlaps across routes. The situation since 2009 has changed in several areas, but the total change is not very dramatic.

Table 1: Importance of routes in the national policy and recent changes

Route	Short assessment of the importance of the route in the national policy	Main policy changes since 2009
1	Important, but relatively small in terms of budgetary weight.	The major use of EU Structural Funds is to support R&D in companies. New measures (e.g. pre-seed fund supported by the OP RDI) should be launched in 2012 with the implementation of the Strategy of International Competitiveness. Tax measures to maintain the company conducting the R&D has not been extended on buying external R&D yet.
2	Very important, also in terms of budgetary weight (via OP Enterprise and Innovation).	Through the Tip programme allocates the MIT support to companies that carry out R&D. More interest to this route has been devoted through the Alpha programme requiring co-financing by enterprises, which is a traditional mean how to stimulate private investment to R&D. Also parts of the OP EI are relevant to this issue.
3	Relatively high importance but relatively small in budgetary weight.	The TIP programme as well as the Alpha programme is open to enterprises that have never performed R&D, but there is no special attention paid to R&D beginners in any support measure in the Czech Republic.
4	Important, but relatively small in terms of budgetary weight.	The investment incentives run under the MIT through CzechInvest Agency have recently oriented to attract more R&D intensive investments. Tax incentives for the implementation of R&D activities can be also used by firms abroad operating in the Czech Republic.
5	Very high importance (included in almost all policy documents in the field of R&D).	There are large support measures advantaging co-operation of particular project partners. Especially new programme Competence Centres launched by the TA CR focuses on a long-term partnership of research organisations and business sector. Also large R&D infrastructures should foster science-industry links.
6	One of the most important routes, building the research capability has been a long term policy goal.	Especially, utilisation of OP RDI represents significant bulk of money that could enhance R&D performed in the Czech public sector. The projects of new research capacities have been currently realised, thus their real impact is not evident yet.

Source: ERAWATCH Country Report 2009, completed

3.2 *Trends in R&D funding*

The Czech system of funding is still characterised by dispersed R&D funding among several main funding bodies and ministries.[1] This is being changed by the Reform of the RDI System, setting the GA CR (supporting basic research) and the TA CR (supporting applied R&D) as main and independent administrators of targeted support. Applications to most of sectoral R&D programmes have been terminated and redirected since 2010 to the TA CR, which manages a programme for applied research called Alpha with three thematic sub-programmes[2]. However, five other ministries (Ministry of Health, Ministry of Agriculture, Ministry of Defence, Ministry of Interior, and Ministry of Culture) will be allowed to implement multi-annual research programmes in their thematic field in the future. As past experience has shown, these programmes while nominally competitive funds are often used as a source of institutional funding for some selected research institutes controlled by the given ministries and also as a means of research funding for the needs of the respective ministries.

The share of public resources spent on thematically non-oriented research exceeds expenditures on oriented research. According to the shares of socio-economic objectives (NABS[3]), non-oriented research had 30.5% share on GBAORD in 2010, followed by the research financed from general university funds (GUF) with 26.3% share. Within thematically oriented research, representing the remaining 43.2% of GBAORD, prevails industrial research (13.4 of the total GBAORD), followed by medical research (5.6%), agricultural research (4.5) and research in the field of energy production, distribution and utilisation (3.5%). Other socio-economic objectives have less than 2.5% share on the total GBAORD (Czech Statistical Office).

The Czech Republic has joined Europe 2020 initiative, and has set its national objective in research policy to invest at least 2.7% of GDP annually by 2020. The share of R&D expenditure on total GDP (i.e. R&D intensity) continued increasing in the previous two years after a decrease in 2008 (to 1.41% of GDP) and reached 1.56% of GDP in 2010. What is more important, the R&D expenditures grew every year in absolute figures to almost CZK60b in 2010 (e.g. €2.3b). This growth was implied by higher R&D expenditures of the business sector (except in the crisis year of 2009), in spite of seemingly growing absolute values (in EUR) of government budget appropriations or outlays for R&D (GBAORD). This contradiction is due to movements of the currency exchange rate. The same values in CZK would show decrease of absolute GBAORD in 2010. The clear trend of the last year is a growing share of foreign R&D investment, but there could be found two different components. While public foreign R&D expenditures were steadily growing during last three years (mainly EU structural funds), and with a high probability will be in several next years too, private foreign R&D expenditures decreased in 2010 due to the economic crisis.

The Czech R&D system has nearly equal balance between public and private funding. Domestic private investment in R&D accounts for some 49% of total R&D investment (2010) and is characterised by a domination of foreign-controlled companies that is one of the highest in the EU. Clearly foreign private funding of R&D activities had a growing trend between 2005 and 2009, when it increased from 3.3% to 8.0% of GERD. However, its share on GERD has slightly dropped to 6.6% in 2010 (Czech Statistical Office). The largest R&D performer in the Czech Republic is traditionally the business sector spending 62% of total R&D expenditure; public research institutions come second with 19.4% and universities spent 18% share of total R&D budget in 2010. More detailed data can be found on the Czech Statistical Office webpage.

[1] Government budget appropriations and outlays for R&D (GBAORD) for the year 2011 amount to approx. €1b and are divided into 18 budgetary chapters comprising R&D budget of the Ministry of Education, Youth and Sports (40%), Academy of Sciences (19%), Ministry of Industry and Trade (15%), Grant Agency of the CR / Czech Science Foundation (10%), Technology Agency of the CR (3%), Ministry of Health (4%), Ministry of Agriculture (3%), Ministry of Interior (2%), Ministry of Defence (1%), Ministry of Environment (1%) and eight other ministries and public administration bodies with less than 1% share on GBAORD (Source: website of Council for R&D&I).

[2] Progressive technologies, materials and systems; Energy resources, and protection of environment; Sustainable development of transportation

[3] Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS 1992)

Table 2: Basic indicators for R&D investments in Czech Republic

	2008	2009	2010	EU average 2010
GDP growth rate	3.1	-4.7	2.7	2,0
GERD as % of GDP	1.41	1.48	1.56	2.0
GERD per capita	208.9	200.0	217.7	490.2
GBAORD (€ million)	821.4	870.3	893.9	92,729.05
GBAORD as % of GDP	0.53	0.62	0.60	0.76
BERD (€ million)	1342.3	1256.6	1448.5	151,125.56
BERD as % of GDP	0.87	0.89	0.97	1.23
GERD financed by abroad as % of total GERD	6.5	10.4	10.4	N/A[4]
R&D performed by HEIs (% of GERD)	16.8	18.1	18	24.2
R&D performed by PROs (% of GERD)	20.9	21.4	19.4	13.2
R&D performed by Business Enterprise sector	61.9	60.0	62.0	61.5

Recent debates about the need to reduce the share of institutional funding in favour of funds allocated for project funding distributed on a competitive basis has resulted in a proposal to reform the system of institutional funding. As a part of the Reform each research organisation receives institutional funds based on its historical research results within their competence achieved over the past five years. The Czech system of public R&D funding is still dominated by institutional funding, although the share of institutional funding decreased in the last few years – from 56% in 2009 to 52% in 2010 and remained at the level of 52% of total public R&D expenditures in 2011. Share of the institutional funding in the public R&D budget approved for 2012 is 51%. (Council for RDI)

As regards to the forms of funding, the RDI policy measures provided in form of grants keep a dominant share. Grants are used for supporting both R&D activities and implementing innovation in businesses. In addition to grants, subsidised loans and guarantees are also used to support innovation, especially in the innovative start-ups (Guarantee and Start sub-programmes of the OP EI, but the share of this funding is very low. The share of venture capital in the financing of R&D and innovation is still very marginal. Next to these forms of funding, also tax allowances (tax-deductible items) for R&D expenditures can be used in the Czech Republic.

Fiscal measures were introduced in 2005 in order to stimulate private R&D effort. However, these measures had only a negligible impact on the collaboration between the private and public sectors, since they cannot be used for the purchase of R&D outcomes from universities and public research institutes. Since 2005, the number of companies drawing on indirect support to R&D increased to 618 in 2009, i.e. 35% of companies performing R&D activities. The total indirect support of R&D in 2009 reached almost CZK1b (€40m) (Czech Statistical Office).

The role of the Structural Funds in the funding of R&D has grown in the new programming period 2007–2013. Public R&D activities are financed particularly by two operational programmes administered by the MEYS: OP Research and Development for Innovation (ERDF) and OP Education for Competitiveness (ESF). The combined allocation of these two OPs equals approximately €3.8b. Business R&D and innovation activities are financed through the OP Enterprise and Innovation (administered by the MIT) with a total budget of approx. €3b for RDI relevant activities.

The private sector co-financing in public R&D programmes is used mainly within the support programme of the MIT called TIP and the TA CR (ALPHA, Competence Centres) with share from 15% to 50% on the funding of these programmes. The role of regional budgets in the RDI measures remains marginal implying that interregional funding of RDI related issues is not relevant in the Czech research system. An exception represents the Innovation Voucher programme of the South Moravia region enabling any European enterprise to get funds for R&D services purchased from regional research organisations.

[4] 8.4 (2009), 9.04 (2005)

3.3 *Evolution and analysis of the policy mixes*

The main body responsible for the formulation and coordination of the Czech RDI policy is Council for RDI (CRDI). At the implementation level, two ministries are the main responsible for RDI issues: the Ministry of Education, Youth and Sports (mainly academic research) and the Ministry of Industry and Trade (industrial research and innovation). These two ministries are not the only institutions dealing with RDI issues. There are also other ministries with their own RDI budget, but their influence on overall RDI policies is rather minor. Their number will be reduced to five plus two mentioned above (see chapter 1) with the implementation of the Reform of the System of Research, Development and Innovation in the Czech Republic. All the ministries with RDI budget have also some conceptual documents dealing with RDI policy in their respective sectors.

The focus of the Czech R&D policy can be described as a predominantly generic one as seen from the structure of financial measures. In financial terms (based on the data of the Czech Statistical Office), over 85% of public R&D funding (approx.€0.85b) is still provided through four main funding bodies (the Ministry of Education, Youth and Sports, the Ministry of Industry and Trade, the Czech Science Foundation (Grant Agency of the CR), the Czech Academy of Sciences) which fund R&D of a more generic kind.

Since the elaboration of the Country Report 2010 for the Czech Republic, new measures were introduced, which are visibly shifting to make public support bound to the collaboration with industry and use of research results. This trend has been evident since the National RDI Policy was approved in 2009, where one of the objectives was to condition public support through the R&D programmes by collaboration of public research organisations with users of R&D, based on co-financing from public and private sources. Some new programmes go even further, requiring an application of R&D results in practice. The last is the case of new programmes designed and implemented by the TA CR, which supports applied research, collaboration between research and application sphere and transfer of knowledge. The “new wave” of R&D programmes in operation since 2011 or 2012 includes:

1. The programme called ALPHA - supporting projects of applied research and experimental development and stimulating intensity and effectiveness of R&D cooperation between businesses and research organisations.
2. The BETA programme - a programme of public procurement in research, experimental development and innovation for the needs of public administration bodies.
3. The OMEGA programme supporting research in applied social sciences.
4. Competence Centres supporting creation and operation of research, development and innovation centres for progressive fields with strong application potential and a perspective for significant contributions to the growth of the competitiveness of the Czech Republic.
5. The development of the international cooperation extends the GESHER/MOST- programme in applied research and experimental development between the Czech Republic and the State of Israel. This is the only programme listed here that is implemented by the MEYS.

Core R&D and innovation policy does not stand alone, thus other policies touching directly or indirectly the issue should be mentioned. Human resources policies with relevance for R&D are currently represented within the educational policy. These measures focus to increase the attractiveness of research careers and research as such. Apart from several smaller local initiatives, the most prominent among these is the Ceská hlava (Czech Head) project which awards an annual prize to distinguished Czech scientists for their life-long achievement in the field of R&D. Recently this award was also extended to include awards for talented young secondary school students.

More activities aimed at increasing the attractiveness of research careers and popularising research are planned in some of the OPs relevant to research ("soft" measures, such as science and technology popularisation courses under OP EC and "hard" measures, such as development of science learning centres under OP RDI). A new measure (called NÁVRAT) dealing with re-integration of successful researchers from abroad was launched under the MEYS in 2011 and the first projects will be supported in 2012.

Also the involvement of the Ministry of Finance has to be mentioned as tax incentives to deduct expenditures on R&D carried out in-house were introduced in 2005. An extension of the current tax incentives scheme for R&D is expected in the near future, when research purchased from research organisations will be also

deductible from the tax base. The first indications from the Ministry of Finance suggest that the effect on private R&D investment is quite substantial, at least in terms of creating an incentive for businesses to report their actual R&D expenditure. The practical implementation of this fiscal measure is, however, complicated by confusion over the practical interpretation of the regulation. The existing methodological guideline from the Ministry of Finance is criticised by businesses since it leaves scope for different interpretation as to what should and what should not be included in the R&D expenditure. The complaints from the business sector are addressed mainly to the lack of awareness at the level of local tax offices who often apply an unnecessarily strict interpretation of the regulation. No further fiscal measures in favour of R&D are currently being proposed. Although there is an increasing recognition that the current form of tax deduction is going against the need to intensify collaboration between academia and business sector.

Commercialisation of R&D results and transformation of new knowledge into innovation is hindered by insufficient utilisation of instruments for IPR protection. However, this situation has been changing through the implementation of the National RDI Policy 2009-2015. Together with the establishment of the TA CR implementing support for applied research greater emphasis is put on the programmes supporting innovation activities and cooperation of the academia and industry. Attention to fostering science-industry links is paid also in several operational programmes. This concerns mainly the OPEI and its priority 4 - Innovation and priority 5 - Environment of Entrepreneurship and Innovation.

The OP RDI also includes several research-innovations and academia-industry links support measures. These include mainly support of commercialisation of R&D outputs in research institutions, in particular by financing the stage from R&D information up to the stage of the subsequent commercial use (proof of concept stage) and support of the commercialisation system and intellectual ownership protection, including the establishment and development of technology transfer offices by research organisations.

3.4 Assessment of the policy mix

The priorities of the Applied RDI defined above are not primarily focused on solving structural problems of the Czech R&D system, but the policy mix provides other measures to address the challenges more effectively. The main innovation policy targets as announced in the key policy documents (National Reform Programme, Reform of the Czech RDI system and the National RDI Policy 2009–2015) are consistent with the current needs for improvement of the national innovation system. However, the present RDI system can be assessed as inadequate in terms of effectiveness, flexibility and appropriateness of research and innovation governance, which results inter alia in the insufficient quality of R&D results and the detachment of public research from industrial and societal needs. The main reason lies in the remaining fragmentation of RDI governance in the Czech Republic. Creation of one central coordination body responsible for research, development and innovation is among activities of the Reform of the RDI System and of the NRDIP, but realisation of this task remains to be a challenge.

The reason for production of R&D results of a doubtful quality relies in the insufficient support for the excellent research and low evaluation standards in the Czech Republic. Higher efficiency of the public support system achieved also through more effective evaluation of R&D is one of the main goals of the NRDIP. However, evaluation methodology remains the challenge for the policy makers as stated in the International Audit of Czech RDI. More generally, evaluation is rather underestimated issue in the Czech Republic. Present “evaluations” of research programmes are highly formalised (including only quantitative formulation of the results achieved) and they do not provide any additional information for policy makers. Similarly, assessment of R&D programmes regarding development of relevant science fields or industry sectors or grasping societal needs cannot be achieved within the present framework. Also systematic evaluation of research organisations is missing in the Czech Republic. According to the NRDIP, a new methodology for the evaluation of research results should be elaborated taking into account some new components (e.g. training of graduates, dissemination of R&D results, technology transfers etc.) and not only research outputs as it is the case now.

Nonetheless, some shortcomings in the RDI system have been addressed in the current in-depth Reform of the Czech RDI system. Particularly the establishment of the Technology Agency and reduction of budgetary chapters has contributed to the improved coordination of targeted R&D funding and de-fragmentation of R&D public support. Some of the existing RDI programmes have encouraging effects on innovation activities in the business sector, and contribute to the development of a favourable

environment for these activities in the Czech Republic. More intensive inclusion of the private sector in joint public-private research projects seems to be promising as new R&D programmes have been introduced by the TA CR, but evidence on the effectiveness of the new programmes is not available yet. Generally speaking, the current innovation policy mix is able to solve all the identified challenges to a certain degree.

Table 3: Assessment of the policy mix

Challenges	Policy measures/actions[5]	Assessment in terms of appropriateness, efficiency and effectiveness
Lack of cooperation between research and business sector	OP RDI Alpha, TIP, Competence Centres OP EI	On one hand, OP RDI supports building of the infrastructure for excellent fundamental and applied research, and infrastructure for transfer of R&D knowledge. On the other hand, the new R&D programmes motivate enterprises to cooperate with research organisations in common projects. Also clustering activities are supported through the OP EI.
Lack of availability of financial resources for improving innovation performance	Realisation of the Reform OP EI	Realisation of the Reform of R&D has contributed to a clarification of the R&D support system, particularly by reducing number of R&D support providers and simultaneously by establishing the TA CR as the dominant supporter of applied research. Two programmes of the OP EI - Progress and Guarantee serve SMEs (particularly start-ups and micro enterprises) to overcome barriers to get external financing. Both programmes are very successful in terms of a number of supported projects.
Insufficient use of instruments for the protection of intellectual property rights	Realisation of the Reform Alpha, Competence Centres OP EI	Among the objectives of the reform is also "utilisation of R&D results in innovation processes." New R&D programmes (such as Competence Centres, ALPHA) require creation of research results and also their utilisation, thus motivate to utilisation of IPR. Also one sub-programme of the OP EI called Innovation enables beneficiaries to spent the grant on the use of IPR.
Lack of venture capital to support innovative business	OP EI Planned establishment of the pre-seed fund	Utilisation of venture capital in the Czech Republic is the lowest among European countries. The establishment of a seed fund (planned for 2012), operated by the MIT and financed from the OP EI should improve this situation..
Insufficient use of public funds for R&D and innovation	New methodology for evaluation R&D results and R&D organisations	The main task to effectively solve this problem is the introduction of a complex methodology for evaluation of R&D results that would replace the current one based predominantly on quantitative indicators. Update of the evaluating methodology has been discussed in the International Audit of Czech R&D. However, change of the current methodology requires consensus of all key players in the national R&D system.

4 National policy and the European perspective

Prevailing fragmentation of responsibilities for the RDI policy at the national level leads to disagreement or overlaps in measures, striving to attain the same target. Therefore, the biggest challenge for the Czech Republic in the RDI policy governance is the continuing implementation of the RDI Reform; especially simplifying the R&D support system and decreasing the number of R&D funds providers. Establishment of the Technology Agency has already led to a simpler and more transparent system of public support that shall

[5] Changes in the legislation and other initiatives not necessarily related with funding are also included.

be further accompanied by a decrease in administration expenses for both suppliers and recipients. This process of simplification has not been finished yet as the agency is in its nascent stage and some of the previous providers have recently launched new measures lasting until e.g. 2018. Nonetheless, expected share of the agency on overall RDI expenditure as prepared by the Council for RDI should increase from approx. 3% in 2010 to 10% in 2014. Another target of the Reform is to establish a single competent body responsible for the innovation policy (in a broader sense) and for the coordination of public support for RDI.

Even though there is still a gap in the R&D and innovation policies governance coordination, the two main ministries responsible for R&D and innovation (MEYS and MIT) started to cooperate on the agenda (this is visible mainly thanks to the Strategy of International Competitiveness of the CR). The under-developed evaluation culture slowly starts to improve mainly due to the evaluation needs arising from the EU Structural Funds rules. In the context of outcomes and recommendations of the International Audit of RDI, the MEYS is preparing a new evaluation methodology of RDI results.

The setting of RDI funding mechanisms always plays the key role in the RDI system functioning. Therefore the issue of RDI funding is usually the most discussed and is often subject to changes arising from the needs of the society. According to the CRDI outlook until 2014, the decrease of the institutional funding share should continue and the ratio of institutional to targeted funding should switch in the favour of targeted funding (around 53%) by 2014. Targeted funding should be focused mainly on potentially strong research fields and the fields that are highly competitive on a global level and have strong potential for applications. In this respect, the National Priorities of Oriented RDI are currently being prepared. After their introduction in the second half of 2012, the volume of thematic funding based on these priorities should gradually grow. Increase of expenditures could be also expected in relation to the operation and sustainability of the recently established R&D centres financed from the Structural Funds (OP RDI).

On the contrary to the planned budgetary changes, the total expenditures of the Government on R&D should remain unchanged for the next three years, as a consequence of the economic crisis and the need to reduce Government spending.

Predominant form of RDI funding for manufacturing sector are direct grants. Introducing new types of tools for RDI support would impact the wider variety of possible applicants. This process has started recently with the introduction of innovation vouchers at the regional level or the establishment of a seed fund by the Ministry of Industry and Trade.

Though newly introduced measures supporting the strengthening of links between academia and industry, insufficient transformation of research results to innovative solutions in the business sector remains a constant challenge. Most currently, the Strategy of International Competitiveness of the Czech Republic 2012-2020 dealing with this issue explicitly mentions the need to stimulate the so far very limited demand for innovation in the domestic business sector. The strategy proposes support for development of the business innovation services and comes up with several concrete actions: pre-seed fund establishment; knowledge transfer partnership programme; support for technology transfer services; support for implementing technology transfer measures in research organisations; R&D public procurement; amendment of the tax law; support for regional innovation.

The research community in the Czech Republic considers it essential to maintain an intensive international cooperation and participation in intergovernmental organisations in research and development as a means to further improve the quality and efficiency of the Czech R&D. The Czech Republic is a member of the most of the intergovernmental organisations in ERA as well as the member of projects of large European infrastructures (ESFRI).

Despite the openness of Czech R&D to international co-operation declared in the main policy documents, national research funding programmes still do not allow transferability of a grant to another country, i.e. all research projects funded by national research programmes must be performed in the Czech Republic. In general terms, reciprocity should be required in any international partnership but there may be cases where it makes sense for national funding to be used outside the country without this requirement (e.g. need to access specialist skills, capacity building in a particular field, preparing the ground for future S&T partnerships and collaborations, etc.).

Generally, the above-mentioned issues reflect the ERA pillars and objectives. The RDI policy mix in the following years shall concentrate on the support of innovative companies, RDI human resources development including the mobility issues, international as well as inter-sectoral co-operation in research,

securing the sustainability of the big research infrastructures and new evaluation methodology of R&D results leading to more effective distribution of the RDI funds.

The following table clearly summarises the main challenges at the national level and relevant policy changes in the context of the ERA 2020 Vision objectives. The summary is based on chapters 2-4 of the report as well as on the Annex.

Table 4: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	**Labour Market for Researchers**	• Labour market for researchers still suffers from lack of researchers mainly in the S&T fields, • International mobility is considered as one of the main challenges for improvement. • low attractiveness of a research career in the CR for foreigners due to lower salaries of researchers in comparison with the EU-15 countries	• Issue reflected in National RDI Policy and in the Reform as a high priority, • OP Education for Competitiveness and OP Human Resources and Employment support measures. New schemes supporting inward as well as outward (short-term) mobility of researchers
2	**Cross-border cooperation**	Low awareness of researchers about the international research programmes leading to a low participation of Czech teams in the international activities in the field of research.	• FP7 Cooperation – international teams common projects, • Issue addressed in the national RDI policy as a priority, • Active participation on formulating FP8/Horizon 2020 in respect to the Czech position in RDI fields, • Czech participation in Eureka, COST etc.
3	**World class research infrastructures**	There is a number of projects supporting the development of research infrastructures from the Structural Funds, but there is a question remaining on the sufficient number of researchers for these new infrastructures.	• Approval of the Roadmap for Large Research, Development and Innovation Infrastructures in the Czech Republic by the Government in March 2010 • OP RDI Priority Axis 1 + 2: support to centres of excellence and regional R&D centres.
4	**Research institutions**	Universities are quite autonomous in the Czech Republic, including the field of research. Third role of universities shall be supported by the reform of tertiary education, which has been prepared and has just started to be implemented. There is also low participation of other stakeholders (mainly from industry) in university management boards.	• Institutes of the ASCR have become autonomous / independent public research institutions including the financial responsibility. • A new methodology on evaluation of research results of HEIs and PROs was introduced together with new system of institutional funding more based on evaluation of research results

	ERA dimension	Main challenges at national level	Recent policy changes
5	**Public-private partnerships**	Existence of R&D programmes supporting research-industry co-operation and industrial R&D with the aim to lead research towards practical outcomes but a lack of organisations ensuring technology & knowledge transfer into practice. Insufficient supply of mediation services provided to innovative companies and unfavourable conditions for setting up academic spin-offs. Low support to inter-sectoral (private-public-university sector) mobility of researchers.	• OP RDI Priority Axis 3 aiming at support of the commercialisation of research results including the technology transfer offices. • issue addressed in the national RDI policy as a priority • Establishment of the Technology Agency of the Czech Republic supporting applied R&D • New programmes of Technology Agency (Alpha, Centres of Competence) and the Ministry of Industry and Trade (TIP) supporting co-operation between PROs and private sector
6	**Knowledge circulation across Europe**	National and European funding enabled the development of science parks, incubators, TTOs, but also qualified human resources for the technology transfer are still a challenge to support the knowledge circulation across Europe.	MEYS is supporting the return of Czech researchers after experience from abroad through a programme called NAVRAT.
7	**International Cooperation**	Concerning the international cooperation, FPs are the most significant programmes for the CR. The participation of Czech industry in FP7 is relatively high; the Czech universities lag behind the EU average. The Czech Republic participates in COST, EUREKA, CERN and other international programmes but the effects are not very well monitored. Support programmes of bilateral international R&D cooperation are: KONTAKT, GESHER and MOBILITY. The main challenge is to promote the possibilities of international cooperation to researchers.	• New measures supporting international co-operation in applied research • On the basis of bilateral schemes, the Czech Republic co-operates mainly with India, Israel, South Korea, Russia, Argentina, China, and the United States. The prioritised research fields correspond with the branches most important for competitiveness of Czech research. Regarding R&D co-operation within the EU, the Czech Republic has bilateral mobility (exchange) agreements with France, Slovakia, Hungary, Germany, Slovenia, Poland and Austria.

Annex: Alignment of national policies with ERA pillars / objectives

1. *Ensure an adequate supply of human resources for research and an open, attractive and competitive single European labour market for male and female researchers*

Besides the ERAWATCH Country Report 2011, this Annex is also based on findings of other analytical studies, mainly the study on Human resources in R&D, elaborated within the International audit of research, development and Innovation in the Czech Republic (2011) by the Centre for Higher Education Policy Studies of University of Twente. Other important sources include the Analysis of human resources in R&D prepared by the National Training Fund for evaluation of the national RDI policy, the study on "brain drain" by the Institute of Sociology of the Academy of Sciences, the study on remuneration of researchers carried out for the European Commission or the Eurostat data on science and technology.

1.1 Supply of human resources for research

The number of researchers in the Czech Republic has grown faster than in EU-27 during 2005-2010 (increase by 21% compared to 14% in EU-27) and reached 29,228 researchers (FTE) in 2010. The most numerous group of researchers (43%) is employed in business enterprise sector (compared to 45% in EU-27), followed by higher education sector (35% compared to 41% in EU-27) and government sector where the share on the total number of researchers (21%) substantially exceeds the figure for EU-27 (13%). Private non-profit sector employing just 1% of researchers is the least significant.[6]
The share of R&D employees on the total labour force (1.0%) remains still slightly below the EU-27 average (1.1%).[7] According to the Reform of RDI System in the Czech Republic (2008) the main problems related to supply of qualified human resources to R&D consist in:

- Low interest of young people in a research career
- Diverse quality of PhD study programmes
- Low level of inwards transnational mobility of researchers and top quality teachers
- Low mobility of researchers between academic and application spheres
- Lack of leading researchers experienced with project management (especially in the age group of 35-55 years)

Despite increasing numbers of PhD university graduates, the low level of PhDs in technical and natural sciences (especially in comparison with humanities and social sciences) hampers further development of these disciplines and cannot fully satisfy the demand of academic sphere for new researchers. According to the database of the Ministry of Labour and Social Affairs from the period 2005-2009, the supply of vacant positions in scientific and technical professions was significantly higher than the number of candidates (in some fields even twofold to fourfold).
Attracting talented doctoral students from abroad is high on the agenda on some institutes, albeit the achievement of this goal is rather difficult because of low financial support available. The highest number of foreign students comes from the neighbouring Slovakia. Efforts have been made to provide a scholarship to them on the basis of a few temporary programmes (from MEYS), Erasmus, own mobility funds, or from own project grants.
Inward and outward flows of researchers are hard to assess as limited statistical data is available. In the last years, the number of incoming foreign researchers in the Czech Republic has increased, especially those from non-EU countries. Nevertheless, the attractiveness of a research career in the CR for foreigners is relatively low due to complicated administration of visas and lower salaries compared to the EU-15 average. This is the

[6] Eurostat data on Science and technology
http://epp.Eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/main_tables

[7] National Training Fund (2010): Analysis of human resources in research and development. Materials for evaluation of the national RDI policy: Area of human resources. *(in Czech language)*

reason why citizens of eastern European countries have a dominant share of foreign researchers in the CR. According to the data of the Czech Statistical Office for government and higher education sector, the share of foreign researchers is quite minor – 3.7% of the total number of researchers in these sectors in 2005 and 4.2% in 2006. More than half of foreign researchers came from Slovakia – due to common history, cultural linkages and similar languages and the fact that many Slovak citizens study at Czech universities – followed by Ukraine and Russia. There was also a significant share of German citizens.

An opportunity to attract new researchers (graduates as well as researchers from abroad) is in the large research infrastructures currently being built up using resources from the EU Structural Funds (OP Research and Development for Innovation).

Despite existing barriers to outwards mobility of researchers, the participation of the staff in mobility schemes and international projects has increased. Universities mostly have international offices that provide information on mobility opportunities not only to students but also to staff. Further institutions as well as the Government of the Czech Republic and the Academy of Sciences of the Czech Republic provide some funding for short-term mobility, such as conference attendance. Czech universities and research institutes have also contracts within the Erasmus Socrates Programme with universities in other EU countries, mainly in the UK, Sweden, Spain, Portugal to exchange doctoral students with stays up to several months long.

The data on outward flows of researchers are even more incomplete. According to the study of Kostelecky and Bernard on international mobility[8], 10-17% of Czech researchers (i.e. 1500-2300 according to different methods of estimating) worked or studied abroad for a minimum of 9 months. Main destinations were the USA (51%) and Western Europe (43%). Within Europe, the most popular destinations are Austria, Germany, the UK, France and Switzerland. One of the most important finding from this study was the conclusion that the probability of return decreases with an extended time of stay. Among the main motivations to go abroad were new experience (83%), increase of qualifications (57%), work conditions (43%), specific topics of research (38%) and increased income (33%).

The measures implemented in order to simplify conditions for inward flows of researchers and thus enhance "brain gain" were the following (Centre for Higher Education Policy Studies, University of Twente, 2011):

- Implementation of the Council Directive 2005/71/EC on a specific procedure for admitting third-country nationals for the purpose of scientific research. Since 2007, researchers from non-EU countries and their families can apply for a Scientific Visa valid for public as well as private research organisations and applicable to researchers hosted by a Czech research organisation for carrying out a research project (based on the Hosting Agreement).The advantage is in a simplified procedure and shorter processing period for a long-term residence permit.

- The EU directive on Scientific Visa Package was transposed into the Czech legislation in December 2007. Since this date, the Scientific Visa is in place and can be applied for.

- A programme for attraction of qualified experts from third countries called "Selection of Qualified Foreign Workers" was managed by the Ministry of Labour and Social Affairs since 2003. The advantages of this programme were to shorten the time needed to receive permanent residence for highly qualified workers from usual five years of uninterrupted stay in the Czech Republic to 1.5 years for highly qualified workers with their family members which were also allowed to obtain permanent residence in the CR. During 2003-2010, the programme had almost 2000 participants (including 159 researchers). However, the number of participants was not as high as the ministry initially expected. Furthermore, as a result of the budget cuts caused by recession, the programme was closed in 2010. Another reason for the termination of the programme was a new system of economic migration to the CR prepared by the ministry. This system should give similar advantages like those of the programme participants to all incoming high qualified workers.

- Programme for human resources development intended for talented MA and PhD students – a grant programme for students from third countries at public HEIs, managed by the Ministry of Education, Youth and Sport.

[8] Kostelecky, T., Bernard, J., Patockova, J. (2008): International Policy Approaches to dealing with Brain Drain. The Institute of Sociology of the Academy of Sciences of the Czech Republic *(in Czech language)*

- Programme for support of bilateral mobility of students and university teachers and researchers funded by the Ministry of Education, Youth and Sports and financial resources from Structural Funds.

- Euraxess Centre (www.euraxess.cz), a project founded by the Ministry of Education, Youth and Sports through the EUPRO programme. The project provides to incoming foreign researchers information about job opportunities in the Czech Republic, advice and assistance on visa procedure, social security, taxes and other practical aspects of everyday life in the CR. The network created by the project includes two main centres and seven regional contact points.

Outwards mobility of researchers from the Czech Republic is supported mainly through the following funding programmes prepared by the Ministry of Education, Youth and Sports in 2009/2010:

- "Mobility" support programme - oriented on sending researchers on short-term internships to partner institutions

- Programme called "Návrat" (i.e. Return) - for researchers/specialists returning back to the Czech Republic after a stay abroad. Support to their reintegration into the Czech research institutions, continuity of their careers.

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions and barriers to cross-border mobility are removed

According to the national statistics, only marginal part of research staff (about 3%) is employed based on a time-limited contract, i.e. on the basis of a research grant for the duration of a particular research project. Actually, the majority of research staff (mainly lower academic staff) that has – according to the statistics – permanent contract, has in fact time-limited contracts that vary from two to five years. Current regulations allow two consecutive periods at most, after which a change of contract into an indefinite one is required. Indefinite or permanent contracts apply in principle to the higher academic ranks. These contracts are continuously extended on a five-year period taking into account the evaluation of individual performance. However it is quite rare that a contract is not prolonged, only in cases of very bad evaluation. In other words, strict permanency in the sense of tenure does not exist, as in accordance with current labour regulations the institution can terminate an indefinite contract. This job uncertainty in the academic and especially higher education sphere is justified by the HEIs by the argument that their vital dependence on time-limited grants cannot create a working environment with permanently guaranteed salaries and working conditions (Centre for Higher Education Policy Studies, University of Twente, 2011).
Comparing the average salaries of researchers to salaries in other occupations in the Czech Republic or to researchers abroad, we have to differentiate between salaries of professors and associate professors and salaries of lower academic positions. Average salaries of professors and associate professors are comparable with salaries in high-qualified positions in other sectors, such as finance and banking or ICT and are among the best paid job categories. Average salaries for lower academic positions are only slightly higher than average salary across the country. Compared the international competitive remuneration of academics, reference can be made to a study carried out for the European Commission (European Commission, 2007). In terms of PPS, the Czech average total yearly salary of researchers (€36,950), lags behind the EU-25 average (€40,128) but exceeds the average of new member countries (€33,959).
Comparing the salaries in absolute figures, the difference between the Czech Republic and the EU average is much higher (the salaries of R&D employees are almost twofold in the EU average compared to the CR), which is one of the most significant pull-factors of outward mobility.
As the Czech system of remuneration in research allows more differentiation between disciplines and institutions, the salaries of researchers are set at the level of institutions and depend on their internal regulations. The distinction is made between the tariff part determined according to the wage schedule for each academic rank and the flexible part that can be reserved for personal income and added to the basic salary. Institutions have freedom to use the tariff system as they wish and the smaller the tariff part, the more can be used for flexible rewards. Some institutions apply a tariff level as low as 50% implying that salary differences can differ substantially between staff in the same rank. Similarly at ASCR institutes salary tables are not set centrally and the different extras (that can add up to 50% of the basic salary) are distributed to the most productive groups. Group leaders in turn operate quite independently in their financial affairs and

have much freedom to determine the salaries of their group members on the basis of individual performances. This means that individual staff can be paid very differently between and within research groups. The existing system motivates researchers to be productive and to maximise their success in grant competitions which has an overall positive impact on the quality of research. On the other hand, lower tariff levels do not attract sufficient number of young researchers, as their salary is dependent on the will of their direct manager (Centre for Higher Education Policy Studies, University of Twente, 2011).

Overall, for the last decade, international cooperation in R&D has been heavily promoted in the Czech Republic, especially after entering the EU structures. The Czech Republic has been connected to various systems of international advertising of research vacancies, including the European Researcher's Mobility Portal.

The Czech Republic's legislative rules provide a relatively open access for foreign researchers to be employed at academic positions, especially in case of EU citizens. There are also several measures simplifying inward mobility of researchers from the "third countries" (for more information on policy measures see the previous section).

Standardisation of PhD programmes as well as university research issues in the country is being currently solved within the reform of tertiary education based on the debate corresponding to challenges identified in the White Paper on Tertiary Education (adopted by the Government in 2009).

1.3 Improve young people's scientific education and increase interest in research careers

The problem in ensuring a sufficient supply of graduates able and willing to work as researchers is in the mismatch between the existing structure and quality of researcher's training and the needs of research branches with excellent results. The total number of postgraduates is increasing but their structure does not correspond to the needs research institutions. The excessive number of PhD graduates in social sciences and humanities cannot find employment in appropriate research positions. And vice versa, the low levels of PhD graduates in technical and natural sciences does not satisfy the demand of research institutions for new researchers, which hampers further development of these research fields.

Present education curricula more or less emphasise the importance of creativity, critical thinking, problems solving, and teamwork or communication skills. However, entrepreneurship training is not commonly included in curricula, which is a weakness that often negatively reflects in the functioning of research institutions.

1.4 Promote equal treatment for women and men in research

The Czech Labour Code guarantees to female employees restoration to the same position after a maternity leave. An extension of the contract due to maternity leave in the case that an employee works in a fixed-term contract is not guaranteed by the law. Nevertheless, the employee has right to receive financial aid for the protective period of 180 days after the termination of the contract. Such conditions may be a barrier for female researchers' career considering the fact that work contracts in research organisations are often on the fixed-term basis. This corresponds to very low percentage of female researchers (25% in FTE) compared to the EU average and the new member states as well.

Representation of women in academic and research leading positions is also very low – 21% in decision making bodies of public HEIs (and just 4% of rectors), 17% in decision making bodies of PROs (and 16% of female directors of PROs), 16% of leading positions in the Academy of Sciences. In bodies evaluating grant proposals, women make up only 14% in the Grant Agency of the Czech Republic (Czech Science Foundation) and 17% in the Technological Agency of the Czech Republic. In the presidiums of these organisations, there is not a single woman. In the Council for Research, Development and Innovation, women make up only 12.5%, i.e. 2 out of 16 members of the Council (Tenglerová, 2010).

In 2010, the Council of the Government for Equal Opportunities for Women and Men addressed for the first time the state of gender equality in science, and drafted a suggestion to the Government regarding to need to address the issue at the level of expert and advisory bodies. However, while acknowledging this suggestion, the Government did not initiate any action in this respect.

One of bright exceptions to the policy leading to equal chances of women and men in research is the newly introduced possibility to interrupt or postpone the implementation of a postdoctoral grant of the Grant

Agency of the CR (Czech Science Foundation) due to parental leave. However, other grant providers do not enable this option.

2. *Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding*

So far the Czech Republic has expressed an interest to participate in five Joint Programming Initiatives (JPIs):

- Neurodegenerative Disease Research,
- Agriculture, Food Security and Climate Change,
- A Healthy Diet for a Healthy Life,
- Cultural Heritage & Global Change,
- and Antimicrobial Resistance.

The CR has nominated representatives to the management structures of JPIs mentioned. In the CR there exist research programmes managed by several programme owners (e.g. Ministry of Agriculture, Ministry of Health, Grant Agency of the CR, Technology Agency of the CR etc.) which support research relevant to the strategic research areas of the JPIs. However, the Czech Republic plays rather a role of an observer in JPIs as the financial participation of the programme owners (Czech public institutions) in JPIs is not obvious so far.

National R&D programmes are open to foreign individual researchers, but only to some extent: when working for a Czech research institution or when being a resident in the CR at the moment of application and realisation of the research project. National programmes are not open to foreign research teams from a foreign research institution.

3. *Develop world-class research infrastructures (including e-infrastructures) and ensure access to them*

The Roadmap for Large Research, Development and Innovation Infrastructures in the Czech Republic was approved by the Government in March 2010 as a strategic document for development of large infrastructures for research, development and innovation. The goal of the Czech Republic in respect to ESFRI Roadmap projects is to have a node or a measuring station in the case of distributed infrastructures or to build a regional partner facility in the case of single sited research infrastructures.

The Czech Republic has been participating in various projects of ESFRI Roadmap projects. These are: Council of European Social Science Data Archives – CESSDA, Common Language Resource and Technology Infrastructure – CLARIN, European Advanced Translation Research Infrastructure in Medicine – EATRIS, Extreme Light Infrastructure – ELI, Feasibility Study for a European Virtual User Office – ESRF-up, European High Power Laser Energy Research – HiPER, Integrated Carbon Observation System – ICOS, The European infrastructure for phenotyping and archiving of model mammalian genomes – INFRAFRONTIER, Integrated Structural Biology Infrastructure for Europe – INSTRUCT, Jules Horowitz Reactor Project – JHR and Survey of Health, Ageing and Retirement in Europe – SHARE.

Strengthening of the Czech research infrastructure is supported by means of the Operation Programme Research and Development for Innovation administered by the Ministry of Education, Youth and Sports. Two main priority axes are entirely devoted to support of research infrastructure development: Priority axis 1 – European Centres of Excellence, which is focused on establishment of large research infrastructure of a European significance and Priority axis 2 – Regional Centres for research and development, from which research infrastructures for especially industrial research are supported. So far approximately €850m was allocated in the call for proposals of large projects in the Priority axis 1 and 2 within the Operational Programme Research and Development for Innovations. These proposals included an obligation to have a partnership with the ESFRI infrastructure. One of the successful projects – ELI (Extreme Light Infrastructure) aims at creation of an excellent large laser infrastructure in the Czech Republic. It is the only ESFRI Roadmap project which has a base in the Czech Republic.

Besides the participation in ESFRI system, Czech Republic also has own national large research infrastructures; the prevailing areas of their specialisation is material sciences and engineering (6 existing facilities – e.g. the Institute of plasma physics is housing the COMPASS-D and the Institute of physics is housing the PALS – Prague Asterix Laser System), energetics (2) and social sciences and humanities (2).

Furthermore, the Czech Republic participates in developing an e-infrastructure within the GÉANT network (the Czech part is named CESNET – Czech NREN Operator). The Czech research institutes also participate in the following European research infrastructures: European Organisation for Nuclear Research – CERN (since 1991), Joint Institute for Nuclear Research Dubna – JINR DUBNA, European Fusion Development Agreement – EFDA, Multidisciplinary Synchrotron Light Laboratory ELETTRA, European Space Agency – ESA, European Southern Observatory – ESO (since 2007), European Synchrotron Radiation Facility – ESRF (since 1999), Institut Laue-Langevin – ILL 20/20 project (since 1998) and PIERRE AUGER Cosmic Ray Observatory.

4. *Strengthen research institutions, including notably universities*

Higher and tertiary education sector in the Czech Republic consists currently of 26 public and 45 private institutions providing tertiary education. Although the number of private universities has undertaken a rapid growth since 2009, the number of enrolled students in private universities is rather low in comparison to those in public universities.

University management has undergone major changes in the last 15 years, evolving from a centralised model to the self-governing (autonomous) management. HEIs in the Czech Republic are therefore quite autonomous in terms of design of research agendas, budget management as well as recruitment of academic staff.
The biggest weakness of the current universities' management is a low participation of other stakeholders, mainly from industry, in the university management boards. The low participation of industry corresponds with the lack of private R&D funds in HEIs sector (1.1% of the university funding in 2008) is a significant problem in the field of higher education in the CR (although the share of private sector in slightly increase during the last three years – it reached 0.7% of university funding in 2007). This is one of the reasons why universities currently do not properly fulfil their third role. Improvement is expected after the tertiary education reform based on the White Paper of Tertiary Education which has been under a large discussion of the expert public. The White Paper of Tertiary Education is currently being transformed into a new Act on tertiary education.[9]
In the context of implementation of the Reform of RDI System adopted by the Government in 2008 considerable changes of the R&D funding system were implemented. A new methodology on evaluation of research results of HEIs and PROs was introduced to lead the research providers to excellence. A higher share of the institutional funding based on evaluation of R&D results ("Development of research organisations") was put in place, together with the decline of financing through research intentions.
According to the amendment of Act on the support of research and development from public funds provision of institutional support to PROs and HEIs is based on evaluation of their research performance – the share of an institution on the total amount of institutional funding of research organisations in the given year corresponds to its share on the sum of research results of all research institutions/organisations in previous five years (based on annual evaluation performed by the R&D Council). In 2010, the share of institutional funding based on R&D results compared to the share of funding through research intentions was 30:70. In 2011, the ratio was 60:40 in favour of evaluation based funding and in 2012, the share of this funding shall dominate.

5. *Facilitate partnerships and productive interactions between research institutions and the private sector*

In recent years, the Czech Republic has started being active in promoting and supporting cooperation of private and public bodies in R&D. The situation has been as if the two worlds (public and private) have lived separately. The new efforts strive to overcome these barriers.

[9] ERAWATCH Country Report 2010: Czech Republic; Czech Statistical Office

The current set of measures puts greater emphasis on technology transfer and co-operation between research institutes and private companies at the first place. In other words, the effort is to gain a more intensive inclusion of the private sector into joint public-private research projects. This shift is connected also with a sounder support to R&D in businesses and private enterprises. These measures are to increase the private expenditures on RDI and facilitate diffusion of new technologies in enterprises.

The support programmes are either financed from the Operational Programme Enterprise and Innovation (the sub-programmes called Innovation, Potential, Cooperation and ICT and Strategic Services), or programmes funded mainly from the national sources and administered by the Ministry of Industry and Trade (IMPULS, TANDEM and TIP). All of the programmes are focused on support of industrial R&D and collaboration of enterprises with research institutions. Programmes administered by the Technology Agency of the CR (Alpha, Centres of Competence) also emphasise strengthening collaboration between public research institutes and private sector as one of their main goals. Also, the Ministry of Education, Youth and Sports currently carrying out a project called EF-TRANS; its goal is to set up and bring into effect knowledge transfer between R&D institutions and industry. A simple system of knowledge transfer is being created, with a special emphasis on patent and licenses applications, intellectual property, establishment of spin-offs, and active cooperation between research institutions and industry.
In the area of IPR protection, an important tool is represented by the programme called INOVACE (forms part of the Operational Programme Enterprise and Innovation) which supports innovative projects based on R&D and allows to subside the use of protection of intangible assets in the form of patents, utility models, industrial designs and trademarks.

Currently, there are around 15 centres for technology transfer in the Czech Republic. The majority of these centres operate within major universities (especially those oriented at technical and material sciences) or specialised intermediary organisations. Establishing technology transfer points and offices in research institutions as a way to use research results is one of the activities eligible within the Priority Axis 3 "Commercialisation and popularisation" of the OP Research and Development for Innovation. The allocation for this priority axis is approx. €250m. The first technology transfer offices could be supported from this programme at the beginning of 2012.
Knowledge transfer at universities and research organisations is set through internal payroll regulations and other internal regulations defining remuneration of researchers including extraordinary fees (related to successful transfers, patents, licences etc.). The main problem is the lack of staff qualified in knowledge transfer and IPR issues.
The level of inter-sectoral mobility of Czech researchers and technology oriented staff between public research organisations (including universities) and businesses is still quite low in the CR. Academic and business sphere largely function in parallel, side-by-side. The practice that a researcher of a public research institution would gain a fellowship at a private research organisation (and vice versa) is certainly not usual. Limited two-way mobility of researchers is also caused by financial reasons - former academics who are successful entrepreneurs often do not intend to come back to academia full time. Existing policy measures have been concentrated mainly on international staff mobility. New measures introduced mainly within OP Education for Competitiveness may improve this situation in the future.
The question of modification of the structure of HEIs governance bodies has been a significant political issue in the recent years. The reason behind it was to promote knowledge transfer between the HEIs and industry by adjusting education curricula and research and development agenda of HEIs so that they would respond more the current industry needs and demands. These issues were addressed in the White Paper of Tertiary Education and consequent Act on Tertiary Education proposals, which introduce an open system of autonomy of HEIs, with representatives of the relevant industries being allowed to their governing bodies. However, the new Act on Tertiary Education is not in force yet and thus the participation of business sector in the governance of universities (management boards) is still low. The current situation at Czech HEIs is that the representatives of various private industrial companies are present in Scientific Boards (as external members) as well as on Boards of Trustees, which has a certain influence on long-term strategy of HEIs.

6. Enhance knowledge circulation across Europe and beyond

Considering the amount of subsidy as well as the number of projects, the most important initiative of international co-operation with participation of Czech research are the EU Framework Programmes. The Czech Republic is also active in international co-operation organisations and platforms as EUREKA, COST, CERN and many others.

Because of the existing and well-functioning environment for R&D co-operation within Europe, the national measures on cross-border co-operation focus on co-operation with countries outside the EU. For more information see the following section.

Cross-border co-operation in R&D and innovation activities is supported also from the Operational Programme Transnational Co-operation – Central Europe. The Czech Republic shares the programme with Austria, Poland, a part of Germany, Hungary, Slovenia, Slovakia, a part of Italy and also a part of Ukraine.

The Research and Development Council of the CR administers the R&D Information System, an information system of the public administration for a collection, processing, publication and utilisation of data about the research and development, which has been supported by public budgets. The system consists of the following parts:

- Central register of R&D projects
- Central register of research intentions
- Information register on R&D results
- Register of public R&D tenders

Web pages of the R&D Information System have two language versions – Czech and English – which allows foreign users to use the system as well.

7. *Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world*

In 2008, the Ministry of Education, Youth and Sports prepared the "Concept of Interdepartmental Policy of International Co-operation in R&D until 2015" as the ministry is the key organisation responsible for this issue in the Czech Republic. The mission of international co-operation in R&D is to create such conditions which allow participation of Czech research teams in the fields of Community research where international co-operation is more advantageous than R&D financed solely from national resources. The Interdepartmental Policy should enable other providers of R&D support (Ministry of Foreign Affairs, Ministry of Defence) to operate their own programmes supporting international R&D co-operation.

The Czech Republic's involvement in bilateral international co-operation in R&D consists of:

- agreements on scientific co-operation;
- "cultural agreements";
- agreements on economic, industrial and scientific co-operation.

The framework of bilateral international co-operation in R&D is formed by:

- Programme of international co-operation in R&D called "KONTAKT II" (2011-2017; approx. €23m) following "KONTAKT" (1996-2012) and supporting projects of basic and applied research (targeted funding) based on co-operation with third countries – in the current period namely with China, Japan, Russia, South Korea and the USA; since 2012/2013, the programme expects involvement of Brazil, India, Israel and South Africa. Specific themes are defined in co-operation with some countries whilst in others the list of themes is open.
- Programme of international co-operation in applied research and experimental development (institutional funding) between the Czech Republic and Israel called "GESHER/MOST" (2010-2016; approx. €12m).
- Activity of international co-operation in R&D supporting mobility of researchers called "MOBILITY" (2011-2018; approx. €6m of institutional funding).

The Czech Republic's international R&D co-operation with third countries is to a large extent carried out through bilateral agreements. The main science fields of the cooperation are material sciences, ICT, biotechnologies, sustainable technologies and engineering sciences. On the basis of bilateral schemes, the Czech Republic co-operates mainly with India, Israel, South Korea, Russia, Argentina, China, and the United

States. The prioritised research fields correspond with the branches most important for competitiveness of Czech research. Prioritisation of countries for bilateral international co-operation reflects important links of the Czech economy to the most developed countries or countries with the biggest economic and population potential in the outside the EU. This attitude could be therefore viewed as a highly strategic one.

Regarding R&D co-operation within the EU, the Czech Republic has bilateral mobility (exchange) agreements with France, Slovakia, Hungary, Germany, Slovenia, Poland and Austria. Agreements with Italy and Greece have not been continued due to the low interest from these countries. The EU-country bilateral co-operations are mostly without money crossing borders, so there is no budget attached to the agreements.[10]

[10] Ministry of Education, Youth and Sports; R&D Information System

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List of Abbreviations

ASCR	Academy of Sciences of the Czech Republic
BERD	Business Expenditure on Research and Development
CERN	European Organisation for Nuclear Research
CESSDA	Council of European Social Science Data Archives
COST	European Cooperation in Science and Technology
CR	Czech Republic
CRDI	Council for Research, Development and Innovation
CSF	Czech Science Foundation = Grant Agency of the Czech Republic
CZK	Czech koruna
EFDA	European Fusion Development Agreement
ELI	Extreme Light Infrastructure
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ERDF	European Regional Development Fund
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESO	European Southern Observatory
ESRF	European Synchrotron Radiation Facility
EU	European Union
EU15	European Union - Member States before 2004
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	European Framework Programme for Research and Technology Development
FP	Framework Programme
FP7	7th Framework Programme
FTE	Full-time equivalent
GOVERD	Government Intramural Expenditure on R&D
GA CR	Grant Agency of the Czech Republic = Czech Science Foundation
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education R&D Expenditure
HES	Higher education sector
HiPER	European High Power Laser Energy Research
ICOS	Integrated Carbon Observation System
ICT	Information and Communication Technologies
IPO	Industrial Property Office
IPR	Intellectual Property Rights
IUS	Innovation Union Scoreboard
JPI	Joint Programming Initiative
MEYS	Ministry of Education, Youth and Sports of the Czech Republic
MIT	Ministry of Industry and Trade of the Czech Republic
MNCs	Multinational companies
NABS	Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets

NRDIP	National Research, Development and Innovation Policy of the Czech Republic 2009-2015
NIS	National Innovation Strategy
OP	Operational Programme
OP EI	Operational Programme Enterprise and Innovation
OP RDI	Operational Programme Research and Development for Innovation
PROs	Public Research Organisations
R&D	Research and development
RDI	Research, Development and Innovation
SHARE	Survey of Health, Ageing and Retirement in Europe
SME	Small and Medium Sized Enterprise
S&T	Science and Technology
TA CR	Technology Agency of the Czech Republic
USPTO	United States Patent and Trademark Office

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Abstract
The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

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