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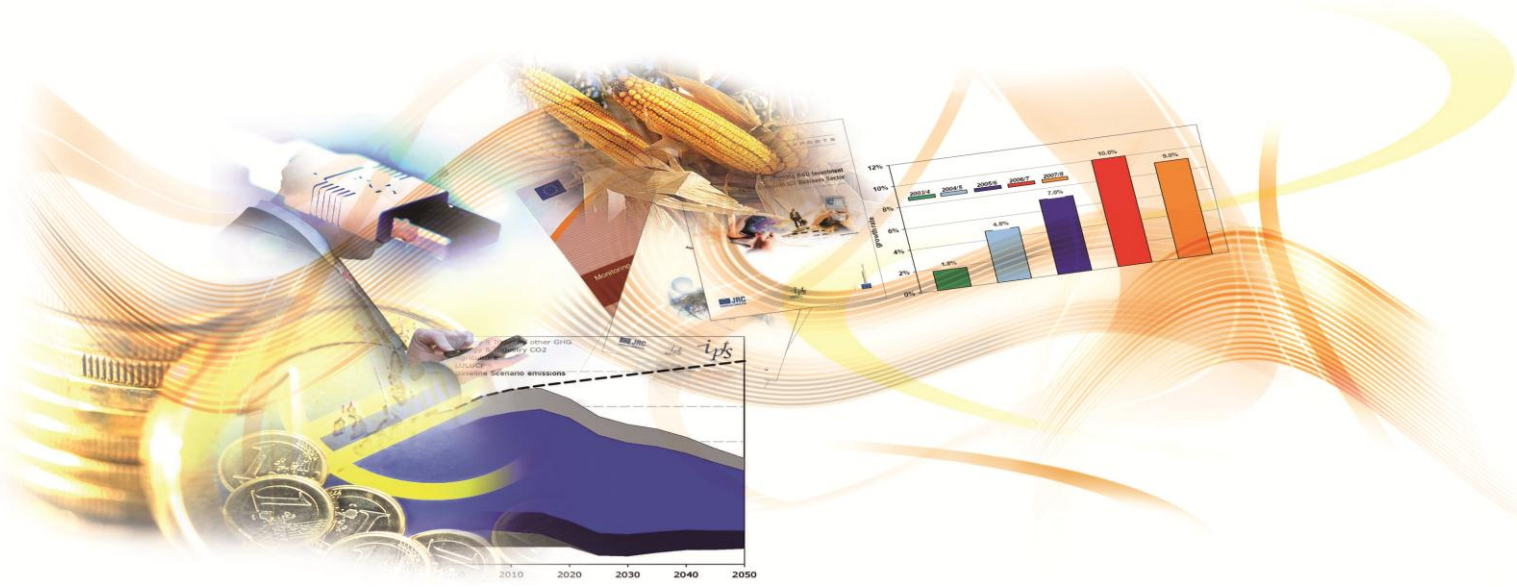

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Abstract

The Analytical Country Reports analyse and assess in a structured manner the evolution of the national policy research and innovation in the perspective of the wider EU strategy and goals, with a particular focus on the performance of the national research and innovation (R&I) system, their broader policy mix and governance. The 2013 edition of the Country Reports highlight national policy and system developments occurring since late 2012 and assess, through dedicated sections:

- national progress in addressing Research and Innovation system challenges;
- national progress in addressing the 5 ERA priorities;
- the progress at Member State level towards achieving the Innovation Union;
- the status and relevant features of Regional and/or National Research and Innovation Strategies on Smart Specialisation (RIS3);
- as far relevant, country Specific Research and Innovation (R&I) Recommendations.

Detailed annexes in tabular form provide access to country information in a concise and synthetic manner.
The reports were originally produced in December 2013, focusing on policy developments occurring over the preceding twelve months.

ACKNOWLEDGMENTS AND FURTHER INFORMATION

This analytical country report is one of a series of annual ERAWATCH reports produced for EU Member States and Countries Associated to the Seventh Framework Programme for Research of the European Union (FP7). ERAWATCH is a joint initiative of the European Commission's Directorate General for Research and Innovation and Joint Research Centre.

The Country Report 2013 builds on and updates the 2012 edition. The report identifies the structural challenges of the national research and innovation system and assesses the match between the national priorities and the structural challenges, highlighting the latest developments, their dynamics and impact in the overall national context.

The first draft of this report was produced in December 2013 and was focused on developments taking place in the previous twelve months. In particular, it has benefitted from the comments and suggestions of Mathieu Doussineau from JRC-IPTS. The contributions and comments from DG-RTD and Dr. Ondrej Daniel, Technology Centre ASCR are also gratefully acknowledged.

The report is currently only published in electronic format and is available on the ERAWATCH website. Comments on this report are welcome and should be addressed to jrc-ipts-erawatch-helpdesk@ec.europa.eu.

EXECUTIVE SUMMARY

During the transition from central planning to market economy in the 1990s, the research and innovation system have been significantly downsized. In recent years, the system embarked on a catching up trajectory with advanced European countries; however, the lag remains quite significant, especially in the quality of research outputs. R&D expenditures along with the number of researchers, doctoral graduates and tertiary students have increased steadily over the last decade. Yet many Innovation Union (IU) indicators have not even reached the EU28 average.

Despite the economic crisis and major slowdown of economic growth, R&D intensity of the economy in terms of gross domestic expenditure on R&D (GERD) as % of GDP increased from the bottom of 1.3% in 2008 to 1.88% in 2012. Since 2011 public funding slightly predominates over the private one. Business and foreign R&D funding, including from the EU Structural Funds, grew rapidly over the recent years, while national public funding earmarked to R&D tends to stagnate (Eurostat, 2013a)

The Reform of the Research, Development and Innovation (RDI) System launched in 2008 has stimulated much needed public debate on the role of RDI for competitiveness and the development of society at large. A number of policy documents and evaluation exercises that have been published during implementation of the reform pinpoint to the key problems. Based on these insights and the latest trends the most daunting structural challenges can be identified as follows:

- *Governance, evaluation and research excellence.* Governance of the RDI system was profoundly revised early in the reform. However, many of the changes remain half-baked due to disagreements among the main stakeholders, in particular over allocation of institutional funding, and political instability that thwarts attempts to make deeper changes in the system.
- *Stagnating public funding and new large infrastructures.* A major attempt to modernize the public research infrastructure is under way with funding from the EU structural funds, while national public R&D funding continues to stagnate. The government needs to make sure that the new infrastructure projects are properly managed, staffed, their operating expenses are covered and that they become integrated into the national system.
- *Skills shortages, rigid labour market for researchers and internationalization*. Higher education reform is long overdue, despite shortages of highly skilled personnel and concerns about the insufficient quality of tertiary graduates. Horizontal mobility of academic staff is low, competition for posts weak and inbreeding widespread. Gender inequality issues are ignored. Research internationalization is very limited in the public sector.
- *Innovation capabilities, disembedded multinationals and venture capital.* Structurally, the business sector appears sound; the high- and medium-high-technology sector is large. However, there is a lingering gap in innovation performance, as the business sector is specialized in low value added segments of value chains. Foreign affiliates are not embedded, access to venture capital is limited and path-breaking innovation is rare.
- *Underdeveloped public-private collaboration, technology transfer and market for technology*. A deeply entrenched weakness is the limited circulation, access and transfer of scientific knowledge. Many public-private linkages are informal, technology transfer services are

weak and the absorptive capacity of businesses is insufficient. Governance of public-private collaboration in research institutions is underdeveloped.

Overall, the policy mix aims to tackle the main challenges. For the first time, the strategic reform documents outlined the RDI policy in a coherent, compact and comprehensive manner. There seems to be emerging consensus on the way forward. Nevertheless, in many respects the reform progress has been painstakingly slow and if the problems are not tackled rather soon many of the objectives outlined in the National RDI Policy 2009-2015 and its mid-term update published in 2013 are not likely to be satisfactorily achieved.

Governance coordination issues, the revision of evaluation methodology of research institutions and generally more efficient allocation of public research funding are flagged as the top policy priorities. The Council for R&D and Innovation (CRDI) has become the central policy actor, the Technology Agency of the Czech Republic (TA CR) has been established as the dominant provider of support to applied R&D and innovation and the funding flows have been streamlined. However, the reform has slowed down significantly after an ambitious early push for changes. The CRDI has not been equipped by adequate resources to live up to its task. The formulae-based evaluation of research organizations and allocation of institutional funding turned out to be unsatisfactory but have not been fixed so far. The dispute among the key stakeholders over the evaluation methodology represents a major impediment for tackling other problems that are related to it.

Large R&D infrastructure projects that are constructed with the subsidy from the EU structural funds represent a great promise for boosting the research output. However, according to preliminary estimates their operating expenses may account for as much as one fifth to one third of the current public R&D budget. Unless the amount of public R&D outlays is expanded towards meeting the national target of 1% of GDP flagged in Europe 2020, which is not expected in the medium-term outlook, there may be painful trade-offs at stake. National program sustainability I and II have been enacted to fund the launch of the new infrastructures but how they are integrated into the system still remains to be seen.

One aim that has been repeatedly stressed in the reform documents is to develop human resources in research. Unfortunately, however, higher education reform ended up in doldrums. Despite initially ambitious plans, the reform agenda in this domain has been significantly watered down due to compromises forced by the existing establishment, as the result of which resolving the core problems, such as the rigid recruitment practices, is not under consideration anymore. Much remains to be done in improving the labour market for researchers.

Given the historical separation of science and business, the lack of public-private collaboration is one of the main policy issues. A number of new measures were introduced that are shifting the focus of public subsidies to promoting joint public-private projects. Another major policy shift that needs to be applauded has been the drive from a system traditionally based on direct RDI subsidies to firms towards a much wider portfolio of support measures, including tax credits for both internal R&D expenditure as well as the purchase of R&D services from research organizations and a public-private venture capital fund.

Generally speaking, the above-mentioned challenges, policy mix routes and measures are aligned with the Innovation Union Commitments and the European Research Area's (ERA) objectives; even though the policy response and implementation has been piecemeal in some respects. The main success area is the upgrading of research infrastructures, while the progress has been

particularly show in education and skills development, open labour market for researchers, gender equality in research and getting ideas to market. National Research and Innovation Strategy on Smart Specialisation (RIS3), including 14 regional RIS3 strategies at the NUT3 level, is expected to be presented in mid-2014.

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1 BASIC CHARACTERISATION OF THE RESEARCH AND INNOVATION SYSTEM

The Czech Republic is a small and open Central European country with an area of 78.9 thousands square kilometres and population of 10.5 million people, accounting for, respectively, 1.8% and 2.1% of the EU28 total. In 2012, gross domestic product (GDP) per capita in purchasing power standards reached €20,700, 81% of the EU28 average. After real GDP dropped in the peak of the crisis by 4.5% in 2009, the economy slowly recovered by 2.5% and 1.8% in 2010 and 2011; however, this positive trend did not last and the GDP dropped by 1.0% in 2012 and is expected to decline by 1.0% in 2013 (Eurostat, 2013b).

Despite the sluggish economy, gross domestic expenditure on R&D (GERD) as % of GDP increased from the crisis bottom of 1.3 % in 2008 to 1.88% in 2012, getting significantly closer to the EU28 average of 2.06%. In 2012, the business sector financed 36% of GERD, of which 97% was spend by the firms themselves testifying to their weak link to the rest of the system. Business expenditure on R&D (BERD) as % of GDP expanded to 1.01% in 2012 compared to 0.91% in 2011 and 0.81% in 2010, hence catching-up with the EU28 average of 1.30%. In 2012, the government sector financed 37% and foreign sources – a combination of EU structural funds and foreign affiliates - accounted for as much as 26% of GERD going up from only 10% in 2008, which makes the latter by far the most dynamic source (Eurostat, 2013a).

As far as high-quality R&D outputs, such as internationally recognized scientific publications and triadic patents, are concerned, there are several high-profile fields that stand out, including organic chemistry, nuclear physics, medical sciences, textile materials, machine tools, electrical engineering, combustion engines and vehicles in general. On one hand, there is clearly a catching up trend in research productivity with the EU28 average. On the other hand, however, the research and innovation system as a whole still lags behind the EU28 average in terms of research outputs per capita or per GDP (European Commission, 2013a).

At the heart of the public R&D sector is (i) the Academy of Sciences of the Czech Republic (ASCR), consisting of 54 formally independent public research institutes, and (ii) 23 public, 2 state and 39 private higher education institutions. Unlike in Western Europe, a large part of research activities are under the umbrella of the ASCR, the primary mission of which is to conduct basic research, while the higher education sector has been traditionally less research-oriented and more focused on teaching. Nevertheless, this has been changing in recent years, as the ASCR tends to get more involved in applied research and the higher education sector significantly expands research activities.

In 2008, the Reform of the Research, Development and Innovation (RDI) system was launched. The reform profoundly changed the governance of RDI policy. Competences of particular governmental bodies are given by the Act No. 130/2002 Coll. on the Support of Research and Development from Public Funds and by the Reform amendment Act. no 211/2009 Coll. The main players in RDI policy making are as follows:

Council for Research, Development and Innovation (CRDI) is an advisory government body for RDI policy with 17 members chaired by the Prime Minister. At the political level, the CRDI plays the main strategic and coordinating role.

Ministry of Education, Youth and Sports (MEYS) is the central administrative authority for R&D programmes in the public sector, particularly institutional funding for public universities. MEYS coordinates the EU Structural Funds through the Operational Programme Research and Development for Innovation (OP RDI) and the Operational Programme Education for Competitiveness (OP EC).

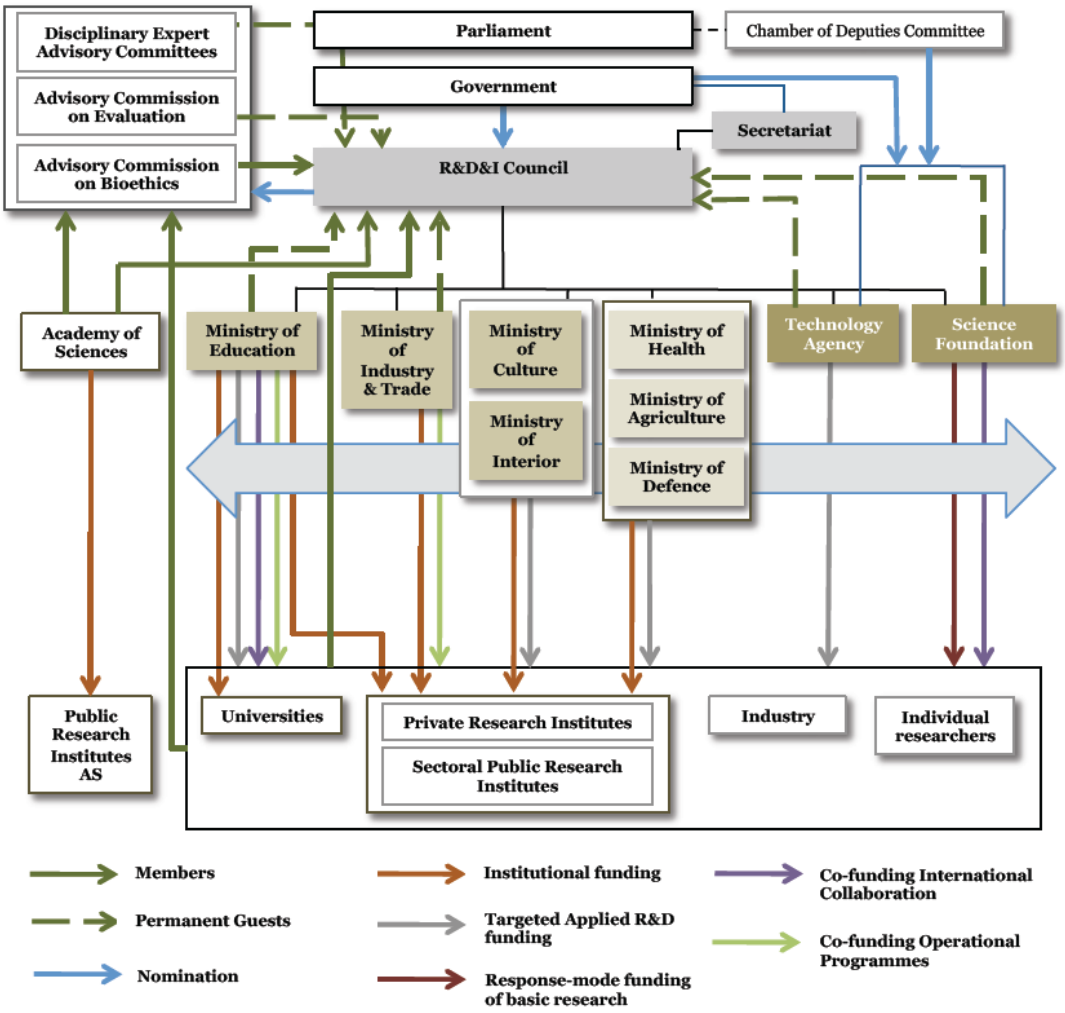
Ministry of Industry and Trade (MIT) administers policies in the domain of business RDI. MIT coordinates the EU Structural Funds through Operational Programme Enterprise and Innovation (OP EI).

Technology Agency of the Czech Republic (TA CR) provides competitive funding for applied research and experimental development.

Czech Science Foundation (GA CR) provides funding for competitive grants in basic research.

Academy of Sciences of the Czech Republic (ASCR) is the single most important research performer.

Figure 1: Structure of the R&I system



Source: Arnold (2011, pg. 27)

RDI policy making is fairly centralized. Regional authorities, the self-governing regions at the NUTS-III level, do not have any legally binding responsibilities in this respect. At the regional level, the role of RDI policy is limited to the implementation of the national programmes and the implementation of regional development policies. Nonetheless, the law does not prevent the regional authorities from launching their own RDI policy initiatives, though only a very few have done so (e.g. South Moravia).

2 RECENT DEVELOPMENTS OF THE RESEARCH AND INNOVATION POLICY AND SYSTEM

2.1 NATIONAL ECONOMIC AND POLITICAL CONTEXT

Real GDP growth was high for nearly a decade, annually on average about 4.5% over 2000-2008, which was well above the EU27 average. However, the slump in export demand during the global economic crisis hit the economy hard and GDP dropped by 4.5% in 2009; despite the fact that the domestic financial sector did not face major difficulties thanks to the cleanup about a decade ago. In 2010 and 2011, the economy recovered at a slow pace with GDP growing by 2.5% and 1.8%, respectively, however only to plunge into a double dip recession with GDP declining by 1.0% in 2012 and is expected to decline by about 1.0% in 2013 again (Eurostat, 2013b).

The center-right coalition government collapsed in June 2013. The Prime Minister Petr Nečas was forced to resign after series of arrests of high-ranking state officials and politicians by the Police Unit for Combating Organized Crime, including Jana Nagyova, the Chief of Staff at the Office of the Government. The President Miloš Zeman appointed Jiří Rusnok as the Prime Minister; however, the government lost a confidence vote. In turn, eventually, the Chamber of Deputies dissolved itself, paving the way to early elections. Jiří Rusnok resigned but the government continued in a caretaker capacity. The elections took place in late October 2013 and a new centre-left coalition government is in place since mid-February 2014. So far the political turmoil has not been accompanied by a major shift in policies. Nevertheless, the RDI reform agenda that was in the pipeline but not formally approved yet before the former government collapse has been derailed or at least seriously delayed.

2.2 FUNDING TRENDS

2.2.1. Funding flows

In 2012, gross domestic expenditure on R&D (GERD) amounted to €2.9b (CZK 72b) and increased by about 15% as compared to the previous year, driven mainly by the expansion of business and foreign funding. GERD jumped by 45% over the period 2008-2012, which marks a remarkable recovery. As a consequence, R&D intensity of the economy in terms of GERD as % of GDP increased to 1.88% in 2012, as compared to the lowest point of 1.3 % at the dawn of the crisis in 2008, hence noticeably approaching the EU28 average of 2.06% (Eurostat, 2013ab).

Business enterprise expenditure on R&D (BERD) accounted for 54% (€1.54b) of the total, the higher education sector came second with 27% (€0.79b) closely followed by the public research

institutions with 18% (€0.53b), while the private non-profit sector remained negligible accounting for less than 1% (€0.01b) in 2012. BERD as % of GDP reached 1.01% in 2012, which represents a significant increase compared to 0.91% in 2011, the crisis bottom of 0.76% in 2008, and about 0.70% ten years ago. BERD is characterised by a level of domination by foreign-owned companies that is one of the highest in the EU, as roughly 50% is performed by foreign affiliates; this represents a particular challenge for the design of RDI policies (Eurostat, 2013a and CZSO, 2013a).

In 2012, the business sector financed 36% (€1.05b) of GERD, of which 97% was spend by the firms themselves, most of the remaining 3% went to the public research institutions and only 0.6% flew to the higher education sector, which testifies to the very weak link between the business sector and other parts of the system. The government sector funded 37% of GERD (€1.06b), most of which split between higher education (44%) and public research institutions (36%). Foreign sources contributed by 26% (€0.75b) of GERD funding, almost tripling from 10% in 2010, about 40% of which came from private and 60% from public foreign sources; predominantly the EU funds, which is a major shift as the private segment dominated in previous years (Eurostat, 2013a and CZSO, 2013a).

The role of the EU structural funds in the funding of R&D has grown enormously in the programming period 2007-2013. Public R&D activities are financed particularly by two OPs administered by the MEYS: OP RDI (ERDF) and OP EC (ESF). The combined allocation of these two OPs equals approximately €3.8b. Business R&D and innovation activities are financed through the OP EI administered by the MIT with a total budget of approximately €3b for RDI relevant activities. Innovation activities with only a small fraction of possible R&D financing are also supported by the OP Prague -Competitiveness (OP PC) and OP Prague – Adaptability (OP PA). Over the period 2007-2013, Czech participants active in projects funded under the 7th Framework Programme acquired support of €208m from the EU (total project costs of €286m), participating in 893 projects (Technology Centre ASCR, 2013).

Government budgetary appropriations or outlays for R&D (GBAORD) amounted to €1.06b and the intensity of the economy in terms of GBAORD as % of GDP reached 0.69% in 2012, which represents a significant increase from 0.53% of GDP in 2008. Hence, GBAORD as % of GDP nearly eliminated the gap as compared to the EU28 average of 0.70%, despite major cuts in other parts of the government budget during the prolonged recession; though remaining far below the national target of 1% in the Europe 2020 initiative (Eurostat, 2013a). GBAORD are expected to stagnate roughly at the same level given the amount approved in the 2013 and 2014 public budgets and earmarked to only slightly increase in the medium-term outlook for the years 2015 and 2016 (CRDI, 2013a). GBAORD is therefore not planned to get significantly closer to the Europe 2020 target in foreseeable future.

Table 1. Basic indicators for R&D investments

	2009	2010	2011	2012	EU (2012)
GDP growth rate	-4.5	2.5	1.8	-1.0	-0.4
GERD (% of GDP)	1.35	1.40	1.64	1.88	2.06
GERD (euro per capita)	184.6	200.3	243.4	273.9	525.8
GBAORD - Total R&D appropriations (€ million)	870	894	1,048	1,058	90,691
R&D funded by Business Enterprise Sector (% of GDP)	0.54	0.57	0.62	0.68	1.12
R&D performed by HEIs (% of GERD)	19.7	20.0	24.4	27.5	23.7
R&D performed by Government Sector (% of GERD)	23.3	21.7	19.8	18.4	12.4
R&D performed by Business Enterprise Sector (% of GERD)	56.5	57.7	55.3	53.6	63.0
Share of competitive vs. institutional public funding for R&D	44.2	46.5	48.1	49.1	..
Venture Capital as % of GDP	0.001	0.008	0.005	0.000	0.025
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	9.5	9.5	10.2	10.5	5.6
Employment in knowledge-intensive service sectors as share of total employment	30.8	31.8	31.8	32.0	38.9

	2004	2006	2008	2010	EU (2008)
Turnover from Innovation as % of total turnover	11.0	25.7	..	..	17.4

Source: Eurostat.

2.2.2 Funding mechanisms

2.2.2.1 Competitive vs. institutional public funding

The Czech system of public R&D funding has been traditionally dominated by institutional support. However, this is changing in the context of the Reform of the RDI System. As a result, the share of project-based funds in GBAORD increased markedly in the last few years, namely from 44% in 2009 to 50% in 2013. According to the GBAORD multi-annual budget plan approved by the government in June 2013, the share of project-based funding is expected to continue steadily increasing to 54% in 2014, 55% in 2014 and 56% in 2016 (CRDI, 2013a). According to the initial reform plans, almost the full amount of institutional funding is supposed to be allocated using performance-based formulae which automatically allocates the funds based on research output recorded by research organizations over the previous five years. However, in order to stabilize the funding flows, a compromise has been reached that only 20% of the money is allocated using directly this formulae-based mechanism until a revised evaluation methodology

is put in place (CRDI, 2012a). As soon as results of the revised evaluation are ready and accepted by the stakeholders, which can be anytime between 2014 and 2016, the full amount of institutional funding should be allocated on competitive basis.

In 2013, the single largest recipient of institutional funds was the ASCR with CZK4.5b (€170m), which constituted the vast majority of its line in the annual public R&D budget and 34% of the total institutional funding. In 2014, the budget of the ASCR and its share of total institutional funding are planned to remain roughly the same. However, the ASCR also acquires funding from other sources than its own budget line. According to ASCR (2013), the total budget of the ASCR amounted to CZ11.1 b (€445m) in 2012, of which public institutional funding accounted for 40% and project-based funding within its own budget line for 1.5%, in addition other national sources of public funding accounted for 30%, including 1.3b CZK (€53m) of project-based funding acquired from GACR and 2.0b CZK (€80m) received from budget lines of other public R&D providers, other sources (outside of the national public R&D budget) amounted to 3.2b CZK (€125m) and 28% of the total, respectively. It is important to note that a part of the institutional funds is re-distributed between the public research institutes within the ASCR based on its own internal methodology, and hence its own policy in this respect. Overall, however, the largest share of the institutional funding, about 54% and CZK6.9b (€276m) in 2013, is channelled to the sector of higher education by the MEYS. Much smaller amounts are channelled through other ministries which predominantly provide institutional funding to research centres controlled by them (the Ministry of Agriculture, the Ministry of Culture, the Ministry of Health and others).

The main providers of project-based funding of a bottom-up type, i.e. competitive research grants driven by the intentions of applicants, are the GA CR which allocates grants for basic research and the TA CR which supports applied research and experimental development. GA CR had an annual budget of CZK 3.0b (€119m) in 2012 and CZK 3.3b (€127m) in 2013. The legal statute of TA CR was adopted by the government in December 2009 and the first programme ALFA was launched in March 2010. The first projects were selected in November 2010 and started at the beginning of 2011. Another three programmes funded by TA CR called BETA, OMEGA and Competence Centres were launched during 2011-2012, two additional programmes GAMA and DELTA are starting in 2014 and EPSILON is scheduled to start in 2015. As the result, the budget of TA CR has grown significantly in recent years from CZK 0.9b (€34m) in 2011, to CZK 2.2b (€86m) in 2012 and the approved budget further increased to CZK 2.6b (€86m) in 2013.

The major part of project funding for applied research is administered by the MIT, primarily through the TIP research programme with expenditures of CZK 3.0b (€121m) in 2012 and CZK 2.0b (€78m) in 2013, the budget of which, however, continues to be significantly reduced in the medium-term outlook and hence this programme expected to expire in the coming years. From 2016 onwards the MIT is supposed to cease to administer competitive R&D funding and completely pass this role to the TA CR. The MEYS also has a significant budget devoted to project-based funding, which is directed primarily towards the higher education sector, namely CZK 2.8b (€113m) in 2013; there are no plans to transfer this funding under the GA CR or TA CR.

Much smaller amounts are channelled through five other ministries which provide competitive funding through their individual research programmes (the Ministry of Agriculture, the Ministry of Culture, Ministry of Defence, Ministry of Health and Ministry of Interior). However, past experience has shown, that these programmes, while nominally competitive funds, are often used

as a source of institutional funding for research institutes controlled by the given ministries and also as means of research funding for the needs of these ministries.

2.2.2.2 Government direct vs indirect R&D funding

Until recently the government stimulated RDI in the business sector predominantly through direct subsidies. The programme TIP administered by the MIT provides subsidies to applied industrial research and R&D collaboration between the business and academic sectors. Several instruments within OP EI are designed to address the needs of industry, from start-ups to mature firms, including Potential programme supporting R&D capacities in enterprises and formalised alliances between companies, the Cooperation programme for technology platforms and clusters and the Innovation, Progress and Guarantee programmes that help start-ups and SMEs to overcome the limited availability of external funding. Most importantly, TA CR, which was established in 2009 as prospectively the main provider of direct subsidies to applied research and innovation, launched a portfolio of new programmes, including ALFA and Competence Centres. Several regions have implemented innovation voucher programmes, albeit the resources devoted to this instrument have been very small so far. Direct subsidies to business RDI channelled through the MIT and TA CR amounted to about CZK 4-5b (€150-200m) annually over the period 2010-2013, hence in terms of funding this is the dominant tool for stimulating innovation.

Yet there has been a shift from a system traditionally based on direct subsidies towards a wider portfolio of support measures. An R&D tax credit scheme has been launched in 2005 to stimulate private R&D expenditure. The new tax regulation enabled enterprises to deduct expenditures on R&D carried out for their own needs from their tax base, a major change as there was no measure of this kind before. In 2005, 27% of R&D performing businesses used the tax relief and the indirect support of R&D amounted to CZK 0.82b (€27m). In 2011, the number of companies drawing on indirect support to R&D was already around 40% of companies performing R&D activities and the indirect support of R&D reached almost CZK 1.85b (€75m). About 80% of firms that use the indirect R&D support have less than 250 employees; hence this instrument proves to be particularly suitable for promoting R&D in SMEs (CZSO, 2013b). Since 2014 the tax credits have been extended to the purchase of R&D services from research organizations.

Venture capital market is underdeveloped. Venture capital investment only amounted to €12m in 2010, €8m in 2011 and €1m in 2012; hence far below the EU average in term of % of GDP. Only several companies receive venture capital funding each year (Eurostat 2013a). Public measures to support venture capital are missing. The MIT plans to establish a public-private seed fund to kick-start the market. A budget of €53m funded from the OP EI has been earmarked for the fund, of which €32m goes to the SEED instrument for early-stage and €21m is devoted to the VENTURE instrument for expansion funding. However, the launch of the seed fund has been delayed by preliminary ruling of the Office for the Protection of Competition that annulled results of the tender for fund caretaker (CzechTrade, 2013).

2.2.3 Thematic versus generic funding

Thematic funding programmes are underdeveloped and the thematic focus is not very strongly promoted by the existing funding sources. Hence, the share of public resources spent on thematically non-oriented research far exceeds expenditures on oriented research. According to the shares of socio-economic objectives (NABS), non-oriented research financed from general university funds had 28.3% and from other sources 29.9% share in GBAORD in 2012, respectively. Within thematically oriented research, representing the remaining 41.8% of GBAORD, prevails industrial research (15.9%), followed by medical research (6.2%) and transport, telecommunication and other infrastructure (4.2%). Other socio-economic objectives have a combined share of 15.5% on the total GBAORD (Eurostat, 2013a).

Despite the Reform of the RDI system, the balance between thematic and generic funding has remained remarkably stable; oscillating in a narrow range between 58% and 61% share of generic funds in GBAORD over the period 2008-2012. So far the allocation of thematic funding has only loosely reflected the national priorities and grand challenges. Yet this is planned to change with implementation of the updated priorities of oriented R&D for the period until 2030 (CRDI, 2012b), which are designed to reflect major societal challenges, and which should be respected in the thematic focus on new support programmes and prospectively also in allocation of institutional funding. None of the existing policy documents, however, sets binding targets in this respect.

2.2.4 Innovation funding

As far as funding specifically for innovation only, the situation has noticeably improved in recent years and there is a growing portfolio of policy instruments in place (or in the pipeline). TA CR programmes, particularly ALFA, GAMA and OMEGA, support projects aimed specifically at the implementation of R&D results, hence at the innovation end of the RDI spectrum. Support to innovation in business enterprises from start-ups to mature is also channelled through the OPs, for example, the MIT organizes the Innovation programme funded from the OP EI that aims to boost the innovation potential of the manufacturing sector and the MEYS administers under the OP RDI several funding measure that include support to commercialisation of R&D outputs. In addition, the MIT plans to launch a public-private venture capital fund funded from the OP EI. Finally, several regional governments have started innovation voucher programmes in 2012 and 2013.

2.3 RESEARCH AND INNOVATION SYSTEM CHANGES

New large R&D infrastructure projects that are going to have a profound impact of the whole R&D system have been approved for funding. Six major projects with a total amount of subsidy of €835m (85% funded by the ERDF) were approved:

i) ELI - Extreme Light Infrastructure (€271m);
ii) BIOCEV - Biotechnology and Biomedicine Research Centre (€92m);
iii) CEITEC - Central European Institute of Technology (€209m);
iv) Centrum excellence IT4Innovations (€72m);
v) ICRC - International Clinical Research Center (€94m); and

vi) Udrzitelna energetika (€97m).

The projects are financed by the OP RDI, through the Priority Axes 1 and 2. For more information see the Annual Report on Implementation of the OP RDI for 2011 (MEYS, 2013a).

As the result of the implementation of the Reform of the RDI System, the number R&D budget providers have been halved to 11 in the budget period 2013-2015. The responsibility for administrating public support for applied research and innovation is moving under the umbrella of the Technology agency (TA CR), which gradually takes this responsibility over from ministries and other state institutions. Therefore, the budget of the TA CR grows, while the R&D budget earmarked for competitive funding of applied research of ministries declines, especially of the MIT, which used to be the main provider of funds for the support of industrial research. On the other hand, the Ministry of education, youth and sport (MEYS) and Ministry of industry and trade (MIT) administer large Operational Programmes (OP) of the EU structural funds dealing with R&D and innovation; therefore there is significant dynamics of expenditure within these programmes as national public co-financing is required.

2.4 RECENT POLICY DEVELOPMENTS

The new centre-left Czech government formed by the Czech Social Democratic Party, the ANO 2011 Movement and the Christian Democratic Union – Czechoslovak People's Party won confidence vote in the Chamber of Deputies of the Czech Parliament in mid-February 2014. The main priorities in science, research and innovation policy are to: i) Increase motivation within the private and public sectors to use RDI results; ii) Create conditions for a change in the way research institutions and projects are evaluated and funded to reflect their real contribution to the development of the Czech Republic, in particular, the dependence of basic research on targeted funding should be reduced; iii) Improve the activities of the Government Council for Research, Development and Innovation, create conditions conducive to the mobility of RDI staff and PhD students and strengthen doctoral disciplines that relate to the needs of the economy in applied fields; iv) Increase support for involvement in international bilateral projects, European Union projects (including the in the ERA), applied research, technology transfer and the use of venture capital; v) Promote new growth sectors of the digital economy, and cultural and creative industries; vi) Formulate new incentives to stimulate projects with high added value, with a high proportion of research and development, or strategic services; and vii) Analyse higher-education legislation and submit proposed amendments.

At the 280th meeting of CRDI on 22th February 2013 was proposed a medium term patch of the evaluation methodology of research outputs for the period 2013-2015, on the base of which institutional funding is going to be allocated in the period 2014-2016. Pillar II of the new methodology is supposed to involve international peer review. More specifically, public research organizations will be asked to submit a list of their top outputs for more detailed review, which will be conducted by an expert panel with significant proportion of foreign reviewers, and on the base of this information the panel will decide on distribution of financial bonuses reflecting quality of the research outputs. Moreover, extra bonuses will be awarded to research organizations, which obtained project funding from the ERC (which is deemed to be a sign of research quality). However, the implementation of the Pillar II hinges on the completion of the project on "Efficient system of evaluation and financing of research, development and innovation" (IPn METODIKA project), which is undergoing under the auspice of MEYS, and which is going to forge details on how this is going to be done. In any case, after a several years

of a stalemate there seems to be an important policy shift, which is likely to lead into incorporating international peer review into the evaluation methodology.

The MIT has announced plans to launch a pilot project of a public-private seed fund funded from the Operational Programme Enterprise and Innovation (OP EI). The aim is to boost the grossly underdeveloped national market for venture capital and supporting the creation of new knowledge-based companies, including university and research spin-offs. The pilot project has been presented at 15 universities during the autumn of 2012 and four workshops for entrepreneurs in the spring of 2013. A budget of €53m is earmarked for this purpose. The seed fund is ready to start operation; however, the launch of the project has been halted by ruling of the Office for the Protection of Competition, according to which the tendering process of the fund caretaker needs to be repeated (CzechTrade, 2013).

In 2012, three new programmes managed by TA CR were launched: i) BETA is a programme of public procurement in research, experimental development and innovation for the needs of public administration bodies, approved for the period 2012 to 2016 and with a budget of €26m over the five years; ii) OMEGA supports applied social science research and experimental development, is approved for the period 2012 –2017 and the budget is only a little over €2.5 million in the first year; and iii) Competence Centres supports RDI centres in progressive fields with strong application potential and with conditions for the development of long-term collaboration between the public and private sectors, approximately 35 centres are supported with a budget of about €240m over 2012 to 2019. Furthermore, TACR is starting two additional programmes in 2014, namely i) GAMA supporting the verification of R&D results in terms of their practical application and their subsequent commercial use, and ii) DELTA funding grants for joint international projects with third countries. TACR is also scheduled to start a new EPSILON programme in 2015.

2.5 NATIONAL REFORM PROGRAMME 2013 AND R&I

Recent debates about the need to reduce the share of institutional funding in favour of funds allocated for project funding distributed on a competitive basis has resulted in a proposal to reform the system of institutional funding. As a part of the Reform of the RDI System, it has been decided that each research organisation receives institutional funds based on its historical research results achieved over the past five years, as reported to the central database of research results. Nevertheless, the new system of quality evaluation of higher education and research institutions has been hotly debated topic in recent years. It has been heavily criticized by the academic community for being too mechanistic and for not taking into account differences in publication behaviour between different fields of science, among other things. It has been also criticized in the International Audit of Czech RDI (Arnold, 2011), one of which recommendation was to fundamentally review the system and replace it by replaced by a system of performance contracts.

As the result, this system of distribution the institutional funding has been modified. More specifically, the formulae used in 2013 is based on the compromise between the need to use quantitative criteria (as required by the law) and other considerations by the main stakeholders, as the results of which a consensus has been reached that 80% of the money is divided in the same way as in the 2011 budget and only 20% is allocated based on the historical research results

achieved over the previous five years (CRDI, 2012a). During 2013 a medium term patch of the evaluation methodology has been introduced for the period 2013-2015, on the base of which institutional funding is going to be allocated until 2016, which involves elements of international peer review and bonuses for obtaining project funding from the ERC. IPn METODIKA project (as a part of the OP RDI) intended to conduct more systematic revision of the methodology is in the progress, the results of which are expected in late 2014.

2.6 RECENT EVALUATIONS, CONSULTATIONS, FORESIGHT EXERCISES

The Update of the National Research, Development and Innovation Policy 2009-2015 with an outlook to 2020 has been approved by the government resolution No. 294 on 24th April 2013. The update provides a comprehensive evaluation of the progress achieved so far in implementing the RDI reform. The main aim of the update is to improve conditions for innovation, knowledge transfer and diffusion of frontier technologies. The update revolves around four priority areas: i) Supply of high-quality human resources; ii) Enhancing the framework for transfer and utilization of knowledge; iii) Boosting the innovative capacity in the business sectors and iv) Improving strategic management of the system. As the keystone has been flagged the field of human resources, as this is deemed to be essential for successful operation of the newly constructed large research infrastructures. Another purpose of the update is to re-align the reform agenda with the government medium-term budgetary plans in public R&D spending, which have been significantly downsized by the economic crisis and prolonged recession. Nevertheless, the government maintains its commitment to meet the 2020 national target of 1% of government spending on R&D as % of GDP.

2.7 REGIONAL AND/OR NATIONAL RESEARCH AND INNOVATION STRATEGIES ON SMART SPECIALISATION (RIS3)

Regional authorities, consisting of 14 self-governing regions at the NUTS3 level, do not have any legally binding responsibilities in RDI policy. Yet the law does not prevent them from launching own RDI initiatives, which is, however, difficult given their restricted budgets. So far their main role has been in catalyzing the EU Structural Funds projects, primarily those funded from the OP RDI. South Moravian region is the main exception that proves the rule, representing the national role-model of regional innovation policy with dedicated authorities, well-functioning innovation agency and dialogue with the business community; for more information see (RISJMK, 2013). Several other regions are attempting to emulate this model with various degrees of success, most prominently Moravia-Silesia, Liberec, Zlín and Hradec Králové regions, while most of the other regions have either only paid a lip service or ignored the need to developing regional innovation policy altogether.

MEYS has accepted the responsibility for designing the RIS3 strategy and appointed the so-called RIS3 Coordination Board in November 2012 (MEYS, 2013b). Regional RIS managers were selected in April 2013 and the national RIS3 facilitator was assigned in September 2013;

arguably facing a very tight schedule. The regional managers are appointed and funded by the MEYS. It remains to be seen to which extent the top-down approach to crafting of the regional RIS3 strategies will make a tangible difference on the ground, especially in the regions where indigenous initiative has been very limited so far. Only South Moravia and the Capital City of Prague have started to work on their RIS3 strategies in a bottom-up manner, independently of the national initiative; the testimony to which is the fact that only three regions, including these two, have registered in the S3 (Smart Specialisation Strategies) Platform initiative of the JRC by October 2013.

According to the update schedule presented by Czesaná (2013, pg. 11), however, the MEYS will not meet the aforementioned timeline. By the end of 2013, only an (unpublished) preliminary draft of the National RIS3 strategy will be available. In January 2014, the RIS3 draft will be considered at the 5th meeting of the RIS3 Coordination Board. The National RIS3 strategy (but without the regional RIS3 annexes) is expected to be submitted for review to the EC by 31.1.2014. Over February-April 2014, the draft documents will be discussed with stakeholders at both the national and regional levels. The regional RIS3 annexes are scheduled to be ready by 31.5.2014. The final version is going to be submitted to the national and regional governments in June 2014 and subsequently submitted to the EC. Hence, the publication of the National RIS3 strategy has been postponed by at least six months.

2.8 POLICY DEVELOPMENTS RELATED TO COUNCIL COUNTRY SPECIFIC RECOMMENDATIONS

The main policy development related to Council Country Specific Recommendations (European Commission, 2013d) that are relevant for RDI policy, namely the recommendation to "Increase the share of performance-based funding of research institutions", is that a revised methodology of evaluation of research organizations that is fully performance-based has been put in place for years 2013–2015 (for more details see Section 2.4). The revised methodology at least partly removes highly criticized shortcomings of the current evaluation system, which are causing inefficiency in the funding of research, though, the methodology continues to heavily rely on the formulae-based approach. Contrary to the previous methodologies, however, it does not include explicit rules for allocating the institutional support, as results of the evaluation constitute only background information, which the RVVI will use for the preparation of its draft state budget for the RDI area. Hence, the evaluation system is based on performance indicators but institutional funding will be ultimately distributed according to budget negotiations among actors. After 2015 a new system of RDI evaluation is scheduled to be implemented.

3 PERFORMANCE OF THE NATIONAL RESEARCH AND INNOVATION SYSTEM

3.1 NATIONAL RESEARCH AND INNOVATION POLICY

Innovation Union Scoreboard 2013 (European Commission, 2013a) classified the Czech Republic among the "moderate innovators", which maintain the overall innovative performance slightly below the EU-27 average. Nevertheless, it ranked on the 10th place in terms of growth over the period 2008-2012, hence in the category of converging "moderate growers". Despite scoring below the EU27 average in most of the individual indicators under consideration, it outperforms the reference group of moderate innovators in many important areas and is catching up with the category "innovation followers". In a nutshell, the Czech RDI system can be characterized by a combination of both moderate level and growth performance.

The main strengths are identified in Human resources (youth with upper secondary education), Firm activities (non-R&D innovation expenditure) and Economic effects (contribution of medium and high-tech product exports to trade balance). The weak areas in which the Czech RDI system is far behind the EU27 average are concentrated in Open, excellent and attractive research systems (top scientific publications and non-EU doctorate students), Finance and support (venture capital), Intellectual assets (patents, trademarks and designs) and in licence and patent revenues from abroad. High growth has been detected in population with tertiary education, whereas the prime setback (from already a very low base) has been in venture capital.

According to the more detailed country profile (European Commission, 2013b), in particular the quality of scientific production and technological development, in other words the level of excellence in S&T, is markedly behind than the EU27 average and is catching up only very slowly. Structure of the economy is generally favourable but business R&D investment remains relatively low and thus the innovation performance is deemed to be below its potential. Another evergreen weakness that is highlighted refers to the limited cooperation between the science and business sectors. The key science and technological strengths are identified in the fields of automobiles, other transport, construction, materials, energy and environment. BERD in foreign affiliates, including inward BERD funding, is the main driving force in the overall increase of R&D intensity in the business sector.

Table 2 Main S&T indicators

HUMAN RESOURCES	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	1.3
Percentage population aged 25-64 having completed tertiary education	23.8
Open, excellent and attractive research systems	
International scientific co-publications per million population	529
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	5.51
FINANCE AND SUPPORT	
R&D expenditure in the public sector as % of GDP	0.72
Public Funding for innovation (innovation vouchers, venture/seed capital, access to finance granted by the public sector to innovative companies)	..
FIRM ACTIVITIES	
R&D expenditure in the business sector as % of GDP	1.11
Venture capital and seed capital as % of GDP	0.010
Linkages & entrepreneurship	
Public-private co-publications per million population	33.7
Intellectual assets	
PCT patents applications per billion GDP (in PPS€)	0.89
PCT patents applications in societal challenges per billion GDP (in PPS€) (climate change mitigation; health)	0.20
OUTPUTS S	
Economic effects	
Medium and high-tech product exports as % total product exports	62.1
Knowledge-intensive services exports as % total service exports	27.3
License and patent revenues from abroad as % of GDP	0.05

Note: The latest year available.
Data Source: European Commission (2013a).

3.2 STRUCTURAL CHALLENGES OF THE NATIONAL R&I SYSTEM

Many national assessments of the RDI system have been recently carried out in the context of the ongoing reform, notably the International Audit of RDI in the Czech Republic summarized by Arnold (2011) and the Update of the National Research, Development and Innovation Policy 2009-2015 with an outlook to 2020 by CRDI (2013b). Moreover, there are the twin documents Competitiveness Report by the National Economic Council (2011) and Strategy of International Competitiveness by MIT (2011a), including the follow-up National Innovation Strategy produced jointly by MEYS and MIT (2011b), which scrutinize the role of RDI in the broader policy context. Drawing on their findings, which are by and large in parlance with results of the Innovation Union Scoreboard assessments by the European Commission (2013ab) and with each other, the main structural challenges can be detected, not necessarily in the order of importance, in the following five areas.

Governance, evaluation and research excellence

Since 2008 the governance system is undergoing a profound reform outlined in the National RDI Policy of the Czech Republic 2009–2015 (CRDI, 2009). RDI funding system has been streamlined. TA CR has been established as the dominant supporter of applied research. The role of ministries has been gradually reduced, especially in favour of the CRDI, GA CR and TA CR. The CRDI has centralised principal activities, become effectively responsible for setting the entire national research budget and de facto assumed the role of a science ministry. However, the CRDI formally continues to be an advisory body of the government only; without adequate executive administration, analytical capabilities and budget line, which inhibits its capacity to make informed decisions on long-term strategy development. The CRDI has become overburdened with responsibilities, which it struggles to cope with given the limited resources.

A particularly thorny liability of the CRDI, which haunts the policy debate for several years, is the dysfunctional evaluation methodology of research institutions, which determines the allocation of public institutional funding. The formulae-based approach that has been implemented early in the reform automatically reallocated the entire flow of institutional funding annually based exclusively on outputs generated in the preceding five years. The idea was to make the allocation performance-based, which in turn was expected to reward quality, boost productivity and de-politicise the funding process. But the methodology has been fiercely resisted by the stakeholders and criticized as simply "not fit for the purpose" by Arnold (2011) for falling into the trap of reductionism, creating inherent instability of the funding flows, failing to address differences between fields of science, stimulating opportunistic behaviour and ignoring national thematic priorities.

As the result, the strategic policy-making has been complicated by arguments over the evaluation methodology. More recently, the institutional funding flow has been refined with the aim to address at least some of its flaws. In 2012, there was a short-term patch into the formulae that redirected the flows in a way agreed in political negotiations among the key stakeholders and that made the flows more stable. In 2013, a medium-term patch of the evaluation methodology has been introduced that awards bonuses for the best performing institutions and involves elements of international peer review. Nevertheless, the vast majority of institutional funding continues to be channelled using the original formulae. The dispute locks the stakeholders in short-term focus and represents a major impediment for tackling many other problems that are intimately related to incentives laid down in the evaluation methodology.

Overall, Arnold (2011) concluded that the political instability in recent years had a major negative impact on the RDI system. There have been frequent changes of ministers that make it difficult to implement consistent policy. All too often, the reform debates have been politicised and the decision making process dominated by interest groups, not based on strategic intelligence and dealing with the problems in a systematic manner. Many of the unresolved issues are symptoms of a lack of trust among the key actors, especially the lack of trust in the government, which thwarts attempts to make deeper changes in the system. Not much has improved in this respect in the meantime. It remains to be seen whether the new government that is currently forming on the base of the early elections hold in November 2013 and that is likely to take the office in early 2014 would make a tangible difference in governance of the RDI system.

Stagnating public funding and new large infrastructures

New large R&D infrastructural projects with a total amount of subsidy of €835m that are constructed with the support from the EU Structural Funds represent a great promise for boosting the national research output. However, the new projects represent a major funding puzzle, because the EU support is for the initial investment only. Later on, wage, maintenance and other operating expenses must be covered from other sources. So there is a danger that these projects turn from blessing to a curse for the public R&D system, as sizeable opportunity costs will need to be resolved in not too distant future. Managers of the projects pledge to obtain funding from private sources. But this is likely to cover only a fraction of their needs. More likely is that their operating costs will start draining public R&D funding from the existing infrastructure. It will be a major challenge for the RDI policy to integrate these new infrastructures into the national system in the coming years.

In the meantime, national public R&D funding is earmarked to stagnate in the medium-term budgetary outlook and hence the prospects for reaching the 2020 national target of 1% of GBAORD as % of GDP remain rather bleak. Unless there is a breakthrough in the near future, unless the government noticeably expands outlays for R&D, there could be painful trade-offs at stake. According to preliminary estimates the full operating costs of the new large infrastructural projects might amount to CZK 5b to 10b (€190m to 385m) per year (Rádio Impuls, 2013), which roughly represents as much as one fifth to one third of the current public R&D budget. Either the new projects or the existing infrastructure might need to shrink; possibly quite significantly. And in the final analysis this can have major disruptive impact for functioning of the national research system.

Another critical bottleneck for success of the new R&D infrastructural projects is availability of qualified human resources, not to mention star scientists, on the labour market. Arguably, this can turn out to be a major problem, as the expected demand by far exceeds domestic supply in the relevant scientific fields. Some of the new staff will have to be poached from the existing infrastructure. Some of them, perhaps even their majority, will have to come from abroad. But attracting large numbers of top foreign researchers in a relatively short span of time required for launching the full operation of the projects is not going to be easy, if one considers the above mentioned funding uncertainties, the unresolved rigidities of national labour market for researchers, the lingering difficulties with attracting foreign talent and last but not least given the fact that the remuneration of scientist in the national system is far below the international competitive wage level.

Skills shortages, rigid labour market for researchers and internationalization

According to the assessment of MIT (2011b), because the reform of tertiary education remains uncompleted, there has been an unchecked expansion of university graduates, the quality of which is however hard to judge. The lack of highly skilled personnel is often cited as not only hampering the quality of research in public institutions but even more so as the major obstacle of innovation in the private sector. Yet modernization of the higher education system is long overdue, the higher education act has been amended seventeen times and it is broadly acknowledged that a comprehensive reform of the education system is necessary.

Human resources management practices in the public sector need to be revised in order to reduce the widespread in-breeding make career progression paths more transparent and intensify

competition for posts. Horizontal mobility of academic staff is very limited. Arnold (2011) noted that management of research groups is underdeveloped, the groups tend to be very small, locked into existing research trajectories, lacking interdisciplinarity and there is little use of career development plans; this is partly because of weak bottom-up incentives and poor mobility among researchers. Overall, the approach to research human resource management is unsystematic.

As shown by National Training Fund (2012), opportunities for early career researchers are weak, post-doc funding remains limited and especially in the university sector often not allocated on competitive basis, which reinforces to in-breeding. GA CR awards postdoc grants but the amount of funding is limited. Attracting talented doctoral students from abroad is high on the agenda on some research institutes, albeit the achievement of this goal is rather difficult because of low financial support available.

Arnold (2011) further points to the fact that less than 10% of researchers are foreign, which is very small proportion by international standards. And about half of the foreigners are estimated to originate from the neighbouring Slovakia, which used to be part of the same country until 1993. There is a considerable scope for making better use of research internationalization particularly in the public sector, the limited extend of which is in a sharp contrast to the pivotal role of foreign affiliates in the business sector. An explicit internationalization strategy of the public research system is lacking.

Gender situation in research is dreadful. The share of female researchers is very low, only 25% in FTE in 2012 (CZSO, 2013a), which is far below the EU average. Gender equality is almost entirely ignored in research policy, the testimony to which is the fact that there is very little, if anything, on this topic in the key strategic documents. Moreover, there are regulations in the research funding system with regards to conditions for maternity leave that are outward discriminatory and that put female researchers in disadvantaged position to conduct the project; especially early in their careers when this matters most.

Innovation capabilities, disembedded multinationals and venture capital

A major policy shift promoted by the RDI reform has been from a system traditionally focused on science towards more attention devoted to boosting innovation. But the success has been at best partial so far. Arnold lamented (2011) that the economy is based on diffusion and absorption of technologies that are new to the firm or new to the country but not new to the world and concluded that domestic knowledge generation has not been yet established as the main driver of growth. Most R&D done by enterprises is limited to experimental development rather than research.

About 50% of business R&D was performed by foreign affiliates in 2012. The testimony to dominance of foreign affiliates is the fact that only two Czech firms, both state-owned, feature amongst the world or EU top R&D investing firms, namely ČEZ (electricity) is 1667th in top 2000 world and 453th in top 1000 EU R&D performers and České dráhy (transport) is 860th in top 1000 EU R&D performers (European Commission, 2013c). As noted by MIT (2011b), however, foreign affiliates are largely doing low-added value work, even within high-tech industries, as the parent companies tend to keep the core research activities close to their headquarters abroad. From this follows the challenge to make the multinationals more embedded in the national innovation system and upgrade the activities they perform locally.

Limited access to external private sources of finance for innovation is perhaps the single most important obstacle for improving the innovative performance, particularly in the sector of SMEs. Availability of venture capital to support innovative businesses and spin-off firms trying to commercialize research outcomes is well-known to be extremely low; one of the lowest among European countries. A lack of experience among potential clients and rather traditional entrepreneurial culture do not constitute a favourable environment to venture capital expansion. No tax measures supporting venture capital or business angels are in place.

Underdeveloped public-private collaboration, technology transfer and market for technology

Given the historical separation of science and business and the prevailing differences in culture or attitudes in these spheres, the lack of collaboration between them is one of the main policy issues. Despite steady effort to strengthen public-private linkages, deficiencies are present on both sides, namely limited industry-valuable results and poor technology transfer practices in the public sector on one hand and low absorptive capacity of public research outputs in companies on the other hand. Since the business sector tends to lag behind the technology frontier, except perhaps of the dis-embedded multinationals, most of the firms focus on absorbing existing technologies rather than collaborating with science. Poor horizontal mobility of professionals between the sectors and sometime too rigid setting of support measures reinforce the weaknesses.

All too many public-private linkages are informal. MIT (2011b, pg. 7) account of the poor management of public-private linkages speaks volumes: "A very important mechanism of knowledge transfer in the Czech Republic is informal networks based on personal contacts. The problem is that collaboration happens between individuals and not between enterprises and research organizations. Hence, the outcome is often what can be described as "privatization of outputs of public research activities". Research organizations suffer a loss of potentially significant source of income. Moreover, these issues generate personal conflicts in research teams. For many public researchers these informal linkages represent the main source of their personal income, which in turn limits the time they devote to science itself." Generally speaking, the lack of rules, the inadequate enforcement of the existing ones and ineffective administrative processes create fertile ground for opportunistic behaviour of actors involved on both sides. National governance strategy of public-private collaboration is lacking.

3.3 MEETING STRUCTURAL CHALLENGES

National research and innovation priorities

National RDI Policy of the Czech Republic 2009–2015 (CRDI, 2009) is the central policy document, the elaboration of which has reflected a growing need to possess a strategic document, which would fully encompass the entire sector of research, development and innovation, and which would substitute various partial strategies that preceded it. CRDI (2009) has been developed in the process implementation of the Reform of the RDI system in the Czech Republic (CRDI, 2008a), which was approved by the Government in 2008. More recently, the Update of the National Research, Development and Innovation Policy 2009-2015 with an outlook to 2020 (CRDI, 2013b) has brought the reform agenda into line with the medium-term

plans of public R&D spending, the growth of which has been significantly downsized due to the economic crisis, but otherwise confirmed the reform track.

The main objectives of the updated national RDI policy are fourfold:

- To stimulate research excellence, use of new knowledge and aligning the allocation of public funding to these ends;
- To utilize R&D outputs in innovations, improve public-private cooperation in RDI and conditions for efficient diffusion and use of knowledge;
- To develop human resources, promote mobility of researchers and prevent brain drain abroad;
- To facilitate development/sustainability of new R&D infrastructures, their cooperation with each other and with the application sphere;

New R&D programmes are supposed to follow the updated National Priorities of Oriented Research, Experimental Development and Innovation (CRDI, 2012b) that have been summarized under six long-term thematic focus areas:

- Competitive knowledge-based economy
- Sustainable energy and material resources
- Environment for quality life
- Social and cultural challenges
- Healthy population
- Safe society

The priorities are designed to reflect major societal challenges and needs of the society as concrete goals solvable through RDI in available capacities and are set for the time horizon until 2030. The new priorities should be taken into account in the multi-annual R&D budget plans and respected in designing public RDI support, including prospectively in allocation of institutional funding.

The Government adopted a comprehensive long-term Strategy of International Competitiveness in 2011 (MIT, 2011a), which addressed framework conditions affecting innovation performance in a broad sense. The core of the competitiveness strategy called "3i" deals with institutions, infrastructure and innovation; the three pillars that are indicated as the main weaknesses of the current system. In parallel, the National Innovation Strategy (MIT, 2011b) that was produced jointly by the MEYS and the MIT develops in more comprehensive way the innovation pillar. The strategy outlines a long list of concrete goals for innovation policy summarized under four main priority axes:

- Improving conditions for excellent research
    - Efficient public R&D spending
    - Access to state-of-the-art infrastructure
    - Leveraging ERA participation
- Developing cooperation for transfer of knowledge between business and academia
    - Governance of PROs geared for technology transfer
    - Extending support for public-private cooperation
    - Deepening innovation infrastructure at the regional level
- Promoting innovative entrepreneurship
    - Providing access to high-quality consultancy services
    - Developing venture capital market

    - Targeting investment incentives for research activities
    - New instruments for export promotion
    - Technological foresight as the source of strategic intelligence
    - Public procurement and regulation with innovation in mind
- Skilled human resources for innovation
    - Higher education reform necessary for boosting quality
    - More support for lifelong learning
    - Core competencies and skills for innovation in curriculum
    - Attracting talent from abroad

Evolution and analysis of the policy mix

One aim that has been repeatedly stressed is promoting excellence in research. Yet this has been grossly mismanaged by introducing the formulae-based system of evaluation of research institutions that annually reallocates the entire flow of institutional funding based on historical output scores, regardless of other concerns. The latest modification of the evaluation methodology by the CRDI established two new pillars that involve international peer review and bonuses for research excellence; however, the funding remains to be predominantly channelled through the impotent formulae-based pillar. IPn METODIKA project launched under the auspice of MEYS is preparing a new more complex evaluation methodology but the progress has been slow so far. Arnold (2011) recommended that the evaluation practice should be the subject of root and branch reform, refocusing on outcomes and impacts in addition to outputs.

Another closely related challenge that is looming on the horizon is to secure funding for operation of the newly constructed large research infrastructure projects, which is likely to send ripples throughout the public research sector. To secure immediate funding the MEYS has launched the National program sustainability I. and the prospective National program sustainability II. that is going to support the start of their operation. Nevertheless, the induced pressures in allocation of institutional funding and the broader picture of their integration into the national system remains a challenge. Overall, public R&D funding has stagnated in recent years in the context of the economic crisis but needs to start increasing again in order to tackle the funding problems and reach the national target of 1% of GDP flagged in Europe 2020 initiative.

Unfortunately, reform of the labour market for researchers that was in preparation for three years ended up in doldrums. The higher education reform initially involved bold plans for modernization of conditions for human resources development. The reform was supposed to be implemented already but the drafting process has been derailed due to instability of the government and disagreements among the stakeholders The push for enacting a new law has been first relegated to an amendment that has been delayed by the collapse of the centre-right government in mid-2013. The amendment is a compromise with the existing establishment that falls short of expectations if compared to the ambitious aims of the reform agenda. For instance, the new regulation is not expected to alter the current system of recruitment, hence not tackling the problem of inbreeding. It is not clear whether this proposal will be picked up by the new administration.

Apart from several smaller initiatives, the most prominent measure to increase the attractiveness of research careers is the Česká hlava (Czech Head) project which awards an annual prize to distinguished Czech scientists. Recently this award has been extended for talented secondary

students. Two projects supported by the EU structural funds entitled Otevřená věda (Open Science) and Otevřená věda regionům (Open Science for Regions) were organized by the ASCR in 2005 and 2007, respectively, the former was prolonged as Otevřena věda II for the period 2009-2012. Both of the projects were targeted at secondary school teachers and assisted them in directing students to research careers. In addition, activities aimed at increasing the attractiveness of research careers and popularising research include science and technology popularisation courses under the OP EC and development of science learning centres under the OP RDI.

NÁVRAT (RETURN) brain gain programme with the aim to improve conditions for re-integration of top researchers coming back from abroad is operated by the MEYS since 2011. The ASCR awards the Fellowship J. E. Purkyně to attract outstanding scientists from abroad since 2004; both Czech scientists working abroad and top foreign scientists are eligible. The MOBILITY programme is focused on outwards mobility of researchers supporting short-term internships at foreign partner institutions. Bilateral mobility of students and researchers is funded by the MEYS from the EU Structural Funds.

Scientific Visa Package that simplifies procedures required by researchers from non-EU countries to apply for a long-term residence permit was established in 2007; this regime only applies to foreign nationals employed at universities and public research organizations. Inward flows of researchers are supported also by the EURAXESS network funded by the MEYS, which provides information support to incoming researchers. MEYS runs the Scholarship Awards within the Foreign Development Assistance Programme intended for talented Master and PhD students coming from third countries and studying in public universities.

In recent years, the government has started to be much more active in promoting cooperation of private and public bodies in R&D. A number of new measures were introduced that are shifting the focus of innovation policy from supporting internal RDI in firms to leverage public subsidies for the purpose of stimulating public-private collaboration and commercialization of research results. At the forefront of this transformation is the wave of new programmes designed and implemented by the TA CR, which support applied research, collaboration between research and application spheres and transfer of knowledge:

- ALFA supports projects of applied research and experimental development and stimulates intensity and effectiveness of R&D cooperation between businesses and research organisations;
- BETA is a programme of public procurement in RDI for the needs of public administration bodies;
- OMEGA supports research in applied social sciences;
- Competence Centres funds creation and operation of RDI centres for progressive fields with strong application potential and a perspective for significant contributions to competitiveness;
- GAMA supports the verification of R&D results in terms of their practical application and their subsequent commercial use;
- DELTA provides applied research grants for joint international projects with third countries.

Attention to support of RDI in industrial enterprises from start-ups to mature and fostering public-private linkages is paid in the programmes administered by the MIT and financed either from the OP EI (the sub-programmes called Innovation, Potential, Cooperation and ICT and

Strategic Services) or from the national sources (TIP). The OP RDI administered by the MEYS also includes several research and academia-industry links funding measures, which include support of commercialisation of R&D outputs in research institutions, financing research up to the stage of the subsequent commercial use (proof of concept stage) and support of intellectual ownership protection. Several regional governments have started innovation voucher programmes in 2012 and 2013, which represents a much needed early step to regionalization of innovation policy, but the amount of funding channelled through this route is very limited.

Since 2005 the Ministry of Finance (MF) operates a system of tax incentives that allows firms to deduct expenditures on R&D carried out in-house from their tax base. It has been recognized, however, that this form of tax deduction is going against the need to intensify collaboration between the business sector and academia. Hence, starting from 2014 the indirect fiscal support through R&D tax credits becomes extended to external R&D services, in other words contractual research, purchased from research organizations with the aim to stimulate public-private linkages. Access to venture capital that is well-known to be particularly problematic is planned to be addressed by the establishment of a public-private seed fund under the auspice of MIT, the launch of which, however, has been repeatedly postponed (CzechTrade, 2013).

Formal methods of intellectual property rights (IPRs) protection are underutilized in spite of the constant policy effort to improve the situation and despite the fact that state of the art IPRs legislation is in place. Yet few experts and little experience can be found in the public sector. There is a lack of organisations supporting knowledge transfer in practice and a lack of staff qualified in knowledge transfer and IPR issues. Knowledge transfer incentives are usually set through internal payroll regulations. However, these practices differ by organization, thus there are no generally accepted standards of behaviour. There is an urgent need for an explicit national knowledge transfer policy, including a new legislation on technology transfer, which would tackle this challenge in a systematic way.

Technology Transfer Offices (TTOs) are in infancy in the public sector. Currently, there are at least 15 TTOs, most of which have been established quite recently, though the number is growing with the increasing public support for their establishment. The majority of them operate within major universities (especially those oriented at technical and material sciences) or specialised intermediary organisations. Establishing technology transfer points and offices in research institutions as a way to use research results is one of the activities eligible within the Priority Axis 3 "Commercialisation and popularisation of R&D " of the OP RDI administered by the MEYS. The first technology transfer offices were supported from this programme at the beginning of 2012.

Assessment of the policy mix

Generally speaking, the national policy mix attempts to tackle the major structural challenges, however, at the same time it should be clear from the analysis above that is some areas the outcome falls short of expectations. A lot of attention has been devoted in the RDI reform agenda to making the national research system more effective; leaving the dysfunctional mechanism for allocating institutional funding aside, a noticeable progress has been made in streamlining the funding system, increasing the share of public funding allocated on a competitive basis and pinpointing sensible thematic priorities of oriented research.

The CRDI that has assumed a central role in the new governance system needs to be provided with resources that allow it to live up to this task. The GA CR and TA CR that have become responsible for competitive funding need to be further supported to mitigate the fragmentation of support programs. Several large R&D infrastructural projects, including pan-European infrastructures, are opening or under construction, which, if their funding is secured, have a potential to both open new avenues for international co-operation and make the system more competitive. Much remains to be done in improving labour market for researchers and in fostering gender equality in research, particularly as far as limited mobility, internationalization, early career opportunities, rigid recruitment practices and widespread in-breeding are concerned.

The inadequate evaluation methodology of research institutions results inter alia in the insufficient quality of R&D results and the detachment of public research from industrial and societal needs. More generally, standards of evaluation remain fairly low and this in turn appears to be a rather understated problem. Present evaluations of research programmes tend to be highly descriptive, including only quantitative formulation of the results achieved, which rarely provide strategic intelligence insights for policy makers. Assessment with regards to development of relevant science fields, industry sectors or grasping societal needs, not mentioning counterfactual analysis, is not conducted. Systematic evaluation of research organisations is missing.

Major challenges remain to be tackled in the domain of circulation, access and transfer of scientific knowledge, which has been historically a weak aspect of the system. More intensive inclusion of the private sector in joint public-private research projects seems to be promising, such as, for instance in the new programmes that have been introduced by the TA CR, though evidence on their effectiveness is not available yet. Despite these measures for the public-private interface, the commercialization of publicly funded research into innovative solutions in the business sector remains a constant challenge. IPRs continue to be grossly underused.

A major policy shift that needs to be applauded has been from a system traditionally based on direct public subsidies to RDI in the business sector towards introducing much wider portfolio of measures aimed at alleviating the problem of insufficient availability of funding for private R&D efforts, such as the R&D tax credits or the public-private venture capital fund; which target the type of applicants, including small and new firms, that typically do not use the direct grants. More measures that go beyond the direct subsidies are clearly desirable in the future.

Table 3

Challenges	Policy measures/actions addressing the challenge	Assessment in terms of appropriateness, efficiency and effectiveness
1. Governance, evaluation and research excellence	CRDI became the central RDI policy actor Public R&D funding is streamlined Share of competitive funding increased TA CR takes over support for applied R&D and innovation Evaluation of research institutions patched More complex evaluation in the making	CRDI does not have sufficient administrative and analytical capacity to deliver Evaluation method of research organizations is ineffective is stimulating research excellence Most institutional funding continues to flow through the old mechanistic formulae Progress in putting forward more complex evaluation methodology has been very slow
2. Stagnating public funding and new large infrastructures	Public R&D funding stagnates Large research infrastructures constructed National program sustainability I is launched	Public R&D needs to increase to meet the challenges Long-term funding of large research infrastructures not secured Staffing of the large research infrastructures is problematic
3. Skills shortages, rigid labour market and internationalization	Higher education reform in doldrums Česká hlava awards Otevřená věda I. and II. popularization programmes NÁVRAT brain gain programme Scientific Visa Package	Higher education reform is overdue for a long time In-breeding is widespread in higher education Competition for posts is not transparent and generally limited Early career opportunities remain scarce Gender inequality problems are ignored Internalization is very low
4. Innovation capabilities, disembedded multinationals and venture capital	TA CR launched a portfolio of new support programmes R&D tax refunds Investment incentives for establishing R&D centres Pre-seed fund operational and public-private seed fund in the pipeline	Commitment to support upgrading of innovation capabilities Shifting emphasis from direct subsidies to indirect support of business R&D Evaluation of innovation policy remains poor Attempts to kick-start venture capital have not been successful so far
5. Underdeveloped public-private collaboration, technology transfer and market for technology	TA CR programmes stimulate joint public-private projects and commercialization Support for technology transfer services, management of IPRs, etc. R&D tax refunds extended to contract research	Much greater emphasis on public-private collaboration in new programmes Governance of technology transfer in research organization remains poor National governance framework is lacking

4 NATIONAL PROGRESS IN INNOVATION UNION KEY POLICY ACTIONS

4.1 STRENGTHENING THE KNOWLEDGE BASE AND REDUCING FRAGMENTATION

Promoting excellence in education and skills development

Labour market for researchers continues to suffer from a lack of experts. According to the data from the Czech Statistical Office (2012) and the assessment of MIT (2011b), the number of PhD graduates has stagnated in recent years, there is a long-term tendency for the proportion of science and technology tertiary students to decrease in comparison to those of social science and humanities, and because the reform of tertiary education remains uncompleted, there has been an unchecked expansion of university graduates over the last decade or so, the quality of which is however hard to judge.

The approach to RDI human resource management is unsystematic. Human resources management practices in the public sector need to be revised in order to reduce the widespread in-breeding make career progression paths more transparent and intensify competition for posts. Czech institutions or organizations have not received, not even a single one, the Commission acknowledgement for progress in the context of the HR Strategy so far, i.e. there is no organization with the "HR Excellence in Research" badge. Two institutions, namely the ASCR and Central European Institute of Technology (CEITEC), have endorsed the Charter & Code. But there is no HRS4R acknowledged institution.

The EURAXESS Centre is funded by the MEYS. The network created by the project includes contact points in ten cities. In practical terms, however, only a minority of vacancies is announced through EURAXESS (it is not formally required to advertise new positions nationally and internationally in media, on the Euraxess jobs and other international portals). The MEYS admits that the awareness of Euraxess Jobs portal is still very low and its potential is not fully exploited (VERA 2011). Several measures simplify inward mobility of researchers from the non-EU countries, such as the Scientific Visa Package. Nevertheless, there is a considerable scope for making better use of research internationalization in the public sector.

The situation in gender equality in research is alarming but generally not considered as a problem that needs to be addressed by the government. On one hand, gender equality is ignored in research policy; there is very little, if anything, on this topic in the key strategic documents, and on the other hand government policies that are devoted to fostering gender equality largely ignore the field of science, research and innovation. Likewise, gender mainstreaming is grossly neglected in the current policy agenda; there are no measures at the national level in this respect.

Research Infrastructures

The Roadmap for Large Research, Development and Innovation Infrastructures in the Czech Republic was approved by the Government in March 2010 (updated in May 2011) as a strategic document for development of large infrastructures for research, development and innovation (RIs). New large RIs projects that are going to have a profound impact of the whole R&D system have been approved for funding in 2011 and 2012 and are currently under construction, including six major projects with a total amount of subsidy of €835m financed by in the Priority axis 1 and 2 of the Operational Programme Research and Development for Innovations (MEYS, 2013a). Most importantly, the Extreme Light Infrastructure (ELI) project develops a large laser infrastructure; this is the only ESFRI Roadmap project which has a base in the Czech Republic. But all of these projects have an obligation to have a partnership with the ESFRI infrastructure.

Nevertheless, the EU Structural Funds cover the initial investment only. Most of their operating expenses must be covered from other sources. Managers of the projects pledge to obtain funding from private sources. But this is likely to cover only a fraction of their needs. Hence, a major challenge for public R&D funds is to secure funding for operation of the newly constructed large RIs. For this purpose the MEYS has launched the National program sustainability I. that is going to fund the start of the operation of the large infrastructural projects.

The keystone of the Czech e-infrastructure for research is CESNET (Czech Education and Scientific NETwork) and there are currently large projects investing into various elements of e-infrastructure (integrated in the ESFRI Roadmap), so this is likely to improve in near future. The Czech Republic has its own national large research infrastructures, many of which also participate in the ESFRI system; the prevailing areas of their specialisation is material sciences and engineering (6 existing facilities – e.g. the Institute of plasma physics is housing the COMPASS-D and the Institute of physics is housing the PALS – Prague Asterix Laser System), energetics and social sciences and humanities.

According to a draft version of the Amendment of the Act No. 130/2002 Coll. that has been approved for releasing to the government at the 281th meeting of the CRDI on 29th March 2013, it should be permitted to provide institutional funding for support of international cooperation in research (in order to conform to the Council Directive 2009/723/EC from 25th June 2009 about ERIC). Nevertheless, none of the existing laws or documents explicitly elaborates on access to RIs by non-resident researchers and there are no specific measures to facilitate cross-border access to RIs.

4.2 GETTING GOOD IDEAS TO MARKET

Improving access to finance

European Commission (2013) testifies to the fact that utilization of venture capital to support innovative businesses and spin-off firms trying to commercialize research outcomes is one of the lowest among European countries and that limited access to external sources of finance for innovation is perhaps the single most important obstacle for improving the innovative performance. Unfortunately, a lack of experience among potential clients and rather traditional entrepreneurial culture do not form an environment favourable to venture capital expansion.

Public support measures to boost access to venture capital have been missing. Yet this is going to change sometimes soon, as the MIT is ready to launch with the help of funding from the

Operational Programme Enterprise and Innovation (OP EI) a pilot project of a public-private seed fund. The aim is to kick-start the underdeveloped national market for venture capital. A budget of €53m is earmarked for this purpose. The fund is waiting for approval by the Office for the Protection of Competition.

TA CR has been established in 2009 as the dominant supporter of applied research and innovation and launched a portfolio of new programmes (most prominently ALFA, Competence Centres and the forthcoming EPSILON); two programmes of the OP EI, Progress and Guarantee, help start-ups and micro enterprises to overcome the limited availability of external funding. Several regions have implemented innovation voucher programmes, albeit the resources devoted to this instrument have been very small so far. More measures that go beyond the direct subsidies are clearly desirable in the future.

Protect and enhance the value of intellectual property and boosting creativity

Formal methods of intellectual property rights (IPRs) protection, in particular patents and their licensing, are underutilized, as clearly shown by European Commission (2013), in spite of the continuous effort to improve the use of public R&D outputs in innovation processes and despite the fact that state of the art IPRs legislation is in place. Yet few experts and little experience can be found in this field, especially in the public sector, except only perhaps of a few exceptions under the umbrella of ASCR (Academy of Sciences) that prove the rule. Poor commercialisation of R&D outcomes in general requires systematic attention as well as support to research excellence to produce high valuable research outcomes being worth of patenting costs.

Furthermore, there is a lack of organisations supporting knowledge transfer in practice. Supply of mediation services provided to innovative companies is insufficient. There are unfavourable conditions, including legal impediments, for setting up academic spin-offs. Technology Transfer Offices are in infancy in the public sector, as the results of which there is insufficient experience on how to trade patens and licenses on the market for technology. Knowledge transfer incentives are usually set through internal payroll regulations and other internal regulations defining remuneration of researchers including extraordinary bonuses related to successful transfers, patents, licences etc. However, these practices differ by organization, thus there are no generally accepted standards of behaviour. Systematic solution of the technology transfer issues at the national level, hence an explicit national knowledge transfer policy, is lacking.

Public procurement

Generally speaking, public tenders, except of those for R&D, are very rarely recognized as the opportunity to promote innovation; this is at least partly due to the lingering corruption problem and series of recent corruption scandals, making the relevant bureaucrats rather conservative. Public procurement in R&D (assigned competitively) for the needs of public administration bodies is newly centralized under the BETA programme of the TA CR. National target on public procurement of innovative goods and services has not been announced. National procurement policy does not consider the objective of supporting innovation.

4.3 WORKING IN PARTNERSHIP TO ADDRESS SOCIETAL CHALLENGES

In the context of the National Policy of RDI 2009-2015 implementation, new long-term national priorities of oriented RDI (for the period until 2030) that are largely in line with the grand challenges of Horizon 2020 were prepared by panels of experts at the end of 2011 and approved by the government in mid- 2012 (CRDI, 2012b). More specifically, the priority research fields were identified within six broader areas: i) Competitive knowledge-based economy; ii) Sustainable energy and material resources; iii) Environment for quality life; iv) Social and cultural challenges; v) Healthy population; and vi) Safe society. The governmental ministries, ASCR (Academy of Sciences), GA CR (Grant Agency) and TA CR (Technological Agency) have responsibility for implementing the priorities within their authority; they are taken into account for the preparation of proposal of state budget expenditures for 2014 and later.

The Czech Republic has become a member of five Joint Programming Initiatives (JPIs), all four from the first wave of 2009 and only one from the second wave of 2010: 1) Neurodegenerative Disease Research, 2) Agriculture, Food Security and Climate Change, 3) Cultural Heritage and Global Change, 4) Healthy Diet for a Healthy Life and 5) The Microbial Challenge – An Emerging Threat to Human Health. However, the Czech Republic plays a rather passive role in the JPIs. The Czech Republic is also formally engaged in all five Joint Technology Initiatives (JTIs). But only in two of them, namely ARTEMIS and ENIAC, are currently issued calls for proposals by the MEYS.

According to Acheson et al. (2012), the main constraints regarding to Czech participation in the JPIs are budgetary restrictions, limited human resources, lack of coordination at the national level and insufficient compatibility of the national and European rules and procedures. It is therefore no wonder that albeit there are several programmes at the national level which support research on topics relevant to the strategic research areas of the JPIs, the national funding providers have not come forward with direct involvement in terms of financial participation so far. Šebková, et al. (2011) conclude that national financial support to joint programs is very low; ERA-NETs funding is close to zero and bilateral agreements account for a very low part of research funding.

As far as national participation in European Innovation Partnerships (EIPs) is concerned, this is very early to evaluate. Four users from the Czech Republic registered and they are involved in 33 out of 293 initiatives in the pilot EIP on Active and Healthy Ageing since 2011; hence, there is a small number of highly active participants. The other four existing EIPs are too new to assess, indeed. Given evidence on the participation in other joint research efforts discussed above, however, it is reasonable to expect that the involvement of Czech entities is not likely to be particularly high, unless national policies stimulating indigenous initiative are put in place.

4.4 MAXIMISING SOCIAL AND TERRITORIAL COHESION

National Research and Innovation Strategy on Smart Specialisation (RIS3), including 14 regional RIS3 strategies at the NUT3 level, is due to be approved by the government in June 2014. The national RIS3 facilitator started to work as late as in October 2013, hence working under an immense time pressure to produce the final document.

Nevertheless, RDI policy making has been fairly centralized. So far co-ordination between the national and regional level innovation strategies has been very weak, if not missing altogether. National innovation strategy has addressed the regional aspects of innovation vaguely only. Drafting of the national RIS3 strategy involves, at least formally, a coordinated action of the national and regional authorities on the topic of innovation policy; hence representing a much needed opportunity for establishing a nation-wide debate on this topic. Needless to say, it is pertinent that this dialogue is sustained beyond this particular purpose and elements of multilevel governance of the RDI system are implemented in the future.

4.5 INTERNATIONAL SCIENTIFIC COOPERATION

The Czech Republic maintains a number of bilateral agreements with third countries either on intergovernmental level or on inter-institutional level, involving, for instance, the GA CR (Grant agency) and ASCR (academy of sciences). However, judging from the funding flows, the activity organized under these agreements is very limited. Moreover, the majority of them is focused on establishing contacts, networking and promoting mobility, hence not joint research projects. Except only of the GA CR bilateral grants, calls organized under these agreements are not regular.

Because of the existing and well-functioning environment for research co-operation within Europe, the bilateral research agreements are oriented toward non-EU countries. For example, the program KONTAKT supporting bilateral programs was re-oriented outside of the EU after the accession in 2004. Hence, these initiatives are used to support external non-EU networking. But there is a very weak link between the Czech joint programmes on one hand and the European programs on the other hand. The Czech Republic participates in CERN, OECD and other international programmes.

TA CR (Technology agency) prepares a new DELTA programme that is starting operation in 2014 with the aim to facilitate international cooperation of support to applied research and experimental development through joint programmes with technological (and innovation) agencies in non-European countries. The DELTA Programme will improve access of teams from the Czech Republic to international expertise and know-how, international research capacity and facilitate the penetration of foreign markets.

Since 2007, in line with the Council Directive 2005/71/EC on a specific procedure for admitting third-country nationals for the purposes of scientific research, researchers from non-EU countries and their families can apply for a Scientific Visa valid for public as well as private research organisations and applicable to researchers hosted by a Czech research organisation for carrying out a research project (based on the Hosting Agreement). Hence, there is special regime with lower administrative burden and shorter processing period for a long-term residence permit of researchers of foreign origin.

A new programme called NÁVRAT, i.e. “return" in English, aimed to improve conditions for re-integration of top researchers coming back from abroad was launched under the MEYS in 2011 and the first projects have been supported in 2012. Attracting talented doctoral students from abroad is high on the agenda on some research institutes, albeit the achievement of this goal is

rather difficult because of low financial support available (through there is the Fellowship J. E. Purkyně awarded at the ASCR). The highest number of foreign students comes from the neighbouring Slovakia.

5 NATIONAL PROGRESS TOWARDS REALISATION OF ERA

5.1 MORE EFFECTIVE NATIONAL RESEARCH SYSTEMS

In 2008, a comprehensible reform of the research, development and innovation system was launched. The main act regulating the field of research, development and innovation is the Act No. 130/2002 Coll. on the Support of Research and Development from Public Funds and on the Amendment to Some Related Acts, which has been substantially updated by the reform amendment announced as Act. No 211/2009 Coll; the reform is outlined in the National RDI Policy of the Czech Republic 2009–2015 (CRDI, 2009). The reform profoundly changed the governance of system and the responsibilities of the main players, namely mandated the CRDI to become the central player with the main strategic and coordinating role in policy making, established the TA CR as the dominant supporter of applied research and increased the share of public funding allocated on a competitive basis.

Public R&D funding has been traditionally dominated by institutional support. However, this is changing in the context of the reform. As the result, the share of institutional funds in GBAORD decreased to 50% in 2013. The largest share of institutional funding is distributed between the ASCR and the MEYS which, in turn, forward the money to individual recipients, predominantly public research institutes and higher education institutions. The main providers of competitive project-based funding are the GA CR which allocates grants for basic research (€132m in 2013) and the TA CR which supports applied research and development (€86m in 2013)

A new methodology on evaluation of research results of higher education institutions and public research organizations was introduced, on the base of which institutional funding is allocated. According to the reform amendment of Act No 211/2009 Coll. provision of support is based on evaluation of their research performance: the share of an institution on the total amount of institutional funding of research organisations in the given year corresponds to its share on the sum of research results of all research institutions/organisations in previous five years (based on annual evaluation performed by the CRDI). In 2010, the share of institutional funding based on R&D results compared to the share of funding through research intentions was 30:70. In 2011, the ratio was 60:40 in favour of evaluation based funding and in 2013, the share of this funding was planned to reach 96% of the total, i.e. almost the full amount of institutional funding was supposed to be allocated on competitive basis. However, in order to stabilize the funding flows, a compromise has been reached that in 2013 only 20% of the money is allocated based on the historical research results achieved over the previous five years and 80% of the money remains divided in the same way as in the 2011 budget (CRDI, 2012a). In addition, it should be pointed that the CRDI can recommend to the government to increase budgets lines of particular providers, thus this provides only the baseline for budget negotiations.

The idea of the formulae-based approach was to make the allocation of institutional funding performance-based using exclusively quantitative indicators, which in turn was expected to

reward quality, boost productivity and de-politicise the funding process. Even though the methodology has been fiercely criticizes by the stakeholders and become understood as unsatisfactory, the revision requires consensus of the key players, which proved extremely difficult to achieve, especially if redistribution of public funds between sectors is at stake. In the meantime, the CRDI introduced a couple of patches to the evaluation system negotiated among the key stakeholders that somehow moderated its impact; and there is a project that is expected to produce a new evaluation methodology, partly based of international peer-review, which should lead to more effective distribution of institutional funding.

Systematic evaluation of research organisations that involves international peer review, except only of GA CR, remains underdeveloped. GA CR provides competitive grant funding for basic research using international peer review to guide the allocation of funds. The main funding instrument is a standard grant project, the call for which announced annually and can have duration of 1-3 years. The applications are assessed by an expert panel (39 panels in 5 disciplinary areas) on the base of two-step review procedure; first, the applications are evaluated by two internal reviewers and then only those that satisfy minimal quality requirements (about two-thirds of the applications) are assigned to two foreign reviewers (Slovaks are not perceived as foreigners). Other funding instruments of GA CR, i.e. postdoctoral grants, projects for excellence in basic research and international bilateral grants, are evaluated using the same (or a very similar) procedure.

5.2 OPTIMAL TRANSNATIONAL CO-OPERATION AND COMPETITION

The Czech Republic is a member of the most of the intergovernmental organizations in ERA as well as the member of projects of large European infrastructures (ESFRI) and of course participates in the EU Framework Programmes. ASCR and GA CR are the members of the European Science Foundation. Several large R&D infrastructural projects, including pan-European infrastructures, are under construction, which have a potential to both open new avenues for internationally co-operation. Because of the existing and well-functioning environment for research co-operation within Europe, bilateral research agreements are oriented toward non-EU countries.

MEYS which is the main intermediary body responsible for international cooperation in research manages a host of programs that support international cooperation in research, namely EUREKA, COST, EUPRO, INGO (terminated in 2012), KONTAKT (devoted to financing bilateral projects based on intergovernmental agreements primarily with countries outside the EU) and GESHER/MOST. The Czech Republic participates in the European Space Agency, European South Observation, European Molecular Biology Conference, CERN, OECD, EUROATOM, EFDA and other international programmes.

GA CR provides funding for international bilateral research grants (based on agreements with the National Science Foundation of Korea, National Science Council of Taiwan and Deutsche Forschungsgemeinschaft), though the combined funding for the bilateral grants comprises about 2% of GA CR budget only. DETLA programme that starts operation under TA CR in 2014 aims to facilitate international cooperation of support to applied research and experimental development through joint programmes with technological (and innovation) agencies in non-European countries. The Visegrad fund and the Financial Mechanisms of the EEA/Norway also

promote research cooperation with the respective countries. Nevertheless, according to Šebková, et al. (2011), there is a very weak link between the Czech joint programmes on one hand and the European programs on the other hand. Arnold 2011) urged the CRDI to generate a research internationalisation strategy.

The Roadmap for Large Research, Development and Innovation Infrastructures in the Czech Republic was approved by the Government in March 2010 (updated in May 2011) as a strategic document for development of large infrastructures for research, development and innovation). So far six major projects with a total amount of subsidy of €835m (85% funded by the ERDF) were approved. The ELI project aims at creation of a large laser infrastructure; this is the only ESFRI Roadmap project which has a base in the Czech Republic. But all of these projects have an obligation to have a partnership with the ESFRI infrastructure. The MEYS has launched the National program sustainability I. that is going to fund the start of the operation of the large infrastructural projects.

The Czech Republic has become a member of five Joint Programming Initiatives and it is also formally engaged in all five Joint Technology Initiatives. As a member of the European Science Foundation, GA CR coordinates and co-funds its programs in the European Collaborative Research (EUROCORES) framework (but these programs comprise a negligible part, i.e. less than 1%, of GA CR's budget), Research Networking Programmes, Research Conferences, Forward Looks and Member Organisations Fora (however, there has been limited activity in the latter four initiatives so far).

Bilateral agreements under GA CR recognize the assessment of proposals conducted by the partner funding agency, i.e. the National Science Foundation of Korea, National Science Council of Taiwan and Deutsche Forschungsgemeinschaft; however, it is not obligatory that the evaluation conforms to international peer-review standards (although this is typically the case). The DETLA programme of TA CR recognizes evaluations of the partner technology (or innovation) agency as the basis for national funding decisions. Again, it is not explicitly required in the background documentation that the evaluation process of the partner agency conforms to international peer-review standards.

According to a draft version of the Amendment of the Act No. 130/2002 Coll. that has been approved for releasing to the government at the 281th meeting of the CRDI on 29th March 2013, it should be permitted to provide institutional funding for support of international cooperation in research (in order to conform to the Council Directive 2009/723/EC from 25th June 2009 about ERIC).

5.3 AN OPEN LABOUR MARKET FOR RESEARCHERS

Most public research institutions conduct their activities in accord with the Act on Public Research Institutions (Act no. 341/2005 Coll.). For higher education institutions the main human resources issues are defined by the Tertiary Education Act (Act No. 111/1998 Coll.), which sets rules for the appointment of professors and docents. However, it is essential to understand that the system is based on a high level of institutional autonomy. Research institutions have extensive self-governing rights and decision-making powers which have been further decentralized to the faculty and departmental level. Generally speaking, research institutions employ individual academics in a market driven decentralized system; the recruitment

process is an internal affair of every institute. Hence, it is hard to assess policy-measures that define the way researcher's recruitment is carried out.

Likewise, career development is a matter for internal institutional regulations in higher educational institutions. The Higher Education Act gives the task of appointing professors and obtaining venium docendi (habilitation) to the Scientific Board of the higher education institution. Professors are appointed by the President of the Czech Republic on the recommendation of the higher education institution's council, submitted through the MEYS. Academic careers are hierarchical and consecutive and the academic titles have lifelong and countrywide validity, even though the underlying conditions vary by institution. The academic labour market is quite internally oriented. There is a very low horizontal mobility of academic staff leading to a clear pattern of inbreeding and limited competition for posts. Opportunities for early career researchers are weak, post-doc funding remains limited and often not allocated on competitive basis.

The legislation rules provide an open access for foreign researchers to be employed at academic positions, especially in case of EU citizens. There are also several measures simplifying inward mobility of researchers from the non-EU countries, such as the Scientific Visa Package. However, national funding is generally closed to non-residents. Public research funders support almost exclusively resident researchers, with the exception of special programmes and funding based on agreement for international research cooperation. Funding for non-residents is generally not possible, unless they become residents for the purpose of conducting the research project. The opening of national programs is not set as a priority and it is not expected that the trend will change in near future. Language barriers for participation of foreign researchers are important; the main exception represent the grant programmes of GA CR that require applications exclusively in English; however, the background documentation remains to be accessible in Czech only.

The EURAXESS Centre is funded by the MEYS through the EUPRO programme: Project „EURAXESS Czech Republic 2012 - 2015".The network created by the project includes contact points in ten cities. It is not formally required, however, to advertise new positions nationally and internationally in media, thus in practical terms only a minority of vacancies is announced through EURAXESS. Since 2007, in line with the Council Directive 2005/71/EC on a specific procedure for admitting third-country nationals for the purposes of scientific research, researchers from non-EU countries and their families can apply for a Scientific Visa. Hence, there is special regime with lower administrative burden and shorter processing period for a long-term residence permit of researchers of foreign origin.

5.4 GENDER EQUALITY AND GENDER MAINSTREAMING IN RESEARCH

General legislation guides the behaviour of funders and employers on matters of non-discrimination and equal opportunities (the Act No. 262/2006, Coll. on labour code, the Act No. 435/2004 Coll. on employment and the Act No. 198/2009, Coll. on antidiscrimination). Hence, there are hard laws on treating job candidates and employees equally as regards their recruitment, working conditions, remuneration and professional development. Also the general laws require that employers do not enquire about arguably irrelevant matters that might bias their decision (such as questions about pregnancy, etc.).

The Czech Labour Code guarantees to female employees restoration to the same position after a maternity leave. However, an extension of the contract due to maternity leave in the case that an employee works in a fixed-term contract is not guaranteed by the law. The employee only has right to receive financial aid for the protective period of 180 days after the termination of the contract. Such conditions may be a barrier for female researchers' career considering the fact that work contracts in research organizations are often on the fixed-term basis.

In government proceedings (or law), the so-called "Jednací řád vlády", there is requirement to assess gender impact of every government resolution, i.e. there must be an appendix evaluating gender impact. However, this has a limited impact on gender equality in research policy, as the CRDI – formally only an advisory body of the government - is not obliged to follow this rule, hence the governance system ensuring that gender issues are considered is bypassed, because gender equality is rarely considered when the actual decision are made in the council (before submitting the results to the government for a formal approval).

In 2001, as the follow up on the establishment of the Helsinki Group, the Working group for women in science in the Czech Republic started to operate in the MEYS. In 2009, furthermore, the Working group for equal opportunities for women and men, including a committee for science, has been launched at the MEYS, the purpose of which is to formulate priorities of the ministry on gender equality. However, both of the working groups have limited powers, operate at the lowest level of hierarchy and appear to have a rather small impact on decision making.

In 2001, the government adopted Resolution No. 1033 on the Council of the Government for Equal Opportunities for Women and Men. The Council is a permanent advisory board of the government for equal opportunities policies. At the meeting on the 23rd February 2010, the Council of the Government for Equal Opportunities for Women and Men addressed for the first time the problem of gender equality in science, and drafted a suggestion to the government regarding fair representation in expert and advisory bodies and grant competitions. However, while acknowledging this suggestion, the government did not initiate any action in this respect.

There are ministerial gender focal points. Since 2001 ministries are required to create a systemic job (one-half of full-time equivalent, 4 hours per day) to take care of the equal opportunities agenda. However, there is no concept or policy behind the establishment of this position and therefore, the gender focal points do not have any powers, have very little support from their superiors and the position has been established within various departments and units at various ministries.

Female researchers have the possibility to interrupt or postpone solving a postdoctoral grant of GA CR due to maternity leave for exactly one year only; they are obliged to inform the agency about their pregnancy when they become aware of it and the leave can start only on the 1tst of January or the 1st of July. Other grant provides still do not allow female researchers to interrupt of postpone research grants due to maternity leave. In April 2012, the GA CR maternity leave regulation was challenged by a formal complaint to the Public Defender of Rights, who in January 2013 confirmed its discriminatory nature and recommended GA CR to adjust the rules accordingly. GA CR agreed to relax the rules. However, no changes in this respect have been implemented until the end of 2013.

The main agent promoting cultural change in women in science is National Contact Centre for Women and Science. Established in 2001, the centre contributes to building gender equality in

science and research by stimulating debates and petition for measures and steps to eliminate discrimination and gender inequalities. Moreover, they urge action from responsible institutions, offer solutions to improve the professional advancement of women, i.e. lobby for gender equality. Also the team carries out analyses that address the asymmetrical distribution of power between men and women in science in order to raise awareness about gender issues and give visibility to women researchers and their work. The centre is a project of the Institute of Sociology of the ASCR funded by the EUPRO programme administered by MEYS.

Milada Paulová Award is organized jointly by MEYS and National Contact Centre for Women and Science for lifelong achievement of female researchers to Czech science since 2009. The award aims to publicly and financially appreciate research achievements of prominent Czech women researchers, who provide role models and inspires women researchers and students at the beginning of their research careers. The winner receives a donation of 150,000 CZK. L'ORÉAL Scholarship Czech Republic for Women in Science is awarded by L'ORÉAL in cooperation with ASCR and UNESCO for young female scientists in the field of natural sciences (no more than 35 years old) since 2007. The winner receives a donation of 250,000 CZK.

5.5 OPTIMAL CIRCULATION, ACCESS TO AND TRANSFER OF SCIENTIFIC KNOWLEDGE INCLUDING VIA DIGITAL ERA

Among the top objectives of the ongoing reform of the RDI system is to improve the commercialization of R&D outputs on the market for technology and innovation processes at large. There are newly implemented R&D programmes supporting public-private R&D co-operation with the aim to lead research towards practical outcomes. However, there is a lack of institutions (both formal and informal) facilitating technology transfer into practice. In particular, there is poor management in this domain in the public research sector, a lack of qualified human resources for the technology transfer, unfavourable conditions for setting up academic spin-offs and insufficient supply of mediation services provided to innovative companies. Inter-sectoral (private-public-university sector) mobility of researchers is very limited.

ALFA, Centres of Competence, DELTA and EPSILON support programmes recently launched (or under preparation) by the TACR emphasize as one of their main goal promoting collaboration of enterprises with public research organizations. In addition, the MEYS supported the EF-TRANS project on "Efficient Transfer of Research and Development Outputs in Production and their Subsequent Utilization" with the goal to set up and bring into effect knowledge transfer between R&D institutions and industry. Technology Transfer Offices (TTOs) are in infancy in the public sector. Formal methods of intellectual property rights (IPRs) protection are underutilized in spite of the constant policy effort to improve the situation and despite the fact that state of the art IPRs legislation is in place. Admittedly, there is an urgent need for a comprehensive national knowledge transfer policy, including a new legislation on technology transfer, which tackles this challenge in a systematic way.

Major challenges remain to be tackled in the domain of open access of scientific knowledge. Generally, there is consensus in the scientific community to allow open access to publications whenever possible, but the concern is about the funding for such arrangements. Hence, open access to both scientific publications and data hinges on the non-existence of infrastructure and

institutional framework. Policies with regards to access to scientific publications are fragmented; the deals are negotiated separately by the ASCR and universities. National open access repository does not exist. However, there is the Research and Development and Innovation Information System of the Czech Republic, which provides open access to information about publicly funded research activities, projects and their outputs.

The keystone of the Czech e-infrastructure for research is CESNET (Czech Education and Scientific NETwork) and there are currently large projects investing into various elements of e-infrastructure (integrated in the ESFRI Roadmap), so this is likely to improve a great deal in near future. CESNET is also the national operator of EDUROAM infrastructure and the Czech academic identity federation eduID.cz project (a member of eduGAIN). IT4Innovations is a unique project (integrated in the ESFRI Roadmap) the aim of which is to build a national Centre of Excellence in the field of information technologies. CERIT Scientific Cloud offers storage and computing resources and related services, including support for their experimental use. The centre complements the other parts of the approved national e-Infrastructure – CESNET and the supercomputing center IT4Innovations.

Annex 1. PERFORMANCE OF THE NATIONAL AND REGIONAL RESEARCH AND INNOVATION SYSTEM

Feature	Assessment	Latest developments
1. Importance of the research and innovation policy	(+) Promoting innovation is one of three pillars in the Strategy of International Competitiveness (+) National Innovation Strategy approached innovation policy in a holistic way (+) National Priorities of Oriented RDI better reflect major societal challenges (-) Higher educational reform proposal does not address problems of the labour market for researchers	New national priorities of oriented RDI Higher education reform is further delayed Not much happening in the RDI reform due to political instability
2. Design and implementation of research and innovation policies	(+) The CRDI is chaired by the Prime Minister (+) Multi-annual R&D budget plans are published (+) Public R&D funding flows have been streamlined (+) National Priorities of Oriented RDI until 2030 (+) The RDI Information System provides comprehensive information on R&D outputs (-) The CRDI is overburdened with responsibilities without adequate resources to address them (-) The quality of research evaluation is unsatisfactory (-) Multi-annual R&D budget plans are often revised (-) RIS3 is not ready by the EC deadline (-) Bilateral co-operation with third countries is not coordinated with other EU members (-) Local authorities have little say in RDI policy (-) There is a lack of trust among the key actors	National public R&D budget stagnates New national priorities of oriented RDI Evaluation of research institutions newly involves international peer review RIS3 coming out in mid-2014
3. Innovation policy	(-) Innovation policy is pursued according to the linear model of innovation (-) Programmes supporting broad innovation and interdisciplinary approaches are rare (-) Demand-side policies are missing	TA CR has become the dominant supporter of applied R&D and innovation
4. Intensity and predictability of the public investment in research and innovation	(+) Promoting research excellence is often cited as the prime policy objective (+) A large attempt to construct new world-class research infrastructures funded from the EU structural funds (+) Public R&D budget have not been cut during the recession (but did not expand either) (+) Public funding aims at leveraging private sector investment (co-funding of joint public-private projects, R&D tax refunds, etc.)	R&D intensity of the economy increased during the recession Indirect support to business R&D grows in importance Six major research infrastructures opening or under construction
5. Excellence as a key criterion for research and education policy	(+) Public research funding in increasingly allocated on project-based and competitive basis (+) GA CR and TA CR are selected on the basis of external peer review (+) Research institutions are highly autonomous (-) The balance between institutional and project-based funding does not have a clear rationale (-) Competition for posts in higher education is low (-) Attractiveness of research careers is low (-) Female researchers are discriminated in accessing project-based funding with regards to regulation of maternity leave (-) Research institutes are evaluated according to formulae that	The proportion between institutional and competitive funding is even in 2013 The Public Defender of Rights ruled that the GA CR regulation with regards to maternity leave is discriminatory Evaluation of research institutions newly includes

	takes into account primarily the quantity of R&D outputs (-) Portability of funding is limited across institutions and borders (-) IPRs protection of publicly funded research is weak	bonuses for research excellence
6. Education and training systems	(+) Otevřená věda I. and II. programs assist secondary school teachers in directing students to research careers (-) Supply of (post)graduates in S&T is insufficient (-) Quality of tertiary graduates is being questioned (-) Education and training curricula are weak on competences and skills for innovation (-) Entrepreneurship education and courses are rare	Higher education reform is further delayed
7. Partnerships between higher education institutes, research centres and businesses, at regional, national and international level	(+) Public support programmes increasingly involve promoting of public-private partnerships and commercialization of innovative ideas (+) Innovation voucher programmes are implemented at the regional level (+) There are no obstacles on transnational partnerships and collaborations (-)The R&D evaluation system does not motivate researchers to cooperate with the business sector. (-) Horizontal mobility of researchers between the public and private sectors is very limited (-) Rules on IPRs ownership are unclear (-) Conditions for the creation of university spin-off are difficult (-) National knowledge transfer policy is lacking	Several TA CR programmes support public-private partnerships Support services to technology transfer, IPRs, etc. and promoted from the EU OPs Regional governments have started innovation voucher programmes
8. Framework conditions promote business investment in R&D, entrepreneurship and innovation	(+) Policies to enhance innovation, entrepreneurship and business environment are connected (+) Insolvency regulations support the financial re-organization of enterprises as well as individuals (+) Start-up regulations are relatively simple and flexible (-) Market for technology is underdeveloped (-) Access to venture capital is very limited	Public-private seed fund is going to be launched soon
9. Public support to research and innovation in businesses is simple, easy to access, and high quality	(+) Public support becomes better targeted, differentiated and streamlined (+) The emphasis on support measures is on outputs rather than inputs or controls (+) Selection criteria are straightforward, bureaucracy is not excessive (-) Quality of evaluation is poor, benchmarking to comparable schemes in other countries is rarely done	Support of schemes of innovation in business becomes concentrated under the TA CR DELTA programme of TA CR provides grants for joint projects with third countries
10. The public sector itself is a driver of innovation	(+) Access to government-owned data has significantly improved (-) Public sector does not stimulate innovation within its organizations (-) Public procurement is not used to stimulate innovation, tenders do not favour innovative solutions	Corruption in public tenders complicates using public procurement for innovation

Annex 2. National Progress on Innovation Union commitments

		Main changes	Brief assessment of progress / achievements
1	**Member State Strategies for Researchers' Training and Employment Conditions**	(+) The Update of the National RDI Policy highlights improvements in the field of human resources as the utmost priority (+) Amendment of Higher Education Act (prepared in 2013 but not yet adopted) simplifies recognition of university diplomas acquired abroad (-) Amendment of Higher Education Act (prepared in 2013 but not yet adopted) solidifies rigidities in hiring associate and full professors, not improving possibilities of competition for posts by foreigners (-) National public budget for research stagnates	(+) Career Development System of Tertiary Educated Employees in ASCR takes into account the Charter & Code (+) Code of Ethics for Researchers of the ASCR reflects the Charter & Code (+) The Common Rules for Human Resources Management of CEITEC implements the Charter & Code (+) Scientific Visa package simplifies procedures for researchers from third countries (+) Professors and docents are appointed by scientific boards of the higher education institutions, hence the hiring procedure is decentralized (+) GA CR postdoc grants provide competitive funding of basic research of postdocs (+) Specific research in higher education institutions program by MSMT provides competitive funding for research conducted by master and doctoral students (-)Bureaucracy , rigidities and language barriers to access research positions may discourage foreign applicants for associate and full professors (-) There is no organization with the "HR Excellence in Research" badge (only the ASCR and CEITEC endorsed the Charter & Code) (-) There is no HRS4R acknowledged institution (-)Only a minority of vacancies is announced through EURAXESS (it is not formally required to advertise new positions in media) (-)Labour market for researchers continues to suffer from a lack of experts (-)RDI human resource management is unsystematic , there is little use of career development plans (-) Management of research groups is underdeveloped, the groups tend to be very small

			(-) Opportunities for early career researchers are weak, post-doc funding is limited (-) There is a low horizontal mobility of academic staff leading to a clear pattern of inbreeding and limited competition for posts (-) There is no support that specifically promotes the setting up and running of innovative doctoral training programmes (-) Gender issues are grossly neglected in the current policy agenda (-)An explicit internationalization strategy of the public research system is lacking
4	**ERA Framework**		
5	**Priority European Research Infrastructures**	(+) The Roadmap for Large Research, Development and Innovation Infrastructures (adopted in 2010, implemented and updated in 2011) (+) National program sustainability I. grants secure sustainability of RIs (adopted in 2012, implemented in 2013) (+) Draft version of the Amendment of the Act No. 130/2002 Coll.; 281th meeting of the CRDI on 29th March 2013: Block funding is allowed for international cooperation in research.	(+) The Roadmap for Large Research, Development and Innovation Infrastructures (strategic national document) confirms co-funding of construction of large RIs from the national budget (+) There is separate public R&D budget line for grants co-funding the construction of large RIs (+) National program sustainability I. grants of MEYS sustain funding for the operation of large RIs (constructed with the EU support) (+) The CRDI approved to allow for providing block funding for international cooperation in research (in line with the Council Regulation 723/2009 EC from 25th June 2009 about ERIC) (-) No specific measure have been implemented to remove legal and other barriers to cross-border access to RIs (-) None of the existing laws or documents explicitly elaborates on access to RIs by non-resident researchers
7	**SME Involvement**	(+) MEYS organized eight call under Eureka Eurostars in 2012	(+) The Eureka Eurostars initiative has been administered by MEYS (eight calls over 2008-2012) but the success rate of Czech applicants was small (only four, two and three projects supported in the last three calls and the total is thirty supported projects) (-) No partnership has been formed in Horizon 2020 so far (but preparations are in progress under MEYS)
11	**Venture Capital Funds**	(+) MIT has established a public-private seed fund financed from the OP EI to boost the access to venture capital, but the fund has not been put into operation yet (expected in 2014)	(+) Priority Axis 3 "Commercialisation and popularisation of R&D" of the OP Research and Development for Innovation supports pre-seed activities (+) The new public-private seed fund under MIT will help to kick-start the underdeveloped venture capital market (-) Eurostat on-line reports that the venture

			capital investments (% of GDP) amounted to 0.005% in 2011 and 0.000% in 2012, respectively; the availability of venture capital is one of the lowest among EU countries (-) No EU Venture Capital funds passports have been issued for a Czech entity so far (-) There are not tax measures supporting venture capital or business angels
13	**Review of the State Aid Framework**	(+) CzechInvest agency (under MIT) has become the main body of government dealing with cluster policies	(+) State aid for innovation clusters is concentrated in the Cooperation Clusters programme of the OP Enterprise and Innovation (2007 – 2013) under MIT; 28o projects have been carried out (+/-) Around 60 cluster organizations have been established so far; only few of which are involved in the EU cluster collaboration platforms, many of which are small and young, their impact is hard to judge (-) Currently, there is no overarching cluster policy. There is little synergy among national and regional cluster policies.
14	**EU Patent**	(+) Czech Republic joined the "patent package" in 2012 (+) The ratification process of the Agreement on a Unified Patent Court has started in 2013	(-) The Agreement on a Unified Patent Court has been signed but has not been ratified (not passed by any chamber of the parliament so far)
15	**Screening of Regulatory Framework**	n.a.	(-) Review of the existing regulatory framework (with regards to eco-innovation and EIPs) has not been released yet (-) Innovation impact assessment is not considered in government decisions
17	**Public Procurement**	(+) BETA program for public procurement in R&D launched by TA CR in 2011 (+) TA CR announced for the first time a public tender using the PCP (Pre-Commercial Procurement) method in February 2014	(+) BETA programme of the TA CR facilitates public procurement in R&D (assigned competitively) for the needs of public administration bodies (-) National target on public procurement of innovative goods and services has not been announced (-) Public tenders, except those for R&D, do not include innovation criteria (-) National procurement policy very rarely considers the objective of supporting innovation
20	**Open Access**	(+) Open Access Policy at the AS CR (implemented in 2011) ensures the widest possible access to scientific results (+) Grants for e-infrastructure (eIGeR, CESNET Large Infrastructure, CERIT Scientific Cloud, IT4Innovations) implemented in 2011	(+) Institutes of the ASCR are obliged to make all possible efforts to provide ASCR and the Library of the ASCR publication outputs created by their employees and non-exclusive licences to their use (+) Initiative of the Association of Libraries of Czech Universities provides supports for open access (+) There are 10 open access repositories scattered at various research organizations

			and universities (+) Czech Statistical Office provides access to confidential micro data for scientific research purposes (+) Research Data Repositories (there are four) provide open access to data (+) The Research and Development and Innovation Information System of the Czech Republic provides open access to information about R&D supported from public budgets (+) CESNET (Czech Education and Scientific NETwork) provides state-of-the-art e-infrastructure for research, including ESFRI (+) IT4Innovations has been established as a national Centre of Excellence in ICTs; including a high-performance supercomputer (+) Project eduroam.cz supports and spreads IP mobility and roaming within the Czech NREN (+) Czech academic identity federation (eduID.cz) provides inter-organizational identity management and access control to network services (-) Despite consensus to allow open access whenever possible, the concern is about the funding for such arrangements (-) National open access repository does not exist (-) Policies with regards to access to scientific publications are fragmented; national policy is lacking
21	**Knowledge Transfer**	(+) National Innovation Strategy (2011) outlined plans for improving cooperation and knowledge transfer between academia and industry (+) ALFA programme of TA CR supports public-private cooperative projects (implemented in 2011) (+) Competence centres grants of TA CR (implemented in 2012) support projects involving at least one research centre and business enterprise (+) Amendment of the Income Tax Act extends tax credit to R&D purchases from research organizations from 2015	(+) ALFA programme of TA CR provides funding for public-private cooperative projects of applied R&D in natural sciences (+) Competence centres grants of TA CR provide long-term funding for partnership of research organisations and business sector in applied R&D (+) EF-TRANS programme aims to set up and bring into effect knowledge transfer between R&D institutions and businesses (+) Priority Axis 3 "Commercialisation and popularisation of R&D" of the OP Research and Development for Innovation supports commercialisation of research results including funding for technology transfer offices (+) R&D tax credits are extended to purchase of external R&D services from research organizations

			(-) Knowledge transfer is not recognized in the evaluation of research organization for the purpose of allocating block funding (-) Informal channels of knowledge transfer seem to be important, which is a testimony of poor governance, bureaucracy discourage knowledge transfer through the official means (-) There is a lack of organisations supporting knowledge transfer in practice, TTOs are in infancy (-) There are unfavourable conditions, including legal impediments in the university sector, for setting up academic spin-offs (-) Systematic solution of the technology transfer issues at the national level, hence an explicit national knowledge transfer policy, is lacking
22	**European Knowledge Market for Patents and Licensing**	(+) IPO organized workshop aimed at matchmaking and information sharing on IPR protection in January 2012, in which participated 80 persons from 52 organization (+) Since early 2012 IPO has signed a formal memorandum of cooperation with 34 institutions; including incubators, innovation parks and TTOs (+) The first INVENTO Prague fair of inventions took place in Prague in June 2013	(-) National policies pay little attention to developing knowledge markets for patents and licensing ; largely relying on initiatives of the EU in this domain (+) IPO maintains searchable, free of charge, on-line database of granted national IPR instruments (+) IPO organizes events raising awareness and provides consultation services with regards to IPR protection; including „IP audit“ directed at SMEs (-) National trading (or exchange) platform does not exist
23	**Safeguarding Intellectual Property Rights**	n.a.	(+) The Guidelines on Horizontal Cooperation Agreements have been recognized by the Office for the Protection of Competition (-) National measures specifically designed to support the use of the Guidelines on Horizontal Cooperation Agreements are not in place
24	**Structural Funds and Smart Specialisation**	(+) National Research and Innovation Strategy on Smart Specialisation (RIS3), including 14 regional RIS3 strategies at the NUT3 level, is due to be presented by the MEYS in December 2013	(-) RIS3 is crafted under a very tight schedule; rushed to meet the EC deadline by the end of 2013, the time required has been grossly underestimated (-) Consequently, there will be a little room for broader public debate before the RIS3 is submitted to the EC (-) Most regions do not pursue regional innovation policy; South Moravian region is the main exception, hence there is very limited tradition, competences and awareness at the regional level (-) RIS3 is produced using top-down approach by the MEYS; only 2 out of 14 regions have started to work on their RIS3

			strategies in a bottom-up manner (+) Policy-making has been fairly centralized so far, so there is a chance that the RIS3 stimulates much need move toward regionalization
25	**Post 2013 Structural Fund Programmes**	(+) There will be only a single Integrated Regional Operational Programme centralized under the auspice of MRD (formerly there were 7 programmes divided by regions)	(+) The design of new SF programmes for the programming period 2014-2020 is well under way; most of innovation-relevant programmes will be administered by MEYS, MIT and newly also by the MRD
26	**European Social Innovation pilot**	(+) The OP Human Resources and Employment administered by the MoLSA issued a pilot call for the Social Innovation programme in 2013; this the first measure focused on supporting social innovation	(-) Measures supporting social innovation are extremely rare (-) Social innovation is neglected in the existing strategic documents and hence in the national innovation policy
27	**Public Sector Innovation**	(+) CZSO conducted a pilot survey of public sector innovation in 2011 (reference period 2008-2010)	(+) CZSO collected data on public sector innovation in a pilot survey in 2011; however, the results have not been published (+) The Prize of the Minister of Interior for Quality and Innovation in Public Administration is awarded ex post annually since 2005
29	**European Innovation Partnerships**	n.a.	(+) Four users from the Czech Republic registered and they are involved in 33 out of 293 initiatives in the pilot EIP on Active and Healthy Ageing since 2011; hence, there is a small number of highly active participants (-) The other four existing EIPs are too new to assess
30	**Integrated Policies to Attract the Best Researchers**	(+) NAVRAT , NAVRAT II grants for re-integration of top Czech researchers from abroad (implemented in 2012)	(+) Scientific Visa package make access to third countries' talent easier (+) Fellowship J. E. Purkyně awarded by the ASCR attracts outstanding young (under 40) scientists from abroad (including from the US) (+) NAVRAT , NAVRAT II grants of MEYS improve conditions for re-integration of top Czech researchers coming back from abroad (brain gain measure) (+) GA CR grant programme applications must be submitted in English, which pulls down language barriers of entry (-) National funding is generally closed to non-residents. Public research funders support almost exclusively resident researchers (-) National research internationalisation strategy is lacking
31	**Scientific Cooperation with Third Countries**	(+) DELTA programme of TA CR (adopted in 2013 and implemented in 2014) funds grants for joint international projects with third countries	(+) Several national programmers promote cooperation with third countries on R&D and innovation; some of them are well established (+) GA CR bilateral grants with its Israeli, Korean and Taiwanese counterparts allow for collaborative basic research projects

			(+) KONTAKT, KONTAKT II grants of MEYS support collaborative basic research with non-EU countries (+) DELTA programme of TA CR facilitates international cooperation of support to applied research and experimental development through joint programmes with technological (and innovation) agencies in non-European countries (-) There is a very weak link between the Czech joint programmes with third countries on one hand and the European programs on the other hand
32	**Global Research Infrastructures**	(+) Separate public R&D budget line for fees for membership in international R&D organizations (implemented in 2013) (+) Separate public R&D budget line to support international collaborative projects (implemented in 2013) (+) Separate public R&D budget line to fund fees for participation in international R&D programmes (implemented in 2013)	(+)INGO, INGO II program of MEYS promote participation of research institutions in international non-governmental organizations (+) Separate public R&D budget lines under MEYS provides block funding for membership in R&D organizations, collaborative projects and participation in international R&D programmes, hence securing the funds on annual basis
33	**National Reform Programmes**	(+)A medium term patch of the evaluation methodology has been introduced for the period 2013-2015, on the base of which institutional funding is going to be allocated until 2016	(+) Quality evaluation of research institutions has been enriched by elements of international peer review and bonuses for the ERC grants (-) However, the backbone of the evaluation methodology remains to be largely formulae-based, which is unsatisfactory with regards to promoting quantity (rather than quality), obscuring societal needs and being too mechanistic (+) IPn METODIKA project (as a part of the OP RDI) intended to conduct more systematic revision of the methodology is in progress. The results are expected in 2014.

Annex 3. NATIONAL PROGRESS TOWARDS REALISATION OF ERA

ERA Priority	ERA Action	Recent changes	Assessment of progress in delivering ERA
1. More effective national research systems	Action 1: Introduce or enhance competitive funding through calls for proposals and institutional assessments	Partial revision of the formula for allocation of institutional funding has been introduced for the period 2013-2015 IPn METODIKA project is in progress to revise evaluation of research organizations The share of project-based funding has increased significantly	(+) There is multi-annual public R&D budget strategy (-) Institutional funding was already supposed to be allocated competitively (+) As soon as a revised evaluation is ready, the full amount of institutional funding will be allocated competitively (+) Project-based funding accounts for about a half of GBAORD (+) TA CR has been established as the dominant supported of industrial R&D
	Action 2: Ensure that all public bodies responsible for allocating research funds apply the core principles of international peer review	Elements of international peer review are newly introduced in evaluation of research organizations ASCR conducted internal evaluation of its member institutes based on international peer review	(+) International peer review is increasingly used for the allocation of institutional funding (+) GA CR project-based funding adheres to international peer review (-) Other providers of project-based funding rarely apply international peer review (-) Standards for evaluation of project-based funding are very low
2. Optimal transnational co-operation and competition	Action 1: Step up efforts to implement joint research agendas addressing grand challenges, sharing information about activities in agreed priority areas, ensuring that adequate national funding is committed and strategically aligned at European level in these areas	New long-term priorities of oriented RDI are in line with the grand challenges EPSILON programme of TA CR (starting in 2015) aims at the grand challenges	(+) Grand challenges are increasingly reflected in funding priorities and the design of new programmes (+) Membership of intergovernmental organisations in ERA and ESFRI (+) National Information Centre for European Research (NICER) (+) Czech Liaison Office for Research and Development in Brussels (CZELO) (-) Thematically oriented funding is small (-) Participation in Joint Programming and Joint Technology Initiatives is limited (-) Alignment of national funding at the European level is poor but improving

	Action 2: Ensure mutual recognition of evaluations that conform to international peer-review standards as a basis for national funding decisions	DETLA programme of TACR that starts operation in 2014 recognizes evaluations of the partner technology (or innovation) agency	(+) Assessment of proposals conducted by the partner funding agency (i.e. mutual recognition) is recognized by GA CR and TA CR
	Action 3: Remove legal and other barriers to the cross-border interoperability of national programmes to permit joint financing of actions including cooperation with non-EU countries where relevant	Draft version of the Amendment of the Act No. 130/2002 Coll. allows providing institutional support for international cooperation in research	(+) KONTAKT programme and GA CR's international bilateral agreements with non-EU countries (+) The Visegrad Fund (-) National research funding programmes do not allow transferability of a grant to another country
	Action 4: Confirm financial commitments for the construction and operation of ESFRI, global, national and regional RIs of pan-European interest, particularly when developing national roadmaps and the next SF programmes	The roadmap for large RIs was approved March 2010 (updated in May 2011) National program sustainability I. and II. sustain funding for operation of large RIs	(+) Large-scale effort (funded from OPs) to modernize RIs (+) Medium-term financial sustainability of RIs is guaranteed
	Action 5: Remove legal and other barriers to cross-border access to RIs		(+) Large RIs are linked with ESFRI (-) Access to RIs by non-resident researchers is not elaborated in laws or documents
ERA priority 3: An open labour market for researchers	Action 1: Remove legal and other barriers to the application of open, transparent and merit based recruitment of researchers	Higher education reform is in doldrums The latest draft of the reform simplifies the recognition of university diplomas acquired abroad MOBILITY programme facilitates outward mobility NAVRAT programme improve conditions for re-integration from abroad	(+) Professors and docents are appointed by the Scientific Board of higher education institutions (+) MOBILITY, NAVRAT and Fellowship J. E. Purkyně programmes support mobility (-) Competition for posts is limited (in higher education sector) (-) Inbreeding is widespread (-) Little use of career development plans (-) Limited horizontal mobility (-) Internalization strategy is lacking
	Action 2: Remove legal and other barriers which hamper cross-border access to and portability of national grants	GA CR proposals need to be submitted in English	(-) Public research funders support almost exclusively resident researchers (-) Funding for non-residents is not possible, unless they become employed locally in the research project (+/-) GA CR submission procedures are organized in English but background documentation is only in Czech
	Action 3: Support implementation of the Declaration of Commitment to provide coordinated personalised information and services to researchers through the pan-European EURAXESS3 network	EURAXESS3 network has contact points in 10 cities	(+) EURAXESS3 Service Centres provide personalized assistance to researchers (+) Scientific Visa Package is implemented (-) EURAXESS3 is underused

	Action 4: Support the setting up and running of structured innovative doctoral training programmes applying the Principles for Innovative Doctoral Training.		(-) Early career funding opportunities are weak (-) Standardization of PhD programmes is limited
	Action 5: Create an enabling framework for the implementation of the HR Strategy for Researchers incorporating the Charter & Code	CEITEC endorsed the Charter & Code	(+) Code of Ethics for Researchers of the ASCR and he Common Rules for Human Resources Management of CEITEC endorse the Charter & Code (-) Little awareness of the Charter & Code in the higher education sector (-) There is no organization with the HR Excellence in Research badge
ERA priority 4: Gender equality and gender mainstreaming in research	Action 1: Create a legal and policy environment and provide incentives	Ombudsman's ruling on gender discrimination in GA CR post-doc grants GA CR gender audit is planned Council of the Government for Equal Opportunities for Women and Men addressed for the first time the problem of gender equality in science	(+) General legislation guarantees gender equality in employment (+) Government proceedings ensure gender impact assessment (-) CRDI is not obliged to consider gender issues (-) Ministerial gender focal points have little power (-) Working Groups for Equal Opportunities for Women and Men have a little impact (-) Gender equality in committees, expert groups, advisory bodies, etc. is poor (-) Maternity leave regulations clash with fixed-term contracts for female researchers
	Action 2: Engage in partnerships with funding agencies, research organisations and universities to foster cultural and institutional change on gender	en.zenyaveda.cz promotes cultural changes in gender issues	(+) National Contact Centre for Women and Science (+) Milada Paulova Award (+) L'ORÉAL Scholarship Czech Republic for Women in Science
	Action 3: Ensure that at least 40% of the under-represented sex participate in committees involved in recruitment/career progression and in establishing and evaluating		(-) No specific measure is implemented
ERA priority 5: Optimal circulation, access to and transfer of scientific knowledge including via digital ERA	Action 1: Define and coordinate their policies on access to and preservation of scientific information	International Open Access Week in October 2013	(+) RDI Information System provides comprehensive information about R&D supported by public budgets (+) www.openaccess.cz and www.dspace.cz promote open access (-) Open access to scientific publications and data is underfunded (+) There are 10 open access repositories and 4 research data repositories at various research organizations and universities

			(-) National open access repository does not exist (+) Micro data from the Czech Statistical Offices are available for research purposes
	Action 2: Ensure that public research contributes to Open Innovation and foster knowledge transfer between public and private sectors through national knowledge transfer strategies	ALFA, Centres of Competence, DELTA and EPSILON programme of TA CR (starting in 2015) fosters public-private partnerships 15 technology transfer offices have been established recently R&D tax credits are extended to purchase of external R&D services from research organizations	(+) National Innovation Strategy emphasizes cooperation and knowledge transfer between academia and industry (+) TA CR programmes support public-private cooperation in R&D (+) Commercialisation and popularisation of R&D supported from the OP RDI (-) Technology transfer services are underdeveloped (-) Intellectual property rights are underutilized (-) The R&D evaluation system does not motivate researchers to cooperate with the business sector
	Action 3: Harmonise access and usage policies for research and education-related public e-infrastructures and for associated digital research services enabling consortia of different types of public and private partners	Public e-infrastructure is continuously upgraded and extended	(+) Czech Education and Scientific NETwork (CESNET) (+) CERIT Scientific Cloud (+) IT4Innovations supercomputer
	Action 4: Adopt and implement national strategies for electronic identity for researchers giving them transnational access to digital research services		(+) Project eduroam.cz (+) Czech academic identity federation (eduID.cz) - member of eduGAIN

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LIST OF ABBREVIATIONS

ASCR	Academy of Sciences of the Czech Republic
BERD	Business Expenditure on Research and Development
CERN	European Organisation for Nuclear Research
COST	European Cooperation in Science and Technology
CRDI	Council for Research, Development and Innovation
CZK	Czech koruna
CZSO	Czech Statistical Office
ELI	Extreme Light Infrastructure
ERA	European Research Area
ERDF	European Regional Development Fund
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESO	European Southern Observatory
EU	European Union
EU27	European Union including 27 Member States
FP	European Framework Programme for Research and Technology Development
FP7	7th Framework Programme
GA CR	Grant Agency of the Czech Republic = Czech Science Foundation
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
HEI	Higher education institutions
ICT	Information and Communication Technologies
IPO	Industrial Property Office of the Czech Republic
IPR	Intellectual Property Rights
MEYS	Ministry of Education, Youth and Sports of the Czech Republic
MIT	Ministry of Industry and Trade of the Czech Republic
MRD	Ministry of Regional Development of the Czech Republic
MoLSA	Ministry of Labour and Social Affairs of the Czech Republic
NABS	Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets
NIS	National Innovation Strategy
OP	Operational Programme
OP EI	Operational Programme Enterprise and Innovation
OP RDI	Operational Programme Research and Development for Innovation
PROs	Public Research Organisations
R&D	Research and development
RDI	Research, Development and Innovation
RIS3	Research and Innovation Strategy on Smart Specialisation
S&T	Science and Technology
TA CR	Technology Agency of the Czech Republic

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