ERAWATCH Country Report 2009
Analysis of policy mixes to foster R&D investment and to contribute to the ERA
Czech Republic

Lenka Hebakova and Ondrej Pokorny
The mission of the JRC-IPTS is to provide customer-driven support to the EU policy-making process by developing science-based responses to policy challenges that have both a socio-economic as well as a scientific/technological dimension.
ERAWATCH COUNTRY REPORT 2009: Czech Republic

Analysis of policy mixes to foster R&D investment and to contribute to the ERA

ERAWATCH Network – Technology Centre AS CR

Lenka Hebakova and Ondrej Pokorny
Acknowledgements and further information:

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Executive Summary

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are thus at the heart of the Lisbon Strategy. This is reflected in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This advocates increasing and improving investment in research and development (R&D), with a particular focus on the private sector. This report aims at supporting the mutual learning process and the monitoring of Member States efforts. Its main objective is to characterise and assess the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The report builds on the analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

The Czech research and development (R&D) system is a centralised one. Private investment in R&D is dominated by foreign-controlled companies and at quite a high level within the EU. The public R&D sector is characterized by a traditionally strong position of the Czech Academy of Sciences (AS CR - focused mainly on basic research), similarly to most post-Communist countries. Compared to the EU15, far less research is thus conducted in the sectors of higher and tertiary education.

Even though the total R&D expenditures in the Czech Republic are continually growing, the fulfilment of the Lisbon Strategy objectives seems to be still rather distant. Beyond this, the R&D intensity (i.e. the share of total R&D expenditures on GDP) decreased to 1.54% in 2007 compared to 1.55% in 2006. One of the main objectives of the Lisbon Strategy, where the overall R&D expenditures shall reach 3% of the GDP by 2010, is still a way ahead. Even with the current R&D expenditures increase the Czech Republic will hardly fulfil this objective.

The total BERD of the Czech Republic is CZK33b (€1.2b), which is 66.2% of GERD. This share corresponds to the EU27 average but some of the EU15 reached almost 75%. Total R&D expenditures in the business sector have been increasing by 13% a year since 2000, moreover in the last two years BERD increased by 20% a year. The above mentioned increase of BERD is mainly caused by significant increases in R&D investment by multinationals (MNEs - 59% of BERD is funded by foreign-controlled companies).

In 2007, the share of private financial resources (financial resources coming from the business sector) in the overall R&D expenditures reached almost 54% (approx. 0.82% GDP). Despite the fact that the proportion of private resources has increased over the past few years, it is still lower than required by the Lisbon Strategy (2/3 of the total resources for R&D). The share of public expenditures in the overall R&D expenditures slightly increased in 2007 compared to 2006, which is still higher than the EU25 average and even some of the advanced countries of the EU15.

The share of labour costs on R&D expenditure is low, which corresponds to low salaries of researchers, amounting to the level of 30% of EU15 countries. As a result of low salaries, scientific work loses social prestige and leads to leave of excellent
researchers abroad (so-called brain-drain). This also creates barriers not only to the influx of researchers from other countries (brain gain) but also to the return of elite Czech scientists from their stays abroad.

One of the important barriers to R&D investment is the fact that the public support for R&D is fragmented in the Czech Republic and the expenditure on R&D is low. All relevant policy documents mention this barrier. The opportunity for simplification and unification of the fragmented structure of R&D support would bring reform of research and development adopted by the government in April 2008. Barriers to further increase expenditure on R&D may represent the current economic crisis.

Another barrier lies in the low number of researchers. The opportunity for a more attractive environment for research and development is represented by current Operational Programmes. Building a modern research capacity with the new rating system may attract new researchers, or it may encourage the return of qualified researchers from abroad. Barrier is a failure of appropriate conditions for researchers, poor structure of disciplines at universities and small horizontal mobility of researchers and students.

The low proportion of research in high technology intensive sectors is the third identified barrier. The policy mix is more focused on stimulating further development of R&D investment in R&D performing firms. There is a possibility of transformation of companies at a higher technological sophistication and excellence in the fields of high-technology.

Fourth barrier is a small number of domestic companies engaged in R&D. Current policies may not be sufficient to encourage enterprises which do not perform R&D to become involved in research. The opportunity to increase the number of firms conducting R&D is represented by Inovace and Prosperita programmes.

The last identified barrier lies in weak linkages between academic research and business sector. In any case, the Spolupráce programme is a basic conceptual framework for the development of cooperation between academic and business sector.

From the global point of view, the current R&D system is not very satisfactory in the Czech Republic. Some aspects of the reform have already been settled. However, it is necessary to update the current National Innovation Policy and the National R&D programmes in order to improve national R&D system suitably according to new trends and needs in the field of R&D in Europe.

The following table shows the main identified barriers to R&D investment and related opportunities and risks generated by the policy mix.
Barriers to R&D investment | Opportunities and Risks generated by the policy mix
--- | ---
The expenditures on R&D are low and the public support for R & D is fragmented in the Czech Republic. | All relevant policy documents describing this barrier. The opportunity for simplification and unification of the fragmented structure of R & D support would bring reform of research and development adopted by the government in April 2008. The current economic crisis may represent a barrier to further increase expenditure on R&D.
The low number of researchers. | The opportunity for more attractive environment for research and development represent the current Operational programmes. Building a modern research capacity with the new rating system may attract new researchers, or it may encourage the return of qualified researchers from abroad. OP also offers the possibility of development of research in universities. Failure of appropriate conditions for researchers, structure of disciplines at universities and small horizontal mobility of researchers and students can be barriers to the increase of researchers’ number.
The low proportion of research in high technology intensive sectors. | The policy mix is more focused on stimulating further development R&D investment in R&D performing firms. Shift of companies to a higher technological sophistication and high-tech sectors.
A small number of domestic companies engaged in R&D. | Current policies may not be sufficient to encourage enterprises which do not perform R&D to become involved in research. Inovace and Prosperita programmes represent the opportunity to increase the number of firms conducting R&D.
Weak linkages between academic research and business sector. | Current programmes (Tandem, Impuls, Spoluprace) represent an opportunity to strengthen cooperation between academia and industry. Low absorption capacity of the business sector and insufficient interest of SMEs for R&D results are the risks.
Low commercialization of R&D output | The Operational Programme Research and Development for Innovation (2007-2013), to be used for drawing financing from the EU Structural Funds, should support establishment of testing and assessment departments and technology transfer within research institutes as well as the process of commercialisation of R&D outcomes itself.

Concerning the ERA related policies in the Czech Republic, a new National Research, Development and Innovation Policy 2009 – 2014 is currently being prepared taking into consideration the documents on the European level such as Green Paper on ERA or the new Lisbon Strategy goals and targets. The Czech reaction to the 3% Action Plan at EU level consisted in the adoption of a national document entitled **Action Plan for Europe – Approach of the Czech Republic** in 2004. This document describes existing or proposed future activities in the Czech Republic corresponding to measures proposed in the 3% Action Plan.

National research programmes correspond to the needs of ERA, mainly in the field of mobility of students and researchers (Centre for Mobility), joint research initiatives, networks and platforms leading to international cooperation in the field of R&D or centres of excellence.

The next paragraphs summarise the four pillars of ERA and characterise the Czech responding policies.

**Labour market** for researchers in the CR is open, still suffering from lack of excellent researchers. Only one third of PhD graduates choose the research career. The Czech labour market for researchers is still not attracting the foreign researchers due to the financial conditions. However, the new law on financial support to students and new law on tertiary education shall be prepared in 2009 to improve the situation.
The CR is a member of excellent European research infrastructures and actively participates in developing large research infrastructures within the ESFRI. By the year 2013 the EU Structural Funds will provide significant financial resources for developing large research infrastructure in the CR. Since the CR participates actively in the ESFRI Roadmap projects the EU Structural Funds will considerably contribute also to the development of the large research infrastructures throughout Europe.

White Paper on Tertiary Education as well as financial sources from the OP Education for Competitiveness shall contribute to openness of the universities autonomy in the field of research as well as to transparent environment including monitoring of the university results.

Concerning opening national research programmes, National Programmes are generally open to Czech researchers, but the support of foreign researchers is insufficiently covered. However, the CR is involved in the ERA-NET projects as well as in the FPs projects but the Czech participation is not very outstanding and international cooperation within national projects is still not a common practice.

Generally we can claim that the ERA goals and challenges are reflected in all responding policy and strategic documents in the Czech Republic, such as new proposal of National R&D and Innovation Policy 2009 - 2014, National Reform Programme 2008 – 2010 or Green Paper on R&D and Innovation (2008). Concerning ERA related programmes and activities; the participation of Czech teams on ERA initiatives is not very outstanding even though it has been increasing in the last years. Also to attract foreign researchers to participate on Czech research projects seems to be still a big challenge as well as to avoid the brain drain.

The following table is a summary of ERA pillars, their importance and key characteristics of responding policies in the Czech Republic.

<table>
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<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour market for researchers</td>
<td>• Labour market for researchers still suffers from lack of researchers mainly in the S&amp;T fields,</td>
</tr>
<tr>
<td>• Important, especially with regard to removing barriers to mobility</td>
<td>• Post-graduate education has been classified as preparation for research career, but only 1/3 of PhD graduates choose the research career,</td>
</tr>
<tr>
<td></td>
<td>• International mobility is considered as the main challenge for improvement,</td>
</tr>
<tr>
<td></td>
<td>• Proposal of new law on tertiary education shall be prepared by April 2009,</td>
</tr>
<tr>
<td></td>
<td>• Proposal of new law on financial support of students shall be prepared by December 2009.</td>
</tr>
</tbody>
</table>

Governance of research infrastructures

| • Increasingly important, mainly in the field of ESFRI roadmap and centres of excellence. | • In 2007 – 2013, strengthening of the Czech research infrastructure is supported from EU Structural Funds (Operation Programme Research and Development for Innovation) |
|                                                                                            | • CR will focus on implementation of large European and Czech research infrastructures roadmaps, |
|                                                                                            | • CR is a member of excellent European research infrastructures, |
|                                                                                            | • CR participates in 11 ESFRI Roadmap projects |
### Short assessment of its importance in the ERA policy mix

<table>
<thead>
<tr>
<th>Autonomy of research institutions</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
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<tr>
<td>Important; Universities already have a large degree of autonomy. Autonomy is considered crucial in Czech research policy.</td>
<td>White Paper on Tertiary Education deals with stabilization of the open system of R&amp;D institutions and universities autonomy, Reform of tertiary education shall open universities towards external social interests, Transparent environment including monitoring of university results shall be secured, White Paper covers also the topic of healthy competition in the field of R&amp;D.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opening up of national research programmes</th>
<th>National Programmes are generally open to Czech researchers, the support of foreign researchers is insufficiently covered, CR is involved in the ERA-NET projects as well as in the FPs projects but the Czech participation is not very outstanding and international cooperation within national projects is still not a common practice.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasingly important, but progress so far is limited.</td>
<td></td>
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Finally, there are two reforms tackling the above described issues, opportunities and challenges: reform of the R&D and innovation and reform of the tertiary education. These reforms are coming with concrete measures to improve the R&D and tertiary education systems.
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1 Introduction

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are thus at the heart of the Lisbon Strategy. This is reflected in guideline No. 7 of the Integrated Guidelines for Growth and Jobs.¹ This advocates increasing and improving investment in research and development (R&D), with a particular focus on the private sector. For the period 2008 to 2010, this focus is confirmed as main policy challenge and the need for more rapid progress towards establishing the European Research Area, including meeting the collective EU target of raising research investment to 3% of GDP, is emphasised.

A central task of ERAWATCH is the production of analytical country reports to support the mutual learning process and the monitoring of Member States' efforts in the context of the Lisbon Strategy and the ambition to develop the European Research Area (ERA). The first series of these reports was produced in 2008 and focused on characterising and assessing the performance of national research systems and related policies in a comparable manner. In order to do so, the system analysis focused on key processes relevant for system performance. Four policy-relevant domains of the research system have been distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain has been guided by a set of generic "challenges", common to all research systems, which reflect possible bottlenecks, system failures and market failures which a research system has to cope with. The analysis of the ERA dimension still remained exploratory.

The country reports 2009 build and extend on this analysis by focusing on policy mixes. Research policies can be a lever for economic growth, if they are tailored to the needs of a knowledge-based economy suited to the country and appropriately co-ordinated with other knowledge triangle policies. The policy focus is threefold:

- An updated analysis and assessment of recent research policies
- An analysis and assessment of the evolution of national policy mixes towards Lisbon R&D investment goals. Particular attention is paid to policies fostering private R&D and addressing its barriers.
- An analysis and assessment of the contribution of national policies to the realisation of the ERA. Beyond contributing to national policy goals, which remains an important policy context, ERA-related policies can contribute to a better European level performance by fostering, in various ways, efficient resource allocation in Europe.

2 Characteristics of the national research system and assessment of recent policy changes

2.1 Structure of the national research system and its governance

The Czech Republic is a smaller European country (10,446,157 inhabitants in 2008) with only 2% of the total European Union (EU) population. In 2007, GDP per capita was on the level of 81.4% (in purchasing power standards - PPS) of the EU27 average and unemployment rates were 5.3% versus 7.1% of the EU27 average (Eurostat, 2008).

The Czech research and development (R&D) system is a centralised one. Private investment in R&D is dominated by foreign-controlled companies and at quite a high level within the EU. The public R&D sector is characterized by a traditionally strong position of the Czech Academy of Sciences (AS CR - focused mainly on basic research), similarly to most post-Communist countries. Compared to the EU15, far less research is thus conducted in the sectors of higher and tertiary education.

The Czech research and development (R&D) system underwent a radical transformation along with the post-Communist economic and social transformation of the 1990s. The key changes were linked with the new measures in public spending of the early 1990s which resulted in restructuring of the Academy of Sciences, as well as in reducing the number of former sectoral applied research institutes controlled by individual ministries (they were either privatised or shut down). The public enterprises thus underwent large-scale privatisation and, during this process, lost much of their R&D capacity in a rather short-sighted effort to quickly reduce costs. The consequences of these processes are still being felt at present, especially in the context of the virtual absence of applied research institutes to act as partners for the business sector.

In the Czech Republic, trends in R&D expenditures have been fairly positive over the years with total gross expenditure on R&D (GERD) increasing since 1995 (with the exception of year 2001/2002). In 2007, R&D investment exceeded €1.86b, and the share of total R&D expenditures in the Gross Domestic Product (GDP) was 1.53% (the share slightly decreased from 1.55% in 2006). The lower share in comparison with the previous year was caused mainly by a quicker increase of the GDP than in the area of R&D expenditures, mainly in the business sector. There has been progress towards reaching the overall R&D target of 2.06% of the GDP by 2010 thanks in particular to increased Structural Funds allocations, and to increases in private expenditure stimulated by tax incentives.

Public R&D investment has been on the increase since 2002. Total R&D public expenditures in 2007 are €878m which corresponds to 0.58% of the GDP. Public funding of R&D is divided between institutional and project-based support. Recently there has been a debate about the need to reduce the share of institutional funding, which reached the share of 50-60% in the last decade. In 2008, the share of institutional funding decreased below 50% for the first time since 1999 which follows the expected share of 40% of institutional funding and 60% share of project-based funding.
Main actors and institutions in research governance

At the political level, the main role in the research system has been newly assigned to the Council for Research and Development, an advisory body to the Czech government in R&D, its strategic orientation and mid-term budgeting (including the preparation of national R&D policy strategy and documents). At the operational level, the Ministry of Finance allocates funds to the individual providers, with the Ministry of Education, Youth and Sports (MEYS) and the Academy of Sciences representing the largest providers of public R&D funding (respectively around 30% and 23% of public R&D funding). MEYS is responsible for international R&D cooperation, and it provides funds for research conducted at universities and also coordinates the National Research Programme. A specific role is also assigned to the Ministry of Industry and Trade which is responsible for industrial R&D and is the main body providing public support to private R&D (competitive grants for private sector and collaborative grants between public and private sectors). In addition, several Czech sectoral ministries have significant R&D budgets and also act as important R&D supporters (both through project-based and institutional funding). This concerns mainly the following ministries: Ministry of Health, Ministry of Transport, Ministry of Environment and Ministry of Agriculture.

The following figure shows the governance structure of the Czech research system at the national level:

**Figure 1: Overview of the governance structure of the Czech Republic’s research system**

Source: ERAWATCH Research Inventory
The institutional role of the regions in research governance

At the NUTS III level the Czech Republic consists of 14 regions that have their own elected regional councils with their own budgets and responsibilities stipulated by law. Regional authorities do not have any legally binding responsibilities in the field of R&D. These lie exclusively with national bodies. In most cases, lack of funds means that regions are largely passive participants in national level R&D policies. This is partly due to the fact that R&D capacities in the Czech Republic are highly concentrated in the capital city of Prague which, in turn, limits the motivation of other regions to make R&D their priority.

Main research performer groups

The largest R&D performer in the Czech Republic is the business sector spending 63.8% of GERD even though the share decreased from 66.2% in 2006, in favour of the public sector. The government sector comes second with 18.9%, followed by the higher and tertiary education sector with 16.9% and private non-profit sector with only 0.4% share in GERD in 2007.

2.2 Summary of strengths and weaknesses of the research system

The analysis in this section is based on the ERAWATCH Analytical Country Reports 2008 which characterised and assessed the performance of the national research systems. In order to do so, the system analysis focused on key processes relevant for system performance. Four policy-relevant domains of the research system have been distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain has been guided by a set of generic "challenges", common to all research systems, which reflect possible bottlenecks, system failures and market failures a research system has to cope with. The Analytical Country Report for the specific country can be found in the ERAWATCH web site.

The summary assessment of strengths and weaknesses of the Czech research system is shown in the following table (Table 1).
### Table 1: Summary assessment of strengths and weaknesses of the national research system

<table>
<thead>
<tr>
<th>Domain</th>
<th>Challenge</th>
<th>Assessment of strengths and weaknesses</th>
</tr>
</thead>
</table>
| **Resource mobilisation**   |                                                                            | **Justifying resource provision for research activities**  
Secured and increasing long term institutional and project-based funding of R&D (increasing GBAORD) but insufficient horizontal coordination between R&D and innovation policy.  
**Securing long term investment in research**  
Long term orientation of R&D specified through National Research Programmes and Long-Term Principle Research Directions but a relatively high share of institutional support to R&D.  
**Dealing with barriers to private R&D investment**  
Total expenditures on R&D in business sector have been recently rapidly increasing but venture capital financing is not developed in the country and Czech companies spend much less on R&D in comparison with the EU average.  
**Providing qualified human resources**  
Number of university graduates and researchers has been increasing but there is still a significant lack of R&D personnel and graduates in S&T fields, both at universities and in the business sector. |
| Knowledge demand            |                                                                            | **Identifying the drivers of knowledge demand**  
High share of R&D expenditures by foreign companies positively influence globalisation of Czech business research and traditionally strong medium high-tech and developing high-tech sector and sector of services but insufficient R&D expenses in the manufacturing industry lead to a much lower gross value added than the EU average.  
**Co-ordination and channelling knowledge demands**  
Common use of ad-hoc group of experts, foresight methods and multidisciplinary approach in preparation of key strategic documents and new research programmes but fragmentation of R&D governmental support persists and systematic and institutional evaluation culture is in its beginning.  
**Monitoring of demand fulfilment**  
Approved Reform and Green Paper on R&D and Innovation promising a clearer system of public R&D support including more efficient evaluation methods. Basic research dominates over applied research in the public sector, experimental development dominates over applied research in business sector. |
| Knowledge production        |                                                                            | **Ensuring quality and excellence of knowledge production**  
Strong public research sector (with a dominant role of the Academy of Sciences) and developed network of public universities disposing of research capacities. Low evaluation culture not leading to supporting excellence, however, there are starting programmes supporting R&D excellence. Recent faster growth of publication activity slowly catching up advanced EU countries but a low level of citations.  
**Ensuring exploitability of knowledge**  
Low level of R&D outcomes commercialisation by public research organisations. Low level of patent production. |
| Knowledge circulation       |                                                                            | **Facilitating circulation between university, PRO and business sectors**  
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.  
**Profiting from international knowledge**  
Effective system of investment incentives supporting localization of R&D and knowledge intensive services in the Czech Republic.  
**Enhancing absorptive capacity of knowledge users**  
Existence of specialized organisations promoting interests of industrial R&D and innovative companies but insufficient capacities of businesses to apply R&D outcomes. |
Strengths of the Czech R&D system in the field of resource mobilisation are mainly the secured and increasing long term public R&D investment including its thematic orientation based on the Long-Term Principal Research Directions (DZSV) and implemented through the National Research Programmes (I – III) and increase of business R&D expenditures as well as number of university graduates and researchers. On the other hand, there is still lack of R&D personnel needed mainly in the S&T fields and Czech firms still spend much less on R&D than the companies abroad.

Strengths of the Czech R&D system in the field of knowledge demand are mainly the globalisation of Czech business R&D and traditionally strong medium high-tech and developing high-tech service-sector. Another positive point is the use of multidisciplinary approach and different foresight and evaluation methods. On the other hand, there is space for the increase of R&D expenses in the manufacturing industry and the share of applied research in both public and private sector.

The main strength of the Czech research system in terms of knowledge production is ensured by strong public research sector. Although the issue of R&D evaluation represents an important challenge, the main weaknesses of the sector lie in the exploitability of research outcomes related to weak performance of public research organisations in commercialisation and IPR issues.

In the field of knowledge circulation between universities, public research organisations and business sector, policy responses to the main challenges are in place. However, practical outcomes of programmes and policy measures are still insufficient. The issue of researchers’ mobility between the mentioned sectors needs more attention. System responses to the challenges connected with access to international knowledge (and favourable geographic location of the Czech Republic) are in place and could be assessed as rather successful. In terms of enhancing absorptive capacity of knowledge users, organisations promoting interests of industrial R&D and innovative companies exist. However, the cross-cutting issues related to the access of businesses to financial resources and qualified human resources remain challenges.

2.3 Analysis of recent policy changes since 2008

The contribution of research policies to Lisbon goals (as well as to other societal objectives) goes beyond the fostering of R&D investment. It is therefore important to also analyse how other remaining shortcomings or weaknesses of the research system are addressed by the research policy mix. The focus of the section is on the analysis of main recent policy changes which may have a relevant impact on the four policy-related domains.

In February 2008 the Council for Research and Development approved and published the Reform of the Research, Development and Innovation System in the Czech Republic. Subsequently, the document has been approved by the Resolution of the Czech Government n. 287 on March 26, 2008. The main goal of the R&D and Innovation Reform is to create an innovation environment in the Czech Republic, where “Research is the transformation of money into knowledge, and innovation is the transformation of knowledge into money”- which is an official motto introducing the Reform (Council for R&D, 2007).
Key aspects of the Reform are to be: 1) Simplifying the entire system, including an introduction of institutional funding based on results; 2) Reducing the number of funding bodies (from current 22 to less than 10), incl. an introduction of a Technology Agency for applied R&D and simplification of administration; 3) Supporting excellence in R&D a ensuring the use of results for innovation processes; 4) Making the programme support from public sources conditional on co-funding of R&D activities from third parties (commercial partners); 5) More flexible organizational structure of public R&D; 6) Safeguarding personnel for R&D and innovation; 7) Increasing the intensity of international cooperation in R&D.

**Green Paper on R&D and Innovation** as an official annex to the Reform represents a complex analysis of the current situation and recent development in the field of R&D and innovation including its macroeconomic framework, inputs and outputs of the system in the international context. This Paper will be used as a basis for formulating new strategic documents in shaping knowledge based society in the Czech Republic (TC, 2008a).

**White Paper on R&D and Innovation** and Paper on Good Practices in R&D&I have been consequently prepared in 2008, reflecting among others the public debate based on the Green Paper on R&D and Innovation. The White Paper includes not only the EU legislation and EU recommendations on the development of European knowledge based society but also specifies concrete goals, measures and steps to be done. Paper covers the best foreign practices in the area of research, development and innovation systems. All these papers have been prepared by the Technology Centre AS CR (TC, 2008b).

**White Paper on Tertiary Education** shall lead to the reform of the education system including changes in curricula at universities so that they more correspond to the labour market needs and needs of knowledge based society. The reform of the education system should also result in increasing human resources in R&D.

On April 2, 2008 the Government also adopted the final text of the *Operational Programme R&D for Innovation 2007 – 2013* (MEYS, 2008b), which should, together with other national and European sources, bring significant support from the ERDF to the R&D infrastructure. The document has been approved by the European Commission on October 1st, 2008, while the negotiations about the content between Czech MEYS and DG REGIO have finished in July 2008. First calls for proposals have been launched in December 2008.

The Czech Republic adopted, similarly to other Member States, the *National Reform Programme 2005 - 2008* (NRP) in autumn 2005 where measures supporting economic growth and employment were defined (GO, 2005). In January 2007 the responsibility for the coordination of the Lisbon strategy in the Czech Republic has transferred to the Deputy Prime Minister for European Affairs who has also in an expert team prepared the new *National Reform Programme 2008 – 2010* (GO, 2008). The table below summarises the measures that have been or will be implemented to meet all the identified challenges in the Czech R&D system.
### Changes in National Reform Programme regarding the role of research in the broader economic growth strategy

In the “microeconomic part” of the [National Reform Programme 2008 – 2010](#), in the chapter of IG7 “To increase and improve investment in R&D, in particular by the private sector”, there is a summary of adopted and implemented measures in the area of R&D from 2005 to 2008:

- The Reform of research, development and innovation in CR was approved in March 2008. In July 2008 also the “Inter Resort Concept for Security Research and Development of the Czech Republic up to 2015” and “Inter Resort Concept for International Cooperation in Research and Development through 2015” were approved;
- Amendment to Act No. 586/1992 Coll. on Income Tax, which enabled entrepreneurs as of January 1, 2005 to apply a deductible item from the taxable income tax base in expense invested into realization of research and development projects;
- Support of private research and development through tax breaks;
- Acceptance of Act No. 341/2005 Coll. on Public Research Institutions enabling transformation of research institutions;
- Realization of National Development Programmes supporting human resources for research and development;
- Transposition of Directive 2005/71/ES into the Amendment to Act on foreign workers from third countries staying in the Czech Republic for R&D purposes;
- Change to Act No. 341/2005 Coll., on Public Research Institutions changing conditions for R&D personnel from non-EU countries;
- Acceptance of a European Charter for Researchers and a Code of Behaviour for Accepting Researchers;
- Establishment of a Czech Mobility Centre for providing expert information to researchers.

The planned reform measures to be done in the near future are the following:

- Technological Agency will be established for the field of applied research grants by 2010;
- Annual increase of public expenses on research and development is planned to reach at least 8%;
- Use of financial resources through approved [Operational Programme Research and Development for Innovation](#), OP Education for Competitiveness and [OP Entrepreneurship and Innovation](#);
- Creating a “roadmap” of Czech research infrastructures;
- Modernization of research institutions and universities management in accordance with principals contained in the White Paper on Tertiary Education in the Czech Republic;
- Improvement in the area of human resources through national programmes, resources of cohesion policy, measures identified in the “Reform of Research and Development System of the Czech Republic” and legislative modifications of tertiary education.
2.3.1 Resource mobilisation

The recent strategic documents (mainly the R&D system reform) plan the reduction of the institutional funding share on public R&D funding as well as the reduction of the number of R&D funding providers to more effectively justify the resource provision for research activities. The increase of the targeted project-based funding shall lead to the support of excellence in research according to the newly updated Long-Term Principal Research Directions (DZSV).

Long term investment in research is secured through national grants such as National Research Programmes as well as European sources. EU Structural Funds 2007 – 2013 enable to finance not only the research projects covering human resources, knowledge transfer and life long learning (ESF) but also projects financing the research and innovation infrastructures (ERDF). The Czech research teams participation in the EU 7th Framework Programme (supporting also research mobility, platforms etc.) has been constantly increasing even though it must be noted that it is still lower that the EU15 average. Applied research shall be financed by the Technology Agency from 2010 (as planned in the Reform and mentioned as one of the measures also in the NRP 2008 – 2010).

The total BERD of the Czech Republic is CZK33b (€1.2b) in 2007, which is 66.2% of GERD. This share corresponds to the EU27 average but some of the EU15 reached almost 75%. Total R&D expenditures in the business sector have been increasing by 13% a year since 2000, moreover in the last two years BERD increased by 20% a year. Total expenditure in the business sector doubled between 2000 and 2006.

The increase in BERD may be caused by the introduction of a new act concerning tax deductions on R&D expenditure as one of the new policy measures to deal with uncertain returns and other barriers to business R&D investment, mentioned also in the NRP 2008 - 2010. This legislation also increases motivation of businesses to report more accurately on their investments in R&D, which may make the levels of R&D spending more apparent. The effect of the tax deductions is, however, more visible in the low and medium high-tech industrial sectors than in the high-tech sectors.

Even though the number of university graduates and researchers has been recently increasing in the Czech Republic, there is still a lack of R&D personnel and graduates mainly in the S&T fields. This challenge has been also included in the White Paper on Tertiary Education (MEYS, 2008a). Policy measures enabling the integration of immigrants and better conditions for the foreign researchers have been adopted by the Government in 2008. Measures to increase the interest of graduates to choose the research career lies mainly in the financial motivation through international joint research programmes and activities.
Table 2: Main policy changes in the resource mobilisation domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main policy changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justifying resource provision for research activities</td>
<td>• Reduction of the institutional funding share on public R&amp;D funding supported by several strategic documents;</td>
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<tr>
<td></td>
<td>• Reduction of the number of R&amp;D funding providers (R&amp;D Reform, 2008).</td>
</tr>
<tr>
<td>Securing long term investment in research</td>
<td>• EU Framework Programmes for R&amp;D to encourage and facilitate the participation of Czech researchers in the FP;</td>
</tr>
<tr>
<td></td>
<td>• National Research Programmes and EU structural funds projects financing the research and innovation infrastructure;</td>
</tr>
<tr>
<td>Dealing with uncertain returns and other barriers to business R&amp;D investment</td>
<td>• Introducing tax deductions on R&amp;D expenditure;</td>
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<tr>
<td></td>
<td>• Planned Technology Agency to be established by 2010 to distribute the financial sources for the applied research – according to the government reform.</td>
</tr>
<tr>
<td>Providing qualified human resources</td>
<td>• Increasing the number of qualified human resources is one of the main policy objectives included in the White Paper on Tertiary Education (2008);</td>
</tr>
<tr>
<td></td>
<td>• Adoption of strategic documents aiming to facilitate the integration of immigrants in the CR by the Government (since 2005);</td>
</tr>
<tr>
<td></td>
<td>• Measures aimed at increasing R&amp;D personnel (Operational Programmes, National Research Programmes).</td>
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</table>

2.3.2 Knowledge demand

Business expenditures on R&D (BERD) are far below the EU27 average (amounting to about 35% of the EU15 average in EUR per one inhabitant in 2006) and the share of BERD in the total R&D expenditure (GERD) approaches 66%. According to statistical data (CZSO, 2007) business R&D expenditures increased by more than 20% from 2005 to 2006, which significantly exceeds the EU27 average and most of the EU15 countries. This development reflects the fact that the CR is ranked among countries which are in the transition phase from efficiency-driven competitiveness to innovation-driven competitiveness (Lopez-Claros, 2006) and utilisation of knowledge plays a more significant role for building a competitive advantage of Czech enterprises. Business knowledge demand consequently grows.

Processes for identifying drivers of knowledge demand (e.g. foresight and planning exercises, expert groups, technology assessment) have been launched in the Czech Republic. Since 2000, foresight exercises have been periodically used for identifying thematic orientation of National Research Programmes (NRP) for public funding of research. Proposal of the National Research Programme III shall be used as a basis for channelling the public funds on research in the period of 2009 – 2014.

The use of ad-hoc group of experts for development and/or consultations during the preparation of strategic documents is relatively common in the CR. For instance, the proposals of strategic priorities for the new programming period of the EU Structural Funds (2007 – 2013) were prepared by the working groups constituted specifically for particular areas. Expert groups have been also involved in preparation of the White Paper on Tertiary Education and White Paper on R&D and Innovation in 2008, which can be considered as key documents for the upcoming reform of tertiary education and a new National Research, Development and Innovation Policy which shall be finished by May 2009. Also the Long-Term Principle Research Directions setting up strategic thematic orientation of research in the CR were elaborated by working
groups of experts in 2005 and have been updated recently – the document will be adopted soon as an annex to the new R&D&I policy.

Systematic and institutional evaluation culture in the Czech Republic is not satisfactory yet. The evaluation of research results financed from public resources is based on methodology prepared by the Council for Research and Development of the CR. Even though this methodology supports creation of applicable results, the differentiation of further allocation of finances according to the evaluation results is insufficient.

However, the Reform of R&D includes a new proposal for evaluation and monitoring of publicly funded research. Evaluation and monitoring of R&D results will be simplified and prepared by the Council for Research and Development with the aim to effectively distribute institutional support including substantial differentiation of further public support based not only on publications and citations in the field of basic research but also on patents, realized technologies, software, legislative results and certified methodologies in the field of applied research. The planned establishment of the Technology Agency by 2010 shall also use a systematic approach in not only distributing but also monitoring and evaluating the financial support to the applied research.

Table 3: Main policy changes in the knowledge demand domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main policy changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying the drivers of knowledge demand</td>
<td>• Preparation of the National Research programme III proposal with problem-oriented</td>
</tr>
<tr>
<td></td>
<td>and multidisciplinary research priorities (2007)</td>
</tr>
<tr>
<td>Co-ordinating and channelling knowledge demands</td>
<td>• Specification and adoption of the Long-Term Principle Research Directions (2005)</td>
</tr>
<tr>
<td></td>
<td>and their update expected in 2009</td>
</tr>
<tr>
<td></td>
<td>• Preparation of the White Paper on R&amp;D and Innovation (2008) proposing measures</td>
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<tr>
<td></td>
<td>to increase private R&amp;D expenditures and adjust public research more to the demands</td>
</tr>
<tr>
<td></td>
<td>of enterprises and society</td>
</tr>
<tr>
<td>Monitoring demand fulfilment</td>
<td>• New system of evaluation and monitoring of R&amp;D results included in the R&amp;D Reform</td>
</tr>
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<td></td>
<td>(2008)</td>
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</tbody>
</table>

2.3.3 Knowledge production

Knowledge production in the Czech Republic is, as in the most of the post-Communist countries, strongly concentrated into the public sector represented mainly by 53 research institutes of the Academy of Sciences and 25 public universities. Unlike in advanced EU countries, higher share of research activities is performed within the Academy (predominantly dealing with the basic research), while Czech universities are still less research-oriented and more focused on education even though the trend has been changing recently according to the reform of tertiary education.

In 2005, a new Law on Public Research Organisations was enacted which changed the legal status of public research organisations from January 2007. It increased their autonomy and legal and budgetary independence. Individual research institutes of the Academy of Sciences have thus become independent public research organisations with their own legal entity, even though the Academy retains common central management responsibilities. Research institutes controlled by ministries are also qualified under the new law as public research organisations.
The prepared Reform of R&D and innovation system in the Czech Republic stipulates the need to simplify the evaluation of R&D outcomes, carried out by the Council for R&D, in order to improve distribution of institutional R&D funding within the state budget. One of the main objectives of the Reform is to change the current situation towards a real excellence in R&D, based on achieved results. As for the basic research, only worldwide accepted results (e.g. in case of scientific articles only those published in internationally respected journals) will be evaluated (excluding specific nationally oriented disciplines of social sciences and humanities). In case of applied R&D, only results exploitable for innovation (e.g. patents, realized technologies, software and results projected into rules of law or other rules/methodologies) will be considered in the evaluation.

Within the Operational Programme Entrepreneurship and Innovation (2007 - 2013), the issue of IPR is addressed by increasing the innovative capacity of companies (especially SMEs) and by using instruments for protection of intellectual property rights (Ministry of Industry and Trade, 2007). Universities and public research organisations are newly responsible for the IPR protection and commercialisation of their research outcomes. Within the Operational Programme Research and Development for Innovation (2007 - 2013), European Centres of Excellence as well as Regional R&D Centres, technology transfer units and commercialisation of R&D results are to be supported. A limited number of European Centres of Excellence supported by the OP will facilitate cooperation between various research institutes in the Czech Republic and will enable their full connection to ERA and international research infrastructure, including European Strategic Forum on Research Infrastructures - ESFRI.

**Table 4: Main policy changes in the knowledge production domain**

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main policy changes</th>
</tr>
</thead>
</table>
| Improving quality and excellence of knowledge production | • The new Law on Public Research Organisations increasing the autonomy and legal & budgetary independence of research organisations  
• Prepared R&D Reform (2008) changing the present system of evaluation to the system based primarily on achieved results |
| Ensuring exploitability of knowledge production | • Increasing the innovative capacity of enterprises and protecting their intellectual property rights, also supported within the OP Entrepreneurship and Innovation (2007)  
• Support of commercialisation of R&D results and technology transfer from research institutes within the OP R&D for Innovation (2008)  
• Responsibility of universities and public research organisations for their own R&D commercialisation and IPR policies and rules according to the R&D Reform (2008) |

### 2.3.4 Knowledge circulation

Co-operation between public research (including universities) and businesses has been a long-lasting weakness of the Czech R&D system. Lacking financial resources by SMEs and prevailing orientation at utilising relatively low-cost labour force and low value-added production resulted in a low demand for R&D outcomes from business. Research-industry co-operation is hampered by the public R&D system as well, concerning the ineffective system of R&D evaluation and low motivation of researchers. Last but not least – an insufficient number of organisations mediating
technology and knowledge transfer from public research institutes and universities to industry does not contribute to the improvement of research-industry co-operation either (Hebakova and Kostic, 2009).

The importance of research-industry R&D co-operation is emphasised in most national strategic documents. It is addressed also by concrete measures of the National Innovation Policy 2005 – 2010 (EC, 2007b). Nevertheless, there is only one national programme supporting industrial R&D, which provides a direct support to private-public R&D collaboration between research institutes and private sector enterprises – the TANDEM programme administered by the Ministry of Industry and Trade. The IMPULS programme, administered by the same Ministry, is complementary to TANDEM. The programme provides support to R&D with a strong focus on projects with a short-term application and commercialisation potential. The KLASTRY (Clusters) programme represents another Ministry of Industry and Trade tool supporting inter-sectoral R&D co-operation and is funded from the Structural Funds (2004-2006 and 2007-2013 as well).

Financial resources from the Structural Funds 2007 - 2013 represent a big opportunity for further improvement of co-operation between businesses and research & university sphere and for further development of innovation infrastructure as well. Within the Operational Programme Entrepreneurship and Innovation (2007 - 2013), issues of private-public R&D co-operation are addressed. One of the OP priorities supports building R&D capacity of companies (especially SMEs), internally as well as for collaboration with public research institutions. Collaboration platforms (particularly clusters and technology platforms) helping to create infrastructures for a collaboration among companies, research and training institutions, are supported within the SPOLUPRÁCE (“Co-operation”) sub-programme of the OP. The infrastructure for business R&D and for training and development of human resources for innovation is another focal area of the OP. Attention is given to establishing, operating and developing business incubators with the aim to enhance starting new enterprises and creating conditions for setting up academic spin-offs.

The issue of “brain gain” related to potential immigration of researchers to the Czech Republic has been discussed at the highest political level. At the end of 2007, the EC Directive 2005/71 on a specific procedure for admitting third-country nationals for the purposes of scientific research was transferred to the Czech legislation. Consequently, the Czech Parliament amended the Czech Immigration Act in 2008 (as mentioned also in the new NRP).

Efficient links to the business sphere and international networks are essential for ensuring sustainability of infrastructural projects after the termination of subsidies. Within the OP R&D for Innovation, preferential support is to be provided to research infrastructure used by research consortiums of universities, public research institutes and businesses. Preferentially also research infrastructure related to the ESFRI Road-map is to be supported, which guarantees its involvement in international R&D co-operation. Relevance of the infrastructure – at least at the national level – is required as one of the conditions for receiving financial support. Unexploited infrastructure has to be utilized for education and training of students and researchers once the Reform takes effect. Ensuring linkages to the business sphere is another condition for receiving financial support to developing research infrastructure. In the context of lacking qualified human resources, the Operational Programme Education for Competitiveness provides a preferential support to university infrastructure related to S&T study fields.
Table 5: Main policy changes in the knowledge circulation domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main policy changes</th>
</tr>
</thead>
</table>
| Facilitating knowledge circulation between university, PRO and business sectors | • Programmes supporting private-public R&D co-operation (especially TANDEM, IMPULS, KLASTRY)  
• New tax system initiated by the R&D Reform (2008) stimulating co-operation between business and public research  
• Support to business incubators with the aim to create conditions for setting up spin-offs within the OP Entrepreneurship and Innovation (2007) |
| Absorptive capacity of knowledge users | • Increasing R&D capacities of businesses supported by the OP Entrepreneurship and Innovation (2007)  
• Support of training human resources for innovation within the OP Entrepreneurship and Innovation (2007)  
• Preferential support S&T fields of study on universities through the OP Education for Competitiveness (2007) |

2.4 Policy opportunities and risks related to knowledge demand and knowledge production: an assessment

Following the analysis in the previous section, this section assesses whether the recent policy changes respond to identified system weaknesses and take into account identified strengths.

Reform of the RTDI and tertiary education system together with FP7 and the new period of drawing support from the EU Structural Funds through Operational Programmes represent a great opportunity for the Czech R&D system as such. Reform will be also supported by the new National RDI Policy and updated DZSV in 2009. Anyway, a big risk is a low human resources mobilisation for the knowledge economy that can negatively affect the new research infrastructures needs as well as innovative SMEs. New research projects shall primarily support excellence instead of average research teams and more emphasis shall be put on the stimulation of the private sector to invest in R&D.

Concrete main policy opportunities and main policy-related risks are described in the table below. They are based on the relevant chapters of ERAWATCH Country Report 2008 as well as on the text of the Reform including its annex called “Green paper on Research, Development and Innovation” (Technology Centre AS CR, 2008a).
Table 6: Summary of main policy related opportunities and risks

<table>
<thead>
<tr>
<th>Domain</th>
<th>Main policy opportunities</th>
<th>Main policy-related risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource mobilisation</td>
<td>• Reform of R&amp;D and innovation system adopted by the Government in April 2008; &lt;br&gt; • Reform of the Tertiary Education System based on the White Paper published by MEYS in February 2008; &lt;br&gt; • EU measures for R&amp;D mainly within Structural Funds 2007 – 2013 and Framework Programme 7 for R&amp;D.</td>
<td>• Low mobilisation of human resources for the knowledge economy that can critically affect the newly developed R&amp;D infrastructure needs as well as innovative SMEs; &lt;br&gt; • Not enough motivated private sector to support R&amp;D and knowledge based economy; &lt;br&gt; • Persisting brain drain of researchers based on bad conditions in R&amp;D; &lt;br&gt; • Not efficient use of European and national funding based on an evaluation leading to supporting average research teams instead of excellence.</td>
</tr>
<tr>
<td>Knowledge demand</td>
<td>• Reform of RDI shall lead to reduction of fragmentation of the public R&amp;D support; &lt;br&gt; • Development of medium high-tech and high-tech industry and sector of services leading to an increased demand for knowledge by business; &lt;br&gt; • New method of evaluation and monitoring of R&amp;D results leading to a more effective contribution of research to the knowledge based economy.</td>
<td>• Public research not flexible enough to produce research results based on the knowledge demand; &lt;br&gt; • Industrial policy supporting extensive business development and not corresponding to the needs of a knowledge based economy; &lt;br&gt; • Lack of qualified human resources to meet goals of applied research.</td>
</tr>
<tr>
<td>Knowledge production</td>
<td>• Increased autonomy of public research institutes should lead to a more efficient utilisation of public resources; &lt;br&gt; • Emphasis on the applicability of new knowledge included in the Reform of R&amp;D System; &lt;br&gt; • High priority given to excellence through the OP R&amp;D for Innovation; &lt;br&gt; • Addressing the issue of IPR (within the National Innovation Policy and the OP Entrepreneurship and Innovation) should improve the performance of Czech R&amp;D, particularly in terms of patent production.</td>
<td>• Continuing generic support to all R&amp;D disciplines present in the Czech Republic disregarding excellent disciplines, institutes, teams and national thematic R&amp;D priorities; &lt;br&gt; • Potential rigidity of the new evaluation system disregarding differences among individual research disciplines; &lt;br&gt; • Low interconnection between universities and external bodies (including industry) could lead to mismatches between university research and needs of the society.</td>
</tr>
<tr>
<td>Knowledge circulation</td>
<td>• Utilisation of Structural Funds for building top quality innovation infrastructure and environment stimulating research-industry knowledge circulation as well as setting up academic spin-offs; &lt;br&gt; • Improvement of tax conditions stimulating business sector to order R&amp;D at public research organizations and universities; &lt;br&gt; • Enhancement of Czech research participation in ERA and ensuring sufficient linkages to international R&amp;D; &lt;br&gt; • New legislation improving conditions for immigration of researchers.</td>
<td>• Questionable sustainability of new R&amp;D infrastructure after termination of public support (in case of insufficient links to industry and private funding); &lt;br&gt; • Continuing separation of public and private sector R&amp;D aggravates by a low horizontal mobility of human resources; &lt;br&gt; • Decrease of attractiveness of the Czech Republic for foreign R&amp;D investment (also related to the lack of HRST, especially S&amp;T graduates).</td>
</tr>
</tbody>
</table>
3 National policy mixes towards R&D investment goals

The aim of this chapter is to deepen the analysis of national policy mixes with a focus on public and in particular private R&D investment. The Lisbon strategy emphasises an EU overall resource mobilisation objective for 2010 of 3% of GDP of which two thirds should come from private investment. R&D investment is seen as important yardstick for the capacity of an economy to turn the results of science and research into the commercially viable production of goods and services and hence knowledge into growth. Corresponding investment policies are mainly pursued at national level and determined with a national focus.

The chapter is structured around five questions:

1. What are the specific barriers in the country that prevent reaching the Lisbon goal? What barriers exist in the country to prevent reaching the specific targets, particularly related to the private sector R&D investments?
2. Given the above, what are the policy objectives and goals of the government that aim to tackle these barriers?
3. What Policy Mix routes are chosen to address the barriers and which specific instruments and programmes are in operation to implement these policies?
4. What have been the achievements in reaching the above mentioned R&D investment objectives and goals?
5. What are the reasons for not reaching the objectives, adaptation of the goals?

The chapter aims to capture the main dimensions of the national policies with an emphasis on private R&D investment. The chosen perspective of looking at investments in R&D is the concept of Policy Mixes. The analysis and assessment follows a stepwise approach following the five questions mentioned above.

3.1 Barriers in the research system for the achievement of R&D investment objectives

Even though the total R&D expenditures in the Czech Republic are continually growing, the fulfilment of the Lisbon Strategy objectives seems to be still rather distant. Beyond this, the R&D intensity (i.e. the share of total R&D expenditures on GDP) decreased to 1.54% in 2007 compared to 1.55% in 2006. One of the main objectives of the Lisbon Strategy, where the overall R&D expenditures shall reach 3% of the GDP by 2010, is still a way ahead. Even with the current R&D expenditures increase the Czech Republic will hardly fulfil this objective.

One of the main barriers to the development of R&D is a low proportion of private funds in terms of domestic firms. The relatively similar share with EU average of the total BERD investment on R&D is biased by investment on R&D provided by foreign firms. Czech companies still generally spend less on R&D in comparison with companies abroad. According to a detailed analysis (Czech Statistical Office, 2008), companies use their resources mainly for acquisition of technology equipment. The share of R&D expenses in the total amount spent on innovation is substantially lower than in the advanced EU countries. It is caused by the capital intensity of R&D
expenditure and by a low confidence of companies in the return of their investment in R&D.

Lack of a highly skilled workforce for R&D and its adequate financial assessment is another barrier in the area of R&D. The share of labour costs on R&D expenditure is low, which corresponds to low salaries of researchers, amounting to the level of 30% of EU15 countries. As a result of low salaries, scientific work loses social prestige and leads to leave of excellent researcher abroad (brain-drain). This also creates barriers not only to the influx of researchers from other countries (brain gain) but also to the return of elite Czech scientists from their stays abroad.

Another barrier is field of R&D is the sector structure of the firms carrying out R&D in the Czech Republic. The differences between the Czech Republic and EU15 countries in the concentration of R&D in high-tech sectors indicate that companies in the Czech Republic focusing on the assembly of products with a minimum contribution to in-house R&D play a significant role even in high-tech sector. The low intensity of research in the business sector can also be related to the lower capital strength of Czech companies and this can result in low work productivity (or generated gross value added), which is evident in the Czech Republic in comparison with EU15 countries. Czech companies concentrate on products and technology adaptation for the local market rather than on generating new knowledge, which can be reflected in the very low patent activity of companies in the Czech Republic. In comparison with EU15 countries, where research is strong in particular in high-tech sectors, in the Czech Republic the highest proportion of R&D is carried out in industrial sectors with medium or low intensive technology.

Next barrier is low commercialization of R&D output. Commercialisation of knowledge produced by research organisations is hindered especially by a lack of motivation and missing mediators providing an interlink - like specialised departments within these organisations, bringing produced knowledge to market, or specialists/mediators able to direct partners from application sphere to relevant researchers.

Co-operation between public research institutions and businesses is weakness of the Czech R&D system. This is a very strong barrier for R&D development in the Czech Republic. Lacking financial resources by SMEs and prevailing orientation at utilising relatively low-cost labour force and low value-added production resulted in a low demand for R&D outcomes from business. Research-industry co-operation is hampered by the public R&D system as well, concerning the ineffective system of R&D evaluation and low motivation of researchers. Insufficient interconnection between universities and companies can be a significant factor in the ineffective financing of R&D, where resources are spent on research whose results are not utilized in practice. Weak links between university research and the business sector represent also a possible barrier to an effective transfer of knowledge from universities. An insufficient number of organisations mediating technology and knowledge transfer from public research institutes and universities to industry does not contribute to the improvement of research-industry co-operation either.

International comparisons shows that venture capital financing has not really been developed in the country (UNU-MERIT-JRC EC, 2007: indicator 3.4, 2007). Because there is a very small number of spin-offs set up at universities and public research institutes in the Czech Republic. An unfavourable milieu, which does not motivate researchers and university students to get involved in business activities based on
utilisation of research outcomes, has a key role in this situation. There are several other reasons hampering the creation of spin-offs: lack of disposable financial resources, lack of available advisory services, educational and training programmes, lack of suitable technical background and infrastructure, connected with research institutions and providing the needed awareness of business environment.

3.2 Policy objectives addressing R&D investment and barriers

It is clear that the main barriers to R&D are structural. This situation reflects the fact that the CR is ranked among countries which are in the transition phase from efficiency-driven competitiveness to innovation-driven competitiveness. In cooperation with other interested parties, the Research and Development Council decided to formulate principles of the R&D and innovation system reform in the Czech Republic. Reform of R&D and innovation system was adopted by the Government in April 2008. To resolve those barriers there have been designed goals, which are listed in the White Paper on research, development and innovations in the Czech Republic.

The first policy objective addressing R&D investment and barriers is creating a favourable environment for research, development and innovations. One of the main measures for achievement of this objective is setting basic competencies of state administration bodies in the field of R&D and ensuring coordination of their main activities. Second activity for achievement of this goal is establishing a high-quality system of R&D results evaluation and improving the system of management of universities and research organisations and strengthening their responsibility towards society. Third activity is creating a favourable pro-innovation environment that will stimulate research and enterprise activities including the use of knowledge in practice and the increase of demand for innovation.

The second policy objective to overcome barriers of R&D is providing enough qualified human resources for R&D in both public and private sectors. The main measures to meet this objective are increasing the number and quality of researchers and improving the capabilities of human resources for the needs of knowledge-based economy. This shall be achieved by setting appropriate conditions for foreign researchers to stimulate brain gain, by creating interdisciplinary fields of study in cooperation with the application sphere, by introducing enterprise and IPR-related fields of study to stimulate entrepreneurship and private R&D.

The third objective is to ensure effective allocation of public and private financial resources for R&D. For this it is necessary to use public R&D funds more effectively, to get more actively involved in the ERA, to stimulate private spending on R&D and to stimulate venture capital investments. In spite of tax incentives to realize own research having to a certain extent a positive stimulating effect, there exists a possibility that own research of firms will be given priority over the cooperation with public research institutions, too.

The last main policy objective is to provide infrastructure for R&D and intensify the co-operation between the research and industry. In order to achieve this objective it is necessary to build effective infrastructure for excellent fundamental and applied research. At the same time it is important to create infrastructure for transfer of R&D knowledge and enhance co-operation in R&D.
All the objectives set out in the White Paper on R&D and Innovations are consistent with the objectives which are listed in the Reform of research and development. The objectives are also consistent with objectives suggests in the new National Policy of Research, Development and Innovation 2009 - 2015, which will be approved in the first half of 2009. The objectives set out in this policy document will focus on improving the institutional environment, to increase efficiency in the system of financing R&D, participation of international cooperation between the public and private sector in the field of R&D. The emphasis is given on the evaluation of the results of R&D. The new NP RDI shall be improved by the Government by the end of May 2009 which is a crucial step forward in the RDI reform process.

3.3 Characteristics of the policy mix to foster R&D investment

This section is about the characterisation and governance of the national policy and instrument mix chosen to foster public and private R&D investment. While policy goals are often stated at a general level, the policy mix has a focus on how these policy goals are implemented in practice. The question is what tools and instruments have been set up and are in operation to achieve the policy goals? The following sections will each try to tackle a number of these dimensions.

3.3.1 Overall funding mechanisms

In the Czech Republic, trends in R&D expenditures have been fairly positive over the years with total gross expenditure on R&D (GERD) increasing since 1995 (with the exception of year 2001/2002). In 2006, R&D investment exceeded €1.8b, and the share of total R&D expenditures in the Gross Domestic Product (GDP) was 1.55%. The increase against the previous year was 18.3%. Most of the increase in recent years has been due to the increased level of private R&D investment, strongly linked with the growing attractiveness of the country for foreign direct investment. Also public R&D investment has been on the increase since 2002. The share of private R&D investment reached 57% in 2008 which is slightly higher than the EU27 average (54%).

Total R&D public expenditures in 2007 are €878m which corresponds to 0.58% of the GDP. Public funding of R&D is divided between institutional and project-based support. Recently there has been a debate about the need to reduce the share of institutional funding, which reached the share of 50-60% in the last decade. In 2008, the share of institutional funding decreased below 50% for the first time since 1999 (see Figure 2) which follows the expected share of 40% of institutional funding and 60% share of project-based funding.

A major part of the institutional funding in the Czech Republic is financed by the Ministry of Education, Youth and Sports (MEYS) and the Academy of Sciences (AS CR) and has the form of so-called "research plans" (výzkumné záměry) which represent the main source of multi-annual institutional funding.

The Czech Science Foundation (GACR) represents the main body on the Czech R&D scene that provides non-thematic project-based funding. The Czech Science Foundation administers the fourth largest share of the public R&D budget (after the Ministry of Education, Youth and Sports, Academy of Sciences and the Ministry of Industry and Trade) which is then distributed through open competitions through grants to researchers. Tenders for proposals are organised on a thematic basis...
within five scientific areas (technical, natural, medical, social and agricultural sciences). Non-thematic project-based funding represents 73% of funds allocated within the targeted project-based support in the Czech Republic.

Ministry of Industry and Trade is the main provider of the thematic project-based funding bringing together industry and research, which is provided namely through the TANDEM, IMPULS and Trvalá Prosperita (Sustainable Prosperity) programmes. These programmes fund projects of industrial research, either carried out by businesses themselves (IMPULS, Trvalá Prosperita), or by consortia of business and academic partners (TANDEM). Themes covered are relatively broad and cover a whole spectrum of topics from energy, materials, mechatronics and engineering, to diagnostic instruments, transport or pharmacy.

Thematic targeted funding in Czech research is also represented by specific sub-programmes of the National Research Programme II administered by the Ministry of Education, Youth and Sports, namely thematic sub-programmes addressing the following themes: "Healthy and High-Quality Life" (biomedical and environmental research), "Information Technologies for A Knowledge-Based Society" (ICT), "Socio-economic Development of Czech Society" (research in social science and humanities).

In addition to these national thematic programmes, there are R&D budgets managed by individual sectoral ministries (e.g. Ministry of Health, Ministry of Transport, Ministry of Environment and Ministry of Agriculture) to be allocated to their specific sector-related research.

To define long term orientation in research, 8 national thematic priorities – the so called Long-Term Principal Research Directions (DZSV) – were defined. The DZSV include sustainable development, molecular biology, energy sources, material research, competitive engineering, information society, security research and socioeconomic research. These national thematic priorities are currently being updated. The DZSV influence priorities of public R&D support programmes such as National Research Programmes.

In total 22 providers take part in the system of R&D support in a varying degree which very much complicates both thematic and administrative coordination and leads to public support being significantly fragmented. Other institutes and organizations acting on the central and regional level are regional and district branches of the Czech Chamber of Commerce, information and advisory agencies, the Association of Research Organizations, the Association of Innovative Entrepreneurship of the Czech Republic, the Science and Technology Parks Association, the Czech Association of Development Agencies and other associations and societies. On the other hand, professional associations of small and medium-sized enterprises can be considered as being insufficiently developed.

The most significant provider of support for R&D and innovation from the EU Structural Funds is the Ministry of Education and Ministry of Industry and Trade. In this period the Ministry of Education implement programmes in the framework of the Operational Programme Research and Development for Innovation (OP RDI) with a budget of approx. €2.4b and the Operational Programme Education for Competitiveness (OP EC) with a budget of more than €2.1b. The second one
significant provider of R&D and innovation support is the Ministry of Industry and Trade which implements programmes in the framework of the Operational Programme Enterprise and Innovation with a budget of approx. €3.5b for the period of 2007 – 2013 (though these resources are only partially earmarked for activities related to R&D&I).

These three programmes complement each other and form an important tool to support development of knowledge based economy in the Czech Republic. In comparison to the programming period of 2004 – 2006 there is a remarkable shift in focus towards expansion of research infrastructure of universities and public research institutes (OP RDI). Concerning the support of innovation from the Structural Funds (OP EI) emphasis was increased in the area of ICT, research potential of businesses and protection of industrial property rights.

Considering the fact that resources in the framework of OP EI and OP RDI will be invested mainly in developing, expanding and modernizing research and innovation infrastructure, the potential for financial sustainability of the infrastructure after putting the infrastructure into operation and termination of financing from public resources must be taken into consideration. The issue of support for the development of research and innovation infrastructure in Prague, which does not fall under the Convergence Objective of the EU SF remains unsolved. The amount of support for the development of innovation infrastructure and innovation activities in Prague, provided from the OP Prague - Competitiveness is significantly lower in comparison to. Some support form the OP Prague - Competitiveness is also allocated to R&D activities. The supported activities are, among others, the following ones: development of innovation infrastructures (science parks, incubators, innovation centres and centres of excellence); creation of partner links between public research institutions and companies, development of innovation capacities of enterprises etc.

Technology transfer and human resources in R&D are partly covered by the OP Prague - Adaptability. The total allocation for Prague from both ERDF and ESF equals to €420m for the period 2007 - 2013.

Participation of Czech research teams in the EUREKA and mainly in the EU Framework Programmes for R&D represents another access to the EU funding. Czech participation in the EU Framework Programme (FP) is regularly monitored and reports are published on a regular basis within the publication Analysis of the Existing State of R&D in the Czech Republic. According to the latest report (from 2007) covering Czech participation in FP6 until May 2007, Czech participants still feature one of the lowest participation rates in the EU (21st out of 27) when measured by the number of participations per million inhabitants. When measured by the amount of funds contracted per one researcher, the Czech Republic's score is among the worst in the EU (20th out of 27). On the more positive side, the Czech participation between the 5th and 6th Framework Programme increased substantially (in financial terms it doubled). The Ministry of Education, Youth and Sports, in addition to its existing projects which fund several regional and thematic networks providing information to potential FP participants, also decided to open a dedicated liaison office for R&D in Brussels called the Czech Liaison Office (CZELO). The main aim of the office established in 2005 is to encourage and facilitate the participation of Czech researchers in the FP in cooperation with the National Information Centre for European Research project (NICER), both performed by Technology Centre AS CR.
3.3.2 Policy Mix Routes

The “Policy Mix Project” identified the following six ‘routes’ to stimulate R&D investment:

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;
6. increasing R&D in the public sector.

The routes cover the major ways of increasing public and private R&D expenditures in a country. Each route is associated with a different target group, though there are overlaps across routes. The routes are not mutually exclusive as, for example, competitiveness poles of cluster strategies aim to act on several routes at a time. Within one ‘route’, the policy portfolio varies from country to country and region to region depending to policy traditions, specific needs of the system etc.

Route 1: Promoting the establishment of new indigenous R&D performing firms

There are some instruments in place to foster private R&D in the Czech Republic. Particularly there is a Strategy for Economic Growth (2005-2013) prepared in November 2005 that specifies the need to support commercial sources of financing, such as private equity and venture capital. Programmes operated by the Ministry of Industry and Trade support the creation of companies and their development by granting credits and bank guarantees. However, there is no programme focusing on financing early stage development of innovative and start-up companies by venture capital (e.g. through a programme on a venture capital fund). There is still a need to support start-ups and development of new and technology-based companies through creating financial tools facilitating SMEs access to pre-seed and seed capital. New technology-based companies are however supported by grants and subsidized loans within the Operational Programme Enterprise and Innovation.

Traditional indirect tools of public support for R&D and innovation include tax incentives and public procurement. Tax incentives in the Czech Republic for R&D were introduced in 2005 in the form of tax-deductible items from R&D expenditure. It is evidenced that these tax incentives had positive stimulating effects on R&D activities of the Czech firms. However, the tax incentives are less stimulating for innovative start-ups which usually record loss in the initial phase of investments into R&D. In addition to a tax-deductible item there is a tax relief for donations for R&D in the Czech Republic although effectiveness of this tool is relatively low. Another tool for indirect support (public procurement) in the area of R&D and innovation is not yet widely used in the Czech Republic.

Route 2: Stimulating greater R&D investment in R&D performing firms

Stimulation of existing R&D performers to increase their investment in R&D is provided by the following programmes of the Ministry of Industry and Trade:
• **TANDEM**: The main goals of the programme are: improved cooperation between industrial and research organizations, technology support of SMEs, increased competitiveness of products and technologies, significantly enhanced transfer of basic research results towards industrial research and development/applications. The budget for the year 2009 is €31.3m.

• **TIP**: Tip (Technology, Information Systems, Products), is a programme approved by the Ministry of Industry and Trade for implementation R&D in industrial production, especially for creation of knowledge, R&D for industrial production and ensure their rapid and efficient use. The programme supports R&D from the public funds. The total budget amounts €11b for 2009 – 2014.

• **Trvalá prosperita**: The programme aims to support R&D projects at universities, public research institutions and enterprises in order to increase the competitiveness of the Czech economy and promote the overall technological development of the Czech Republic. The programme is a thematic sub-programme of the National Research Programme II and it has been implemented in the period 2006 - 2011.

Furthermore, enterprises in the Czech Republic can use a series of measures to promote R&D, which are included in particular in the existing Operational programme Enterprise and Innovation. This OP contains 7 priority axes which are specified through the programmes indicated (support areas). Under the priority axis called Innovation two programmes exist:

• **INOVACE**: The programme contributes to the implementation of the development of innovative projects based on R&D and allows subside the use of protection of intangible assets in the form of patents, utility models, industrial designs and trade marks. The programme also supports the projects for the protection of intellectual property rights. Allocation of funds for the last call is approximately €70.6m.

• **POTENCIAL**: The programme aims at strengthening the capacity of corporate R&D in connection with production activities of firms. It supports in particular the creation and development of technology centres and in-house R&D departments. The support is intended to invest in the establishment or extension of the developmental centre focused on R&D of products or technologies, including development of specific software required for the production of innovations. Allocation of funds for the last call is approximately €32m.

**Route 3: Stimulating firms that do not perform R&D yet**

Despite the fact that business R&D expenditures in the CR are at a low level and the Czech companies are spending their innovation expenses on purchasing external know-how, only the programme IMPULS launched by the Ministry of Industry and Trade addresses directly this issue:

- **IMPULS**: The main goals of the programme are: increased performance of manufacturing/production/industrial organizations, support of SMEs, increased competitiveness of products and technology upgrade. The budget for the year 2009 is €16.7m.

However, the three policy measures listed in the Route 2 (TIP, TANDEM, Trvalá prosperita) are open also to firms without any R&D activities prior to their participation in these programmes.
Route 4: Attracting R&D-performing firms from abroad

In the area of supporting private investment to R&D and innovation from abroad, the investment incentives scheme launched by the Ministry of Industry and Trade in 1998 was further extended by the support of technology centres and centres of strategic services in 2002. Technology centres focus on R&D and innovation-related activities that generate improvements of products and technologies used in production. Centres of strategic services target shared services, R&D, software development, high-technology services and others. The programme supported 151 companies (48 from Czech Republic) with total budget about approx. €636m.

R&D results produced in these centres are often utilized abroad or the centres adapt the original know-how for the market in the Czech Republic. The most desirable case where a multinational enterprise builds a research capacity in the Czech Republic and results of its R&D are subsequently utilized not only in the branch of the multinational in the Czech Republic but serve also the needs of the whole concern is to-date an exception.

The foreign MNEs involved in R&D activities were also attracted by the indirect tools of R&D and innovation support including tax incentives. Tax incentives in the Czech Republic for R&D were introduced in 2005 in the form of tax-deductible items from R&D expenditure. Tax incentives for the implementation of R&D activities can be also used by firms abroad operating in the Czech Republic.

Programmes for indirect support of private-public co-operation (KLASTRY, PROSPERITA), which terminated in 2006, have been carried over to the new programming period. Another programme of direct support, called “TIP”, is currently being prepared by the Ministry of Industry and Trade (for 2009 - 2017).

Route 5: Increasing extramural R&D carried out in cooperation with the public sector

Weak cooperation between universities and companies in the area of R&D is a significant weakness, which is indicated by a low proportion of business sector resources spent on financing R&D carried out at universities. In comparison with the EU the Czech Republic reaches only 14% of the European level of this indicator. Insufficient interconnection between universities and companies can be a significant factor in the ineffective financing of R&D.

Addressing the current situation in the field of cooperation of research institutions and business partially covers the Spoluprace programme. Programme is aimed at promoting the emergence and development of cooperative sector clusters - clusters and technology platforms. The overall objective of the programme is to create favourable business environment, improve conditions for entrepreneurship and innovation and the development of competitive advantage through improved linkages between research, universities and businesses. Allocation of funds for the last call is approx. €38.8m.

TIP, TANDEM, IMPULS and Trvalá prosperita (Sustainable Prosperity) programmes also respond to the route 5 (for more information see Route 2).

Increasing cooperation between public research sector and business sector would help the upcoming extension of tax relief on the purchased R&D by business sector from universities and public research institutions.
Cooperation development can be improved by successful projects under the Operational programme Research and Development for Innovations. The priority axis of the Programme support construction of infrastructure for the knowledge transfer between the research and business sphere. It will also support infrastructure for the creation and development of new firms (spin-off) and support the commercialization of the results of the universities.

Route 6: Increasing R&D in the public sector

In the Operational Programme R&D for Innovation is currently the most important tool to increase the capacities in the Czech public R&D sector by supporting new research infrastructures. Two priority axes are directly focused on the creation of Centres of Excellence and regional R&D infrastructures.

In the Operational programme Education for Competitiveness (2007 - 2013), there is a priority axis called Tertiary education, research and development. This axis can be used by institutions of tertiary education and R&D units to finance projects in the area of design and implementation of a support system for business, entrepreneurial attitude and innovative solutions in institutions for tertiary education and research and development, innovations in educational programmes, support workers' mobility between research and development departments and the business sector, cooperation between tertiary educational institutions and the private and/or public sectors in the creation and realisation of study programmes, etc. The financial allocation for this priority axis is €688.5m.

Despite the public R&D funds’ growing in the Czech Republic more quickly than in other European countries, their relative amount (considering the number of inhabitants and economic maturity) is still below the EU average. This is caused, among others, also by an insufficient readiness to implement programmes for supporting R&D from public funds. The public R&D support is provided to a wide spectrum of fields and this weakens the potential for excellence creation. The allocation of financial means in the form of institutional support is not sufficiently tied to the evaluation of research work yet. It results not only in lower number of scientific publications and their citations, lower number of patents, new technologies, products and services, as well as lower motivation of researchers to carry out high-quality research.

The importance of education and innovation policies

Policies to promote education in the Czech Republic are in the responsibility of the Ministry of Education, Youth and Sports. One of the key documents supporting the development of education and quality human resources for R&D through the Structural Funds is the National Strategic Reference Framework of the Czech Republic 2007 - 2013.

The objectives set out in the NSRF are supported by the White Paper of Tertiary Education, which was approved by the Government in January 2009. The White Paper is the basis for the reform of tertiary education, which should take place in 2009. Reform of tertiary education represents a change that will lead to increase of the competitiveness of universities and strengthening the role of universities as the main source of innovation to ensure social cohesion. One aspect of the tertiary education reform is also the reinforcing of research and development importance carried out at universities.
In the tertiary education sphere, attention will be paid to the adaptation of curricula to the needs of knowledge society, with emphasis on the development of progressive disciplines and R&D for strengthening competitiveness of the Czech economy. This concerns in particular the increase in quality of education. Efforts shall be made in a better access to tertiary education, increased permeability of the education system, which will enable students to respond flexibly to the changes expected in the labour market, and strengthen motivation to study technical and natural sciences. It is necessary to support personnel capacity of the tertiary education and to establish an incentive system for young staff starting their professional career in the field of R&D.

The need for greater collaboration between public and private R&D sectors has become an increasingly topical issue, especially since the preparation of the Economic Growth Strategy and the National Innovation Policy in 2005. Although the practical policies react to this trend and cover the issues of public-private co-operation, their impact on knowledge circulation between these sectors is still quite weak.

All of the Programme document documents highlight the potential role of R&D and Innovation as a stimulant for future economic growth in the Czech Republic.

Fiscal measures, which were introduced in 2005 in order to stimulate private R&D effort, had only a negligible impact on the collaboration between private and public sector, since they cannot be used for the purchase of R&D outcomes from universities and public research institutes. Indirect support of research by tax relieves should be one of the outcomes of implementation of the currently prepared Reform of R&D and Innovation system. A new tax system should stimulate co-operation between business, universities and public research institutes. Co-operation within the newly set conditions will be more favourable for businesses than just the existing tax deductions for which legal entities are eligible. The objective of this measure consists in stimulating businesses to assign research projects to universities and research institutions.

Currently developing new National Research, Development and Innovation Policy in 2009 should cover the whole area of R&D and innovations. This strategy policy document, which will have a link to others R&D and education policy documents, should be covering the entire R&D and other procedures to align the development of R&D in the Czech Republic.
### Table 7: Importance of routes in the national policy and recent changes

<table>
<thead>
<tr>
<th>Route</th>
<th>Short assessment of the importance of the route in the national policy</th>
<th>Main policy changes since 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Important, but relatively small in terms of budgetary weight.</td>
<td>Use of funds from the EU Structural Funds to support R&amp;D in companies, offer new investment incentives and tax measures to maintain the company conducting the R&amp;D.</td>
</tr>
<tr>
<td>2</td>
<td>Very important, also in terms of budgetary weight (via Operational Programme Enterprise and Innovation).</td>
<td>Through Tandem, Tip and Trvala Prosperita programmes allocates the Ministry of Industry and Trade to support companies that carry out R&amp;D almost €101.6m (assumption for 2009 is almost €61m). Continuation of the Inovace and Potenciál programmes to encourage the emergence and development of R&amp;D department in enterprises. Programmes are implemented by Ministry of Industry and Trade. Financial allocation of these programmes is approx. €103m.</td>
</tr>
<tr>
<td>3</td>
<td>Relatively high importance but relatively small in budgetary weight.</td>
<td>Through Impuls programme the Ministry of Industry and Trade allocates €16.7m for 2009.</td>
</tr>
<tr>
<td>4</td>
<td>Important, but relatively small in terms of budgetary weight.</td>
<td>Compliance with the existing tax incentives for enterprises conducting research and development.</td>
</tr>
<tr>
<td>5</td>
<td>Very high importance (this issue is included in almost all policy documents in the field of R&amp;D), but the financial allocation is relatively low.</td>
<td>Continuation of the Spolupráce programme to encourage the private-public consortia in the field of R&amp;D. Programme is implemented by Ministry of Industry and trade. Financial allocation of these programmes is approx. €38.8m.</td>
</tr>
<tr>
<td>6</td>
<td>One of the most important routes, building the research capability of the higher research sector has been a long term policy goal.</td>
<td>A growing share of total government expenditure on R&amp;D is provided to higher education since 1997. Maximum use of funds from the Structural Funds for the development of universities R&amp;D.</td>
</tr>
</tbody>
</table>

### 3.4 Progress towards national R&D investment targets

Despite the public R&D funds’ growing in the Czech Republic more quickly than in other European countries, their relative amount (considering the number of inhabitants and economic development) is still below the EU average. The public R&D support is provided to a wide spectrum of fields and this weakens the potential for excellence creation. The allocation of financial means in the form of institutional support is not sufficiently tied to the evaluation of research work yet. It is unlikely that the government will be able to increase the share of its budget appropriations or outlays for R&D substantially in the coming years, especially in view of the current economic recession. It can be concluded that the degree of compliance with national R&D investment targets is not high.

National Innovation Policy 2005 - 2010 states that the strengthening of research and development through the promotion of public investment in R&D, higher education and innovative firms should lead to the approach of total expenditure for R&D in the Czech Republic in 2010, closer to 1% of expenditure on the Barcelona goal research and development from public funds. Expenditures on R&D for the years 2009-11 from the state budget were approved by the Government in June 2008. The volume
of funds in 2009 amounts €877.3m and it reaches €1.02b in 2011. Despite the significant increase is probably due to the anticipated growth of GDP fails to realize the Lisbon criteria. There has been progress towards reaching the overall R&D target of 2.06% of the GDP by 2010 thanks in particular to increased Structural Funds allocations, and to increases in private expenditure stimulated by tax incentives.

Despite the relatively high public spending on R&D and high spending to research infrastructure development, it is possible that the Lisbon criteria will be jeopardized due to the low private sector investment in R&D. Low private sector investment in R&D may continue to stagnate due to economic recession and can not be counted in the coming years with significant raise. This can have dire consequences for investment in R&D in the Czech Republic, where the majority of business investment in research produced by investment of large foreign companies which due to economic crisis will be forced to reduce its spending on research activities or moved them to the other (parent) countries. The effect of reducing business expenses may be vulnerable to research projects conducted on the basis of public-private partnerships. However, government spending on R&D will be in accordance with the approved state budget for the coming years still increase.

One of the possibilities to strengthen R&D in the Czech Republic lies in stimulating research at universities financed from public funds and supporting university-based research collaboration with the private sector. Institutional support for research in universities must be allocated in response to the consistent ex-post evaluation of the results of research work and to avoid diluting the overall financial volume of funding for research and development and also to encourage excellence of research teams. This issue of the research, development and innovations has been addressed in the reform of R&D and innovations system adopted by the Government in March 2008. The possibility of effective cooperation of academic research and private sector needs to support infrastructure for knowledge transfer (in order to transform the resulting knowledge into practical applications). To create appropriate transfer infrastructure it is necessary to take maximum advantage of EU structural funds in the Czech Republic. Programmes to promote cooperation, academic and business community are currently being supported in particular by the Ministry of Trade and Industry. For greater diversification of private spending on research and development of the private sector would be desirable to strengthen the expenditure of the service sector.

Strengthening of private investment in R&D is also possible to achieve more attractive business environment for foreign companies that carry out research activities in the Czech Republic. To increase the attractiveness of the Czech Republic has introduced a number of (mainly) financial and legislative measures. However, it should also strengthen investment in the education of sufficient quality researchers and to promote the dynamics of the mobility of labour between the academic and private. In this case it is necessary to ensure maximum synergy between these two spheres, so that the newly created institutional system to benefit all stakeholders. The development of this cooperation and new R&D system may result some other benefits for the Czech Republic, in particular increase the attractiveness of highly educated researchers from abroad.

From previous claims follows that the current system of R&D is not very satisfactory in the Czech Republic. Some aspects of the reform have already settled. However, it is necessary to update current National Innovation Policy and the National R&D programmes in order to reflect the current situation in the Czech Republic and that
the national R & D system suitably integrated with the new trends and needs in the field of R&D in Europe.

**Table 8: Main barriers to R&D investments and respective policy opportunities and risks**

<table>
<thead>
<tr>
<th>Barriers to R&amp;D investment</th>
<th>Opportunities and Risks generated by the policy mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>The expenditures on R&amp;D are low and the public support for R &amp; D is fragmented in the Czech Republic.</td>
<td>All relevant policy documents describing this barrier. The opportunity for simplification and unification of the fragmented structure of R &amp; D support would bring reform of research and development adopted by the government in April 2008. The current economic crisis may represent a barrier to further increase expenditure on R&amp;D.</td>
</tr>
<tr>
<td>The low number of researchers.</td>
<td>The opportunity for more attractive environment for research and development represent the current Operational programmes. Building a modern research capacity with the new rating system may attract new researchers, or it may encourage the return of qualified researchers from abroad. OP also offers the possibility of development of research in universities. Failure of appropriate conditions for researchers, structure of disciplines at universities and small horizontal mobility of researchers and students can be barriers to the increase of researchers’ number.</td>
</tr>
<tr>
<td>The low proportion of research in high technology intensive sectors.</td>
<td>The policy mix is more focused on stimulating further development R&amp;D investment in R&amp;D performing firms. Shift of companies to a higher technological sophistication and high-tech sectors.</td>
</tr>
<tr>
<td>A small number of domestic companies engaged in R&amp;D.</td>
<td>Current policies may not be sufficient to encourage enterprises which do not perform R&amp;D to become involved in research. Inovace and Prosperita programmes represent the opportunity to increase the number of firms conducting R&amp;D.</td>
</tr>
<tr>
<td>Weak linkages between academic research and business sector.</td>
<td>Current programmes (Tandem, Impuls, Spolupráce) represent an opportunity to strengthen cooperation between academia and industry. Low absorption capacity of the business sector and insufficient interest of SMEs for R&amp;D results are the risks.</td>
</tr>
<tr>
<td>Low commercialization of R&amp;D output</td>
<td>The Operational Programme Research and Development for Innovation (2007-2013), to be used for drawing financing from the EU Structural Funds, should support establishment of testing and assessment departments and technology transfer within research institutes as well as the process of commercialisation of R&amp;D outcomes itself.</td>
</tr>
</tbody>
</table>

### 4 Contribution of national policies to the European Research Area

ERAWATCH country reports 2008 provide a succinct and concise analysis of the ERA dimension in the national R&D system of the country. This Chapter further develops this analysis and provides a more thorough discussion of the national contributions to the realisation of the European Research Area (ERA). An important
background policy document for the definition of ERA policies is the Green paper on ERA\(^3\) which comprises six policy dimensions, the so-called six pillars of ERA. Based on the Green Paper and complementing other ongoing studies and activities, this chapter investigates the main national policy activities contributing to the following four dimensions/pillars of ERA:

- Developing a European labour market of researchers facilitating mobility and promoting researcher careers
- Building world-class infrastructures accessible to research teams from across Europe and the world
- Modernising research organisations, in particular universities, with the aim to promote scientific excellence and effective knowledge sharing
- Opening up and co-ordination of national research programmes

In the ERA dimension, the wider context of internationalization of R&D policies is also an issue related to all ERA policy pillars and is normally present in the dynamics of national ERA-relevant policies in many countries.

### 4.1 Towards a European labour market for researchers

The need for adequate human resources for R&D has been identified as the key challenge since the launch of the Lisbon Strategy in 2000 (EC, 2000). The focus of the following analysis is on national reforms put in place to promote a European dimension in research careers and the impact of these reforms on the mobility of researchers.

**The national context**

Although human resources have been increasingly recognized as a crucial aspect of developing a knowledge economy in the long term, Czech Republic has been struggling with the quality of the human resources. This is reflected in low values of EIS-indicators related to human resources – number of S&E graduates, population with tertiary education, and participation in life-long learning. Within this challenge a couple of important issues may be identified:

- The professional structure of graduates at both tertiary and secondary level of education is unsatisfactory and their skills do not correspond to market demands,
- In the education system, the entrepreneurship spirit is poorly supported in the universities curricula,
- The system does not promote excellence among students as well as researchers,
- Private subjects of the knowledge economy have no opportunity to influence the education schedules in universities in favour to the subjects that are most demanded by the business.

On the supply side, the number of R&D personnel as well as researchers has been increasing recently in the Czech Republic. Even though the increase rate of R&D

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personnel is significantly higher than in other European countries, the Czech Republic is still much below the EU25 average. In 2005, the total number of researchers in FTE (full time equivalent) per 1000 labour force reached 80% of the EU25 average and about 40% in comparison with Finland or Sweden.

The number of all university graduates (including PhD) in the Czech Republic has been growing more rapidly than in other European countries but it is still significantly lower than the EU27 average. The Czech Republic (as well as most European countries) has not reached the level of one PhD graduate per 1000 inhabitants in the age of 25 - 34 years yet.

Even though the postgraduate education can be classified as a preparation for the research career, only one third of the Czech PhD graduates decide for research and two thirds for other careers. The main reason for choosing career in research lies in creativity and innovation potential of the work. Only a very low share of research personnel with PhD prefers the research career because of good employment conditions (10%) and because of good financial conditions (3%) (CZSO, 2008).

On the demand side, there is still a lack of R&D personnel in the following fields: technical and natural sciences, ICT and economics. These fields were identified in analysis provided by the Research Institute of Labour and Social Affairs in 2007 (RILSA, 2008).

The level of salaries of researchers in the Czech Republic is about the same as the average salary in the country which does not really attract young graduates to choose the research career – it is definitely one of the significant discouraging factors. Within the public research institutions, public tables of salary level are respected, but additional financial sources can be distributed to researchers within realized projects.

4.1.1 Policies for opening up the national labour market for researchers

The national labour market for researchers is traditionally open, corresponding to the small open Czech economy concept. Generally there is a lack of researchers mainly in the technical sciences fields - number of students and graduates in technical fields has been slightly increasing during the last decade, nevertheless their share on all students and graduates is permanently decreasing.

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 which has been adopted on January 26, 2009 by the Government. Ministry of Education is currently preparing two principal documents:

1) Proposal of new law on tertiary education in the Czech Republic to be prepared in the end of April 2009 and

2) Proposal of new law on financial support of students (in cooperation with Ministry of Finance and Ministry of Labour and Social Affairs) to be prepared in the end of December 2009.

National programmes as tools for stimulating the in and outward mobility of researchers are used to improve the current situation, for example the Programme for human resources development intended for talented MA and PhD students. In 2009, a national Programme for support of bilateral mobility of students and
university teachers and researchers will be realized by MEYS and financial resources from Operational Programmes Research and Development for Innovations and Education for Competitiveness will also be used.

Currently, there is no official statistics about foreigners working in the Czech Republic in the field of research and development but labour market experts estimate that it would be less than 1% of the researchers in the Czech Republic.

Researchers in the public research institutions such as the Academy of Sciences have the status of public employees and are paid according the state rules. Researchers in the private sector have status decided by their employer.

Czech Republic is involved in the majority of European programmes to support the ERA (researchers and students/graduates/post-doc mobility) such as Socrates Erasmus for university students or the Leonardo da Vinci programme for university teachers and life long learning.

Support of mobility of researchers from third countries to Europe is then provided by a transposition of the Council Directive 2005/71/ES on special procedure for accepting nationals of third countries for purposes of science and research. The Czech Republic also respects the Regulation 1408/71 and 1612/68 on social benefits of European citizens even though they do not have permanent residency in the CR.

To simplify the movement of researchers within Europe, the European Commission established a network of mobility centres. These centres provide information for researchers on vacant jobs and administrative processes, necessary for work and stay in the EU Member States. Czech Mobility Centre was created with the Czech Academy of Sciences and it started its activity on January 1, 2005. Since then it provides help and expert information for foreign research workers, who are interested in working in the Czech Republic and also Czech research workers, who are interested on working abroad (NRP 2008 – 2010).

4.1.2 Policies enhancing the attractiveness of research careers in Europe

As for the Czech Republic, the attractiveness of research career is not satisfactory. The main reason consists in the low remuneration level of research career as well as no special tax incentives/pension system/social security schemes. According to the Czech Statistical Office (www.czso.cz), the average salary of the employees in the S&T fields in 2007 reached 75% of the salary of highly qualified staff in other fields. According to the Report of the ERA Expert Group from 2008 called “Realising a Single market for Researchers”, the Czech employees in the field of R&D in average reach a salary of around €1,630 and the European average is around €3,160.

Generally there is no special promotion of women in the research career, but the Czech Republic is traditionally one of the countries with a relatively high share of women on the labour market. In the Czech Republic as such, 91.5% of employed women are employed on the full-time basis in comparison with the EU27 average of 68.6% of employed women (the latter figure being further lower for EU15 countries where a higher percentage of women takes advantage of part-time employment). Part time employment of women has been increasing recently in the Czech Republic, too, mainly in the context of new active employment policy tools – such as financial aid in maternity leave with a possibility to keep a part time job etc. Research and academic career in the Czech Republic is women friendly in the context of
reconciliation between work and family life, but it also has certain limits when talking about the high research positions.

In the Czech Republic, only the Academy of Sciences has signed the Charter for Researchers – the Academy represents 53 research institutes for primarily basic research, i.e. a majority of Czech public research institutions.

4.2 Governing research infrastructures

The research infrastructure in the Czech Republic is characterised in particular by fragmentation by size and strong geographical concentration of research facilities in Prague. It is mainly caused by the location of institutes of the Academy of Sciences of the Czech Republic, of which 70% are seated in Prague. The developing trend shows that there is a gradual de-concentration of R&D infrastructure and its diffusion into other regional centres of the Czech Republic (e.g. Brno – South Moravia or Ostrava – North Moravia). One of the most significant barriers to excellent research is particularly the lack of large research infrastructure whose instrumentation and financial and human capacities would make it possible to implement large research projects.

Therefore, the development of research infrastructure and particularly of large research infrastructure became one of the current governmental priorities in the field of R&D policy. The Czech Republic actively participates also in the discussion on developing large research infrastructures within the European Strategy Forum for Research Infrastructures (ESFRI) and these issues became one of the priority topics of the Czech presidency for R&D.

Currently, the Czech Republic is a member of inter-governmental European research infrastructures. For example, the Czech research infrastructures create conditions for high quality research in energy and material science (the Institute of plasma physics is housing the COMPASS-D and the Institute of physics is housing the PALS – Prague Asterix Laser System). Furthermore, the Czech Republic participates in developing 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 Organization for Nuclear Research - CERN, 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, European Synchrotron Radiation Facility - ESRF, Institut Laue-Langevin - ILL 20/20 project and PIERRE AUGER Cosmic Ray Observatory.

In the context of ESFRI Roadmap projects, the Czech Republic participates in following 11 projects: 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. Some of these projects are linked with the structural funds projects (see below). 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.

At the national level, the Interdepartmental conception for the large infrastructure support to 2015 was approved by the Czech government in December 2008. This Conception, which can be considered as a national roadmap for large research infrastructures, set conditions for future development of large research infrastructure in the Czech Republic and indicates, which financial resources will be used for supporting their formation and initial development. Since the Czech Republic is eligible for the EU Structural Funds support, these funds will provide significant financial resources for developing large research infrastructure in the near future. With connection to active participation of the Czech Republic in the ESFRI Roadmap projects the EU Structural Funds will considerably contribute also to the development of the large research infrastructures throughout Europe.

Strengthening of the Czech research infrastructure will be supported by means of the Operation programme Research and Development for Innovations administrated by the Ministry of Education, Youth and Sports. Two main priority axes are entirely devoted to support of research infrastructure: 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. First project proposals will be assessed in 2009.

During the evaluation of the absorption capacity of the Operation programme Research and Development for Innovations (February – April 2008) a large number of project proposals with budget of more than €50m were identified. The sum of these budgets exceeded the financial allocation for respective priorities of the Operational programme and therefore, the Ministry of Education, Youth and Sports was asked by the European Commission to draft out a shorter list of large projects. The Ministry of Education, Youth and Sports indicated following 6 projects, some of which create a part of ESFRI Roadmap projects: ELITPALS - building a new type of world quality laser in the Czech Republic (linked with the ELI project), BIOCEV - project contributing to creation of functional genomics centre at national level (linked with the INFRAFRONTIER project), IT4INNOVATIONS - building a supercomputer centre focused on Applied Informatics and Computer Technology, CVEVL - project focused on research possibility of using geothermal energy of lithosphere, SUSTAINABLE ENERGY - strengthening of research capacity in the energy sector, particularly nuclear energy. These six project proposals will be evaluated together with other large research infrastructure projects in 2009.

4.3 Research organisations

The higher and tertiary education sector in the Czech Republic consists currently of 25 public and 39 private institutions providing tertiary education. Since 1990s, universities have been increasing their scientific output (measured by publications). The average annual growth of HERD (16%) during 2000–2006 is still much lower than the EU15 average but it recently exceeded the growth in business, government as well as private non-profit sector. Anyway, the public sector represented dominantly of the institutes of the Academy of Sciences is still leading in the public R&D (as in most of the post-communist countries).
Management

Tertiary education institutions - universities

The university management has undergone in the last 15 years major changes, evolving from the centralism model to the self-governing (autonomy) management. The biggest weakness of the current universities management is a low participation of other actors, mainly from industry, in the university management boards. This is one of the reasons why universities currently do not fulfil properly their third role. Improvement is expected after the tertiary education reform based on the White paper of Tertiary Education, adopted by the Government in January 2009 after a huge discussion of the expert public.

The aim of the White paper of Tertiary Education is to stabilize an open system of autonomous institutions of tertiary education. Concerning the management of universities, the White paper of Tertiary Education proposes the following management structure:

1) The Council for Tertiary Education (RTV): RTV should be conceptual, coordinating and Advisory Board appointed by the Government to ensure balanced strategic influence on the development of all parts of the sector of tertiary education. It is assumed that the RTV will work closely with the Ministry of Education, Youth and Sports, in particular in terms of strategic decisions.

2) The Management Board of universities: This body will be a tool for monitoring and influencing the basic steps of strategic institutions. The Management Board should perform also the role of monitoring and evaluation of the institution.

3) Academic Senate of universities: The Senate plays a significant role in the negotiation and approval (not creating) the internal rules of the institution and including the budget and control issues.

4) The Scientific Council: The Council should pay particular attention to long-term focus of R&D and the overall strategy of the institution (including cooperation with the practice).

5) The influence of external actors will be felt especially at the strategic level and the level of control and evaluation. The external actors certainly include not only representatives of regional public administration or business, as well as representatives of research institutions, workers in the field of culture, non-profit sector workers, but also graduates of the institution.

The White paper of Tertiary Education is currently being transformed into a new Act on tertiary education.

Public Research Institutions

Public research institutions underwent significant transformation from centrally steered organizations towards bigger management autonomy. In 2005, a new Act on Public Research Organisations was enacted which changed the legal status of public research organisations from January 2007. It increased their autonomy and legal and budgetary independence. Individual research institutes of the Academy of Sciences have thus become independent public research organisations with their own legal entity, budget and possibilities (such as spin-off creation etc.), even though the Academy retains common central management responsibilities. Also the management boards of the public research institutions have been strengthened including the involvement of other sectors representatives.
Financing

**Tertiary education institutions – universities**

Universities’ research is financed from institutional public funds (MEYS) and targeted public funds (Czech Science Foundation - GACR). Tertiary education is financed through a normative public financing of education and financial support to students.

Lack of private R&D funds (0.7% of the universities funding in 2007) is a significant problem in the field of higher education in the Czech Republic. This fact represents a barrier to the fulfilment of universities third role and to the cooperation with the private sector.

The reform of higher education responds and is based on two key pillars. The first pillar is a new and more liberal system of higher education (a change in the decision-making and supervisory powers of the university authorities).

The [White Paper of Tertiary Education](#) also proposes tuition fees paid by students. Tuition fees shall guarantee the improvement of tertiary education quality and it can be also used to better match the fields of study to the labour market needs. Tuition fees must be accompanied by a system of available student loans, which allow students to defer payment of tuition fees up to earning a career after graduating. All students should be able to study under the same conditions (fees, loans and grants) and socio-economic background of student should play a minimum, ideally no role in their approach to the tertiary education.

**Public Research Institutions**

Public research institutions are financed from institutional public funds (AS CR) and targeted public funds (Czech Science Foundation - GACR). The GACR represents the main body on the Czech R&D scene that provides non-thematic project-based funding and administers the fourth largest share of the public R&D budget (after the Ministry of Education, Youth and Sports, Academy of Sciences and the Ministry of Industry and Trade) which is then distributed through open competitions through grants to researchers. Tenders for proposals are organised on a thematic basis within five scientific areas (technical, natural, medical, social and agricultural sciences).

Share of private funding of the public research institutions is higher when compared to universities (approx. 10%). This fact shows that the Academy of Sciences of the Czech Republic cooperates more than universities with the private sector.

According to a governmental resolution, regular evaluation of public R&D results has been carried out since 2004, when the Methodology for Evaluation of R&D Results was introduced. The methodology is using data from the Central Register of R&D Results managed by the [Council for Research and Development](#) and is used as a basis for allocating future funds to individual funding bodies (based on evaluating individual R&D performers). Using the new evaluation methods enables to reflect excellence (bibliometrics) as well as use of R&D results in practice (patents).

**4.4 Opening up national research programmes**

National research programmes are in principle open for non-national participants, nevertheless, the Czech research community is their main target group. For instance, the national public tender announced by the Czech Science Foundation (GACR),
which is the main provider of targeted support of R&D, are open for entities based in the Czech Republic as well as for foreign participants from EU or EEC countries that are eligible for participation (regarding formal criteria, qualification, capacity etc.) like the Czech participants.

The GACR also announces public tenders in the framework of its participation in the European Science Foundation (EUROCORES projects) and tenders based on the bilateral agreements between the GACR and providers of targeted support abroad. The GACR has such agreements with the German Research Foundation (DFG) and Korea Research Foundation (KRF) and in the bilateral projects the foreign participant submits a joint proposal to the partner funding organization abroad.

Even though the policy documents declare the openness of the Czech research and development area, there are still no funding programmes in the Czech Republic that allow a researcher to transfer a research grant to another country. For example, in the majority of cases, all research projects funded by national research programmes must be carried out in the Czech Republic. In general terms, reciprocity should be required in any international partnerships 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.).

At the European level, ERA-NET projects in FP6 were considered as very successful and useful instruments for the coordination of national research programmes. Czech participation in these projects was not very outstanding, from the total number of 1044 participants only 16 of them were from the Czech Republic. If we take into account projects themselves, Czech teams participated only in 14 projects from the total number of 106. As the reason of the Czech low participation we can see the lack of interest from the projects eligible participants (ministries and science foundations mainly) and also financing of joint ERA-NET calls (hard to find right instruments how to contribute to transnational joint research). Participation of Czech teams in ERA-NET of FP7 is still very low, however, it can be expected that the situation will be improved in the near future.

Concerning the Joint Technological Initiatives (JTIs), the Czech Republic has actively participated in the shaping of several of them (for instance Artemis, ENIAC, and Hydrogen and Fuel Cells). The Czech teams are actively involved in calls that are announced in all JTIs. The Czech Republic also participates in most of the European Technology Platforms (ETPs) as effective members or mirror groups. Moreover, there are over ten national technology platforms active in the Czech Republic (e.g. Biofuels, Hydrogen Technologies, Mechanical Engineering, Textile Food and others).

In relation to measures to foster joint approaches to research programmes, the Czech Republic continues to engage in initiatives co-ordinated and facilitated by the European Commission to encourage greater co-ordination of national research programmes and to encourage joint approaches to the implementation of research programmes targeting specific technological and/or societal objectives (Joint Programming). The importance of active involvement of the Czech Republic in international cooperation in R&D and shaping the ERA is stressed in the White Paper on R&D and Innovation. The new National R&D and Innovation Policy 2009 – 2015, which should be approved by the Government during the first half of 2009, proposes a concrete measure dealing with the involvement in international R&D projects and
Joint Programming, including determination of thematic priorities that will be developed in these activities. The importance of the Joint Programming for the Czech Government has been reflected during the Czech Presidency, which was engaged in the implementation of the December Council Conclusions concerning the Joint Programming with a view to taking decisions on first initiatives in 2010.

Czech Republic's participation in the ERA has also led to several changes within the R&D system including the use of new monitoring and evaluation methods of research results corresponding to the market and societal needs and an effort to introduce efficiency into the R&D public support. Czech delegates in the Programme Committees of the FP7 contribute to the discussion on priorities supported by the FP7 according to the needs of Czech research teams.

### 4.5 National ERA-related policies - a summary

The Czech reaction to the 3% Action Plan at EU level consisted in the adoption of a national document entitled *Action Plan for Europe – Approach of the Czech Republic* in 2004. This document describes existing or proposed future activities in the Czech Republic corresponding to measures proposed in the 3% Action Plan.

In addition to this document the Economic Growth Strategy set out a quantified national target of 1% of public R&D expenditures by 2010, a target that was subsequently integrated in the National Reform Programme. The Economic Growth Strategy published in 2005 anticipated an annual growth of public R&D expenditures in the range of 20–25% per year. The budget plan adopted by the government in May 2007, however, proposes annual growth in the range of 7–8% per year. Nonetheless, the official target still remains in place and since the budget plan is only binding for the nearest financing period, the fulfilment of the target is still theoretically possible.

The Czech Republic's participation in the ERA has led to several changes within the R&D system including the monitoring and evaluation methods of research results corresponding to the market and societal needs. Also measures specified in the relevant Operational Programmes should correspond to national measures to be applied within the R&D system of the Czech Republic. Czech delegates in the Programme Committees of the FP7 contribute to the discussion on priorities supported by the FP7 according to the needs of Czech research teams.

Within the process of building the European knowledge based economy there is a plan in the Czech Republic to support the research and innovation system by formulating a new National Research, Development and Innovation Policy in 2009. New National Research, Development and Innovation Policy should cover both of the above mentioned policies and is to be finished by March 2009 for the period of 2009 – 2015. Background documents have been prepared and gathered recently by the *Council for Research and Development*, such as Green and White Paper on RDI and other strategic studies and analysis including best practices in these areas.

The following table shows the importance of ERA pillars in the ERA policy mix and key characteristics.
## Table 9: Importance of the ERA pillars in the ERA policy mix and key characteristics

<table>
<thead>
<tr>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
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<tbody>
<tr>
<td><strong>Labour market for researchers</strong></td>
<td>• Labour market for researchers still suffers from lack of researchers mainly in the S&amp;T fields,</td>
</tr>
<tr>
<td>• Important, especially with regard to removing barriers to mobility</td>
<td>• Post-graduate education has been classified as preparation for research career, but only 1/3 of PhD graduates choose the research career,</td>
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<tr>
<td></td>
<td>• International mobility is considered as the main challenge for improvement,</td>
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<td></td>
<td>• Proposal of new law on financial support of students shall be prepared by December 2009.</td>
</tr>
<tr>
<td><strong>Governance of research infrastructures</strong></td>
<td>• In 2007 – 2013, strengthening of the Czech research infrastructure is supported from EU Structural Funds (Operation Programme Research and Development for Innovation)</td>
</tr>
<tr>
<td>• Increasingly important, mainly in the field of ESFRI roadmap and centres of excellence.</td>
<td>• CR will focus on implementation of large European and Czech research infrastructures roadmaps,</td>
</tr>
<tr>
<td></td>
<td>• CR is a member of excellent European research infrastructures,</td>
</tr>
<tr>
<td></td>
<td>• CR participates in 11 ESFRI Roadmap projects</td>
</tr>
<tr>
<td><strong>Autonomy of research institutions</strong></td>
<td>• White Paper on Tertiary Education deals with stabilization of the open system of R&amp;D institutions and universities autonomy,</td>
</tr>
<tr>
<td>• Important; Universities already have a large degree of autonomy. Autonomy is considered crucial in Czech research policy.</td>
<td>• Reform of tertiary education shall open universities towards external social interests,</td>
</tr>
<tr>
<td></td>
<td>• Transparent environment including monitoring of university results shall be secured,</td>
</tr>
<tr>
<td></td>
<td>• White Paper covers also the topic of healthy competition in the field of R&amp;D.</td>
</tr>
<tr>
<td><strong>Opening up of national research programmes</strong></td>
<td>• National Programmes are generally open to Czech researchers, the support of foreign researchers is insufficiently covered,</td>
</tr>
<tr>
<td>• Increasingly important, but progress so far is limited.</td>
<td>• CR is involved in the ERA-NET projects as well as in the FPs projects but the Czech participation is not very outstanding and international cooperation within national projects is still not a common practice.</td>
</tr>
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</table>

## 5 Conclusions and open questions

### 5.1 Policy mix towards national R&D investment goals

Main Czech policy documents state that the strengthening of research and development through the promotion of public investment in R&D, higher education and innovative firms should lead to the approach of total expenditure for R&D in the Czech Republic in 2010, closer to 1% of expenditure on the Barcelona goal research and development from public funds.
Despite the public R&D funds’ growing in the Czech Republic more quickly than in other European countries, their relative amount is still below the EU average. This is caused, among other things, also by an insufficient readiness to implement programmes for supporting R&D from public funds. The allocation of financial means in the form of institutional support is not sufficiently tied to the evaluation of research work yet. It results not only lower number of scientific publications and their citations, lower number of patents, new technologies, products and services, as well as lower motivation of researchers to carry out high-quality research. It is unlikely that the government will be able to increase the share of its budget appropriations or outlays for R&D substantially in the coming years, especially in view of the current economic recession. Recently the government published so called National Plan against Crisis where some additional public funds are planned in 2009. Yet the plan is still very general, especially when talking about the budget on research and development.

Low private sector investment in R&D may continue to stagnate due to economic recession and can not be counted in the coming years with significant raise. This can have dire consequences for investment in R&D in the Czech Republic, where the majority of business investment in research produced by investment of large foreign companies which due to economic crisis will be forced to reduce its spending on research activities or moved them to the other (parent) countries. The effect of reducing business expenses may be vulnerable to research projects conducted on the basis of public-private partnerships. However, government spending on R&D will be in accordance with the approved state budget for the coming years still increase. Due to not assumed significant growth of private investment in R&D, it appears that one of the possibilities is to strengthen R&D in the Czech Republic by stimulating research at universities from public funds and support for university-based research collaboration with the private sector. Institutional support for research in universities needs be allocated in response to the consistent ex-post evaluation of the results of research work and to avoid diluting the overall financial volume of funding for research and development and also to encourage excellence of research teams. This issue of the research, development and innovations has been addressed in the reform of R&D and innovations system adopted by the Government in March 2008. The possibility of effective cooperation of academic research and private sector needs to support infrastructure for knowledge transfer (in order to transform the resulting knowledge into practical applications). To create appropriate transfer infrastructure it is necessary to take maximum advantage of EU Structural Funds (SF) in the Czech Republic.

Strengthening of private investment in R&D is also possible by achieving more attractive business environment for foreign companies that carry out research activities in the Czech Republic. To increase the attractiveness of the Czech Republic, Government has introduced a number of (mainly) financial and legislative measures. However, strengthening investment in education and promoting dynamics of the mobility of labour between the academic and private sector remains a challenge.

One of the important barriers to R&D investment is the fact that the public support for R&D is fragmented in the Czech Republic and the expenditure on R&D is low. All relevant policy documents mention this barrier. The opportunity for simplification and unification of the fragmented structure of R&D support would bring reform of research and development adopted by the government in April 2008. Barriers to further increase expenditure on R&D may represent the current economic crisis.
Another barrier lies in the low number of researcher. The opportunity for more attractive environment for research and development is represented by current Operational Programmes. Building a modern research capacity with the new rating system may attract new researchers, or it may encourage the return of qualified researchers from abroad. Barrier is a failure of appropriate conditions for researchers, structure of disciplines at universities and small horizontal mobility of researchers and students.

The low proportion of research in high technology intensive sectors is the third identified barrier. The policy mix is more focused on stimulating further development R&D investment in R&D performing firms. There is a possibility of transformation of companies at a higher technological sophistication and excellence in the fields of high-technology.

Fourth barrier is a small number of domestic companies engaged in R&D. Current policies may not be sufficient to encourage enterprises which do not perform R&D to become involved in research. The opportunity to increase the number of firms conducting R&D is represented by Inovace and Prosperita programmes.

The last identified barrier lies in weak linkages between academic research and business sector. In any case, the Spolupráce programme is considered important for the development of cooperation between academic and business sector.

From the global point of view, the current R&D system is not very satisfactory in the Czech Republic. Some aspects of the reform have already been settled. However, it is necessary to update the current National Innovation Policy and the National R&D programmes in order to improve national R&D system suitably according to new trends and needs in the field of R&D in Europe.

5.2 ERA-related policies

The Czech reaction to the 3% Action Plan at EU level consisted in the adoption of a national document entitled Action Plan for Europe – Approach of the Czech Republic in 2004. This document describes existing or proposed future activities in the Czech Republic corresponding to measures proposed in the 3% Action Plan.

Also a new National Research, Development and Innovation Policy 2009 – 2014 is currently being prepared taking into consideration the documents on the European level such as Green Paper on ERA or the new Lisbon Strategy goals and targets.

National research programmes correspond to the needs of ERA, mainly in the field of mobility of students and researchers (Centre for Mobility), joint research initiatives, networks and platforms leading to international cooperation in the field of R&D or centres of excellence.

The next paragraphs summarise the four pillars of ERA and characterise the Czech responding policies.

Labour market for researchers in the CR is open, still suffering from lack of excellent researchers. Only one third of PhD graduates choose the research career. The Czech labour market for researchers is still not attracting the foreign researchers due to the financial conditions. However, the new law on financial support to students and new law on tertiary education shall be prepared in 2009 to improve the situation.
The CR is a member of excellent European research infrastructures and actively participates in developing large research infrastructures within the ESFRI. By the year 2013 the EU Structural Funds will provide significant financial resources for developing large research infrastructure in the CR. Since the CR participates actively in the ESFRI Roadmap projects the EU Structural Funds will considerably contribute also to the development of the large research infrastructures throughout Europe.

White Paper on Tertiary Education as well as financial sources from the OP Education for Competitiveness shall contribute to openness of the universities autonomy in the field of research as well as to transparent environment including monitoring of the university results.

Concerning opening national research programmes, National Programmes are generally open to Czech researchers, but the support of foreign researchers is insufficiently covered. However, the CR is involved in the ERA-NET projects as well as in the FPs projects but the Czech participation is not very outstanding and international cooperation within national projects is still not a common practice.

Generally we can claim that the ERA goals and challenges are reflected in all responding policy and strategic documents in the Czech Republic, such as new proposal of National R&D and Innovation Policy 2009 - 2014, National Reform Programme 2008 – 2010 or White Paper on R&D and Innovation (2008). Concerning ERA related programmes and activities; the participation of Czech teams on ERA initiatives is not very outstanding even though it has been increasing in the last years. Also to attract foreign researchers to participate on Czech research projects seems to be still a big challenge as well as to avoid the brain drain.

Finally, there are two reforms tackling the above described issues, opportunities and challenges: reform of the R&D and innovation and reform of the tertiary education. These reforms are coming with concrete measures to improve the R&D and tertiary education systems.
References


Research Institute of Labour and Social Affairs (2008): Risk of outflow of scientific, research and development work force from the Czech Republic abroad in the context of the meaning of science and research in contemporary society. RILSA, Praha, 114 p.


<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AS CR</td>
<td>Academy of Sciences</td>
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<tr>
<td>AVO</td>
<td>Association of Research Organisations</td>
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<tr>
<td>BERD</td>
<td>Business Expenditures on Research and Development</td>
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<td>BISONet</td>
<td>Business Support Network of the Czech Republic</td>
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<td>CIP</td>
<td>Competitiveness and Innovations Programme of the EU</td>
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<td>CR</td>
<td>Czech Republic</td>
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<tr>
<td>CZELO</td>
<td>Czech Liaison Office for R&amp;D in Brussels</td>
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<td>CZK</td>
<td>Czech Koruna (currency)</td>
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<td>CZSO</td>
<td>Czech Statistical Office</td>
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<tr>
<td>DZSV</td>
<td>Long-Term Principle Research Directions</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>EEN</td>
<td>Europe Enterprise Network</td>
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<td>EIF</td>
<td>European Investment Fund</td>
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<td>EIS</td>
<td>European Innovation Scoreboard</td>
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<tr>
<td>ERA</td>
<td>European Research Area</td>
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<td>ERDF</td>
<td>European Regional Development Fund</td>
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<td>ESA</td>
<td>European Space Agency</td>
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<td>ESF</td>
<td>European Social Fund</td>
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<tr>
<td>ESFRI</td>
<td>European Strategic Forum on Research Infrastructures</td>
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<tr>
<td>ESO</td>
<td>European Southern Observatory</td>
</tr>
<tr>
<td>GBAORD</td>
<td>Government Budget Appropriations or Outlays on Research and Development</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GERD</td>
<td>Gross Expenditures on Research and Development</td>
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<tr>
<td>GOVERD</td>
<td>Governmental Expenditures on Research and Development</td>
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<tr>
<td>HERD</td>
<td>Higher Education Expenditures on Research and Development</td>
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<tr>
<td>HRST</td>
<td>Human Resources in Science and Technology</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
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<tr>
<td>IG 7</td>
<td>Integrated Guideline no. 7: To increase and improve investment in R&amp;D, in particular by private business (National Reform Programme 2008 - 2010).</td>
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<tr>
<td>IPR</td>
<td>Intellectual property rights</td>
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<tr>
<td>MEYS</td>
<td>Ministry of Education, Youth and Sports of the Czech Republic</td>
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<tr>
<td>MNEs</td>
<td>Multi-National Enterprises</td>
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<tr>
<td>NICER</td>
<td>National Information Centre for European Research project</td>
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</tbody>
</table>
NRP National Reform Programme
NUTS Noméclature des Unités Territoriales Statistiques
OECD Organisation for Economic Cooperation and Development
OP Operational Programme
PPS Purchasing power standards
RILSA Research Institute of Labour and Social Affairs
R&DI R&D – Research and Development
RTDI Research, Technology, Development and Innovation
SET Strategic Energy Technology
SF Structural Funds
SMEs Small and Medium Enterprises
S&E Science and Engineering
Abstract

The main objective of the ERAWATCH Policy Mix Country reports 2009 is to characterise and assess in a structured manner the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The reports were produced for all EU Member State and six Associated States to support the mutual learning process and the monitoring of Member and Associated States’ efforts by DG-RTD in the context of the Lisbon Strategy and the European Research Area. The country reports 2009 build and extend on the analysis provided by analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

This report encompasses an analysis of the research system and policies in Czech Republic.
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