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Research and Innovation Observatory Country Report 2016 Czech Republic
The 2016 series of the RIO Country Report analyses and assesses the development and performance of the national research and innovation system of the EU-28 Member States and related policies.
It aims at monitoring and evaluating the EU policy implementation as well as facilitating policy learning in the Member States.

Contents

Foreword

This report offers an analysis of the R&I system in Czech Republic for 2016, including relevant policies and funding, with a particular focus on topics of critical importance for EU policies. The report identifies the main challenges of the Czech research and innovation system and assesses the policy responses implemented. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports and online publications. The quantitative data are, whenever possible, comparable across all EU Member State reports. Unless specifically referenced, all data used in this report are based on Eurostat statistics available in January 2017. The factsheet in the annex include however the most recent data including one indicator from the last wave of the Community Innovation Survey.

The report contents are partly based on the RIO Country Report 2015 (Srholec and Szkuta, 2016).

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HIGHLIGHTS

- Despite a slow down in real GDP growth, the forecast for 2016 and 2017 are positive. Labour productivity continues also to show a positive trend.
- The R&I system is centralised as regards funding allocation and governance. The main role of regional authorities remains to catalyse Structural Funds.
- GERD is maintained above 1.9% of GDP approaching the EU28 average.
- Public R&D expenditure per GDP meets its 2020 target since 2012. However, about 29% is due to public R&D investment from abroad, especially the European Structural and Investment Fund (ESIF).
- BERD shows a positive trend and a high level of openness with foreign affiliates contributing for more than half of the total amount.

MAIN R&I POLICY CHALLENGES

- **Reforming governance of the public research sector**, the revision of evaluation methodologies and achieving an efficient allocation of public research funding are top challenges. There is a proposal to establish a Ministry for Research and Development which should concentrate part of the existing competences of the R&I governance.
- **Opening labour market for researchers** by improving the higher education reform. Mobility and internationalization in the public sector remain low. Awareness of gender issues in research is increasing but policy response is missing. Limited availability of qualified human resources is a problem for the business sector and for the new large research centres and infrastructure projects, financed mainly from the ESFI.
- **New measures have been introduced to strengthen public-private linkages** and promote the commercialization of research results. Tax R&D credits have been extended to the purchase of external R&D services. Knowledge transfer infrastructure has been upgraded. However, IPRs protection and licensing remain underused and linkages between public and private R&D sectors remain weak.
- **Deepening innovation capabilities and demand for innovations:** Foreign affiliates are poorly integrated in the national innovation system, access to venture capital is limited and path-breaking innovation is rare. Nevertheless, the policy focus has shifted towards supporting innovation. The policy mix is dominated by R&D subsidy programmes and the 2014-2020 programming period is foreseen to address the limited incentives to venture capital. R&I support measures seldom target small and young innovative firms and neglect the potential of using demand side instruments.

MAIN R&I POLICY DEVELOPMENTS IN 2016

- National Research, Development and Innovation Policy of the Czech Republic 2016–2020 (SRI, 2016a) puts more emphasis on applied research
- A law on the support of research, development and innovation is in the pipeline
- The government is preparing a new evaluation methodology
- The national R&I budget for 2017 is increased by 13% and it is expected to increase by 6.8% from 2017 to 2018

1. Main R&I policy developments in 2016

National Research, Development and Innovation Policy of the Czech Republic 2016–2020 (02/2016)	The document was approved by the government in February 2016 (SRI, 2016a). It puts more emphasis on applied research for the needs of the economy and the state administration. The priorities are to: i) streamline governance of the R&I system improving cooperation among sectors; ii) implement a new evaluation framework; iii) develop a base for applied research while stimulating a more applied orientation of the public research sector; and iv) boost R&I capabilities in the business sector strengthening technology transfer and public-private cooperation.
A new law on the support of research, development and innovation is on the pipeline (08/2016)	The Government approved the legislative intention of a new law on the support of research, development and innovation that could fundamentally reform governance of the R&I system introducing a new Ministry for Research and Development. It should take over executive responsibilities from the CRDI and partly from the MEYS and assume a central role among the R&D policy actors. By separating competences for governance and improving coordination of key parts of the R&I system, the new proposal addresses the EC's recommendations (European Commission, 2016bc) to strengthen governance in the R&D
A new evaluation methodology (12/2016)	The government is preparing a new methodology, Metodika 2017+, for the evaluation and allocation of institutional funding. It envisages the gradual implementation of a system based on informed peer review evaluation of research organizations. It is assumed to replace Metodika 2013 and guide the evaluation system from 2017 onwards. Metodika 2017+ is planned to be approved by the Government in early 2017.
The national R&I budget for 2017 is increase by 13 %	After years of stagnation, the national R&I budget for 2017 is increased by €136m, i.e. about 13%, to a total €1.2b and it is expected to increase by 6.8% from 2017 to 2018 (see section 3.1 for more details). The new budget safeguards the sustainability of R&D infrastructure answering concerns expressed by the EC (European Commission, 2016bc).

1.1 Focus on National and Regional Smart Specialisation Strategies

Description and timing: Czech regional authorities do not have any legally binding responsibilities in RDI policy and, so far, their main role has been in catalysing the EU Structural Funds. The only exception is The South Moravian region which represents the national role-model of regional innovation policy with dedicated authorities, a well-functioning innovation agency and a dialogue with the business community (RISJMK, 2013).

In 2015 the responsibility of the management and implementation of the RIS3 Strategy moved from the Ministry of Education, Youth and Sport (MEYS) to the Section for Science, Research and Innovations at the office of the Government (SRI). In December 2014 the first version of the National RIS3 was submitted to the EC, which demanded a revision and an improvement of its alignment with national funding. The update includes an intermediate plan of activities of the SRI and a quantification of relevant financial allocations in public budget and was sent for verification to the EC in late 2015. After successful verification by the EC, the updated RIS3 strategy has been approved by the Government in July 2016 and finally approved by the EC in October 2016.

New developments: The updated National RIS Strategy (SRI 2016b) is expected to steer the allocation of up to €2.5b of European, national, regional and private funds. Eight key enabling technologies and non-technological domains have been identified, as well as

seven national innovation platforms have been established. Regional councils for innovations and regional innovation platforms are starting operation. In addition, the so-called RIS3 Smart Accelerator project has been launched to strengthen institutional capacity at the regional level. Monitoring reports will be published annually and evaluation is scheduled to be conducted every two years in line with the update of the strategy.

Outstanding issues: So far RDI policy making has been fairly centralized. Co-ordination between the national and regional level innovation strategies has been weak. Drafting of the national RIS3 strategy and its implementation involved a coordinated action between national, regional authorities and stakeholders (particularly academics and business sectors) on the topic of innovation policy. It represents an important challenge and also an opportunity for establishing a nation-wide debate on this topic.

2. Economic Context

The Czech Republic is a medium size country with a population accounting for 2.1% of the EU28. After the 2008-2009 economic crisis, its economy is returning to a sustainable growth path with a gross domestic product (GDP) per capita reaching 85% of the EU28 average in 2015. The expected real GDP growth for 2016 and 2017 is of 2.1% and 2.6%, respectively (European Commission, 2016e). This is a slowdown from 2015, when it reached 4.2% thanks to a boost in public investment driven by EU funding. Likewise, the country lags behind the global technology frontier and labour productivity growth has slowed down after the economic crisis to 1.4% in 2014 and it is forecasted to reach 2.3% in 2017 (European Commission, 2016e). While the main strengths are the production capabilities and the use of ICT in the business sector, improvements can still be done in controlling the international distribution, developing clusters and innovation. Inflation is expected to remain below the 2% target, although real wages are growing. Government's finance has improved reducing the public deficit from 1.9% in 2014 to 0.4% in 2015. Despite a moderate government debt ratio, between 41% and 45% of GDP in the period 2012-2015, the fiscal framework is weak with an increasing public expenditure on healthcare and pensions. The economy is highly open and its positive trend and outlook is linked to the recovery of the main trade partners.

2.1 Structure of the economy

The Czech Republic is one of the most industrialized Member States with a share of manufacturing contributing to 27% of value added and 26% of employment. The high- and medium-high-technology manufacturing sector is large due mainly to automotive, mechanical and electrical engineering. Conversely, employment in knowledge intensive services and the service sector remains far below the EU28 average. The country is integrated in the global value chain but local firms are mainly concentrated in low value added segments (OECD, 2016). In 2016 and 2017 exports are forecasted to be larger than imports thanks to foreign-owned firms (European Commission, 2016e).

2.2 Business environment

In 2016 the Czech Republic was ranked 19th among the EU28 in the Ease of Doing Business Index by the World Bank (2016); just short of Poland and Estonia but ahead of The Netherlands, Slovenia, Slovakia and Romania. Its main manufacturing industries are automotive, mechanical engineering, electrical engineering and electronics. According to the World Bank Enterprise Survey (2009), the top three obstacles to running a business are: (i) access to finance; (ii) high tax rates; (iii) inadequately educated workforce. While the government has agreed on reforms to support product market competition and a dynamic industry the tax system appears still complex with a high taxation on labour. The Czech Republic excels in e-commerce of SMEs, but falls behind in the provision of digital public services (European Commission, 2016f). Business R&D investment is low with innovation performance below its potential (European Commission, 2014).

2.3 Supply of human resources

Unemployment is one of the lowest in Europe and is expected to show a downward trend falling from 5.1% in 2015 to 4.2% in 2016, 4.1% in 2017 and 4.0% in 2018. Between 2011 and 2014, the number of researchers has increased by 17.5% reaching about 3,400 researchers per million people, close to the EU28 average but half of the level of top performing countries (Eurostat, 2016). About 50% of researchers are employed in the business sector, 25% in the higher education sector and 20% in the government sector. Nevertheless, labour market for researchers continues to suffer from an insufficient supply of experts with an appropriate mix of skills, especially in STEM fields (MIT, 2011). The participation of female researchers is also unsatisfactory low reaching a share of only 24% in FTE in 2014 (NKC – ženy a věda, 2015). Both policies to boost the supply of (post)graduate in STEM or to address gender imbalance are lacking.

3. Main R&I actors

Deputy Prime Minister for the Science, Research and Innovation is a member of the government responsible for RDI policy supported by the Section for Science, Research and Innovations (SRI) at the Office of the Government. Council for Research, Development and Innovation (CRDI) is an advisory government body for RDI policy. At the political level, it plays the main strategic role. Ministry of Education, Youth and Sports (MEYS) is the central administrative authority for R&D programmes in the public sector funding the HEIs sector and promoting international research collaboration. Ministry of Industry and Trade (MIT) administers policies in the domain of business RDI. Technology Agency of the Czech Republic (TA CR) provides competitive funding for applied research, experimental development and innovation. Czech Science Foundation (GA CR) provides funding for competitive grants in basic research.

Czech Academy of Sciences (CAS) consists of 54 formally independent public research institutes (PROs). CAS is a major funding provider and the single most important research performer with about 5 thousand (FTE) researchers. The academic sector consists of 26 public, 2 state and 44 private HEIs. The HEIs have been traditionally more focused on teaching than research. Nevertheless, this has been changing in recent years and in 2014, the HEIs sector employed 11 thousand (FTE) researchers, most of which in public universities (Eurostat, 2016). All of the major HEIs are in the public sector such as Charles University, Prague and Masaryk University, Brno with up to 50 thousand students each. The main HIEs with STEM focus include Czech Technical University in Prague, Brno University of Technology, VŠB - Technical University of Ostrava, Technical University of Liberec, University of Chemistry and Technology Prague, Czech University of Life Sciences Prague. Council of Higher Education Institutions (CHEI) and Czech Rectors Conference (CRC) coordinate and represent the HEIs sector with regards to the government and other stakeholders.

The business research sector consists of about 2,300 actors, of which about 25% are foreign affiliates and 80% are SMEs. The main R&D performing sectors are the automotive, machinery, electronics and information and communication with about 50% share in R&D employment and expenditure (CZSO, 2016). The largest single private R&D performer is Škoda Auto, a part of the Volkswagen Group. Other major business R&D performers include ABB, ČEZ, Bosh, FEI, Honeywell, Škoda Transportation, Visteon-Autopal and Zentiva, most of which are also foreign affiliates (Kejhová, 2015). The EU Industrial R&D Investment Scoreboard enlists only two Czech companies, ČEZ in electricity and Aero Vodochody in aerospace and defence (European Commission, 2015).

Private non-for-profit funding is negligible accounting for less than 1% of GERD in 2014. The major source of philanthropic funding is the Neuron foundation, which supports scientific research through personal grants, awards and popularization events.

Given the historical separation of science and business knowledge transfer is limited. The TA CR launched support programmes, such as ALFA, Competence Centres, DELTA, GAMA and EPSILON to improve public-private circulation, collaboration and transfer of scientific knowledge. Additionally, 42 science and technology parks, 17 technological platforms, 13 business incubators and 15 Technology Transfer Offices have been established according to the Technological profile of the Czech Republic database and CzechInvest. Association of Research Organizations, Association of Innovative Entrepreneurship, Association of Small and Medium-Sized Enterprises and Crafts, Association for Foreign Investment and the Confederation of Industry of the Czech Republic, provide platforms for debating governance of the innovation system.

4. R&I trends

The Innovation Union Scoreboard 2016 (European Commission, 2016a) classifies the Czech Republic among the "moderate innovators", with an innovative performance slightly below the EU28 average but ahead of Italy, Spain, Portugal and Greece. The main strengths are in upper secondary education, R&D expenditure in the public sector, international scientific co-publications and exports of medium and high-tech products. The weak areas are concentrated in top scientific publications, internationalization of public research sector, public-private scientific co-publications, access to venture capital and the output of applied research with regards to the usage of intellectual asset protection and licensing revenues. With the approval in 2016 of the National Research, Development and Innovation Policy of the Czech Republic 2016–2020 (SRI, 2016a) more emphasis is put on supporting applied research.

4.1 Public allocation of R&D and R&D expenditure

Public R&D funding has been traditionally dominated by institutional support. However, this has changed in the context of the Reform of the RDI System. As a result, according to the Research Development and Innovation Council (CRDI) the share of project funds increased from 44% in 2009 to 51% in 2014 (CRDI 2016). In 2016, the Government approved the national R&I budget for 2017, which envisages an increase of public R&I spending by €136m, i.e. about 13% year-on-year, to a total €1.2b; this is the largest amount ever. The increase is allocated between: co-financing of the European Investment and Structural Funds (ESIF) (€40m), applied research (€26m), basic research (€18m), institutional funding of research organizations (€28m), research meeting the needs of public administration (€12m) and international research cooperation (€11m). It acknowledges the need of a sustainable R&D infrastructure answering to EC concerns (European Commission, 2016bc). The multi-annual RDI budget plan proposes a further increase of the R&I budget by 6.8% from 2017 to 2018 and by 5.6% from 2016 to 2017.

In 2015, gross domestic expenditure on R&D (GERD) amounted to €3.25b increasing by about 4% as compared to the previous year, mainly due to the expansion of business funding. GERD jumped by 67% over the period 2010-2015. Consequently, R&D intensity in terms of GERD as % of GDP increased to 1.95% in 2015, as compared to 1.24% at the dawn of the crisis in 2008, hence, approaching the EU28 average of 2.04% (Eurostat, 2016) and being well above the one of neighbouring countries (Slovakia 1.18%, Hungary 1.38% and Poland 1.00%).

The national 2020 target to reach 1% of public R&D expenditure per GDP has been met and maintained since 2012. However, around 29% is due to public R&D funding from abroad, primary from the ESIF for the construction of several major projects of research infrastructure (Eurostat, 2016). In 2015, the government sector funded 32% of GERD, split between higher education (48%) and public research institutions (39%), the indigenous business enterprise sector financed 35%, and foreign sources contributed by 32%. About half of the foreign funds came from private sources, thus funding of R&D in foreign affiliates through multinational corporations. (Eurostat, 2016 and CZSO, 2016).

Within the 7th Framework Programme (FP7) 1,153 projects with 123 coordinators have been financed. This represents a sizeable increase with respect to the 890 projects and 38 coordinators financed under the FP6, although FP funding is still rather minor.

In 2014, the single largest recipient of institutional funds was the CAS with 34% of the total. In turn, the CAS redistributes the institutional funds between the member research institutes using evaluation methodology that involves international peer review. Overall, about 44% of the national institutional funding in 2014 is channelled to the sector of higher education by the MEYS, which distributes the funds among the individual higher education research organisations using results of the formulae-based evaluation of Metodika 2013.

4.2 Private R&D expenditure

Business enterprise expenditure on R&D (BERD) accounted for 54% (€1.77b) of GERD in 2015. BERD as % of GDP reached 1.1% in 2014 and 1.06% in 2015, which represents a significant increase compared to 0.96% in 2012 catching-up with the EU28 average of 1.30% (Eurostat, 2016).

BERD is characterised by a level of openness that is one of the highest in the EU. In 2015 about 60% of BERD was performed by foreign affiliates and concentrated in the medium-high tech sector (automotive and engineering, see: Figure 1). Likewise, BERD funding from foreign business sources increased rapidly, in fact nearly tripled, from €148m in 2010 to €410m in 2014, thus financed nearly a fifth of BERD (CZSO, 2016).

Domestic companies concentrate more on R&D in services (information and communication, services related to automotive, professional and scientific activities, see: Figure 1) but overall their innovation capabilities remain modest and the technological lag with foreign own firms is considerable. Moreover, 97% of the domestic business R&D funding was spent by the firms themselves, hence only 3% were contracted out to the public sector, which testifies to the very weak link between the business sector and other parts of the system. This proportion remained remarkably stable over the last ten years. Somewhat surprisingly foreign business R&D funding tends to be more open with 11% being spent outside of the business sector, almost all of which goes to the PROs and only a negligible amount ends up in the HEIs (CZSO, 2016).

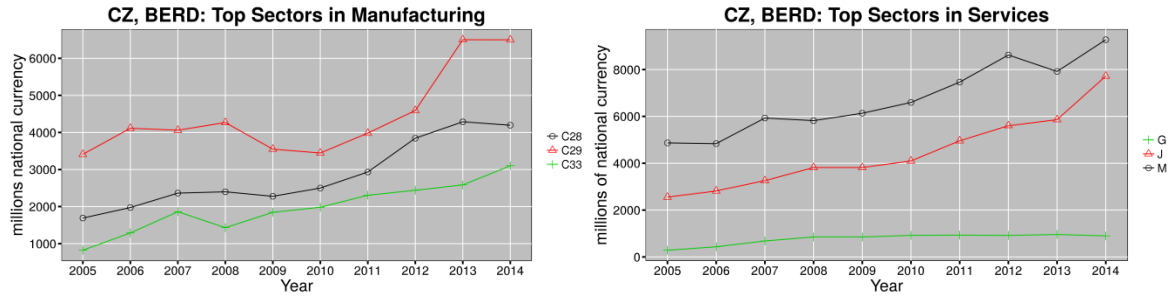

Figure 1 Top sectors: manufacturing (C28: manufacture of machinery and equipment n.e.c; C29=manufacture of motor vehicles, trailers and semi-trailers; C33=repair and installation of machinery and equipment). Top sectors: service (G=wholesale and retail trade, repair of motor vehicles and motorcycles, J=information and communication, M=professional, scientific and technical activities).

4.3 Public sector innovation and civil society engagement

The public sector suffers from weak innovation culture, a traditional approach to innovation policies that are designed in a top-down manner with a scarce civil society engagement, and a risk-aversive methodology in awarding contracts. Consequently, the Public Sector Innovation Scoreboard 2013 (European Commission, 2013) indicates that the Czech Republic generally ranks below the EU28 average. Similarly, the "Government

procurement of advanced technology products" index by WEF ranks the country 106th in 2015, behind most Member States.

In recent years, the focus of innovation policy started to shift from supporting internal R&D in firms to stimulating public-private research cooperation and commercialization of research results. The patenting activity of public research organizations has grown in the recent years (from 108 patents granted by the Czech Industrial Property Office in 2008 to 221 in 2014). However, the growth in patents has not been matched with an increase of licensing agreements, i.e. most of the public sector patents are unused.

Citizen science activities are underdeveloped and the capacity remains very limited. Country-wide platforms do not exist, except for the cooperation of Junák and other youth organizations with the university sector, and project COLOSS that engages beekeepers to collect data about the bee population.

5. Innovation challenges

5.1 Reforming governance of the public research sector

Description

Since 2008 the governance system is undergoing a profound reform (CRDI, 2009), in which the CRDI and SRI have become the central actors. However, the governance framework continues to suffer from overlapping roles, coordination problems and fragmentation of funding (SRI, 2015). The reform introduced a performance-based methodology for evaluation of R&D results and distribution of institutional funding. However, the new system is criticized for being too simplistic, stimulating opportunistic behaviour and creating unstable funding conditions (Arnold, 2011). The evaluation methodology Metodika 2013 establishes international peer review processes, bonuses for research excellence, and offers official guidelines for the evaluation of public R&D support (CRDI, 2013). National R&I programme evaluation suffers from poor quality and ex-ante, on-going, ex-post evaluations and impact analyses are not conducted (Arnold, 2011).

Policy response

National Research, Development and Innovation Policy of the Czech Republic 2016–2020 (SRI, 2016a) emphasises the reform of governance and evaluation framework. The Deputy Prime Minister for the Science, Research and Innovation aims to form a new Ministry for Research and Development. The Government approved the legislative intention of a new law on support for R&I that clarifies the status of the Ministry. The civil service reform, implemented in mid-2015, aims to decrease the high turnover of civil servants and enhance the analytical capacities of the public administration. IPN Metodika (2014) project has proposed a more complex evaluation methodology based on international best practices and peer reviews (Arnold and Mahieu, 2015). Based on the results obtained in 2015, a new evaluation methodology of research organizations should be submitted to the Government by the end of 2016 and implemented in 2017. The IPN Metodika also outlined guidelines for evaluation of R&I programmes and systemic changes needed for their implementation (Srholec, 2015). Likewise, new rules for preparation and evaluation of R&I programmes, including ex-ante, interim, and ex-post impact evaluation, should be submitted to the Government by the end of 2016.

Policy Assessment

The concentration of R&I policy under the new Ministry for Research and Development could be a way to improve coordination of the system, clarify the division of competences and obtain resources for evaluation. The new Ministry is assumed to take over executive responsibilities from the CRDI and partly from the MEYS, include GA CR and TA CR, and hence become the central R&D policy actor. However, the proposal leaves out competences for HIEs under the MEYS and for business R&I support under

the MIT. Similarly, the administration of OP RDI and OP EIC remain under the MEYS and MIT, respectively. As a result, it solidifies the fragmentation of competences for governing key aspects of the R&I system into three ministries. The proposal has been criticized not only by opposition parties but also from within the ruling coalition. If approved by the Parliament, the new law may become effective in 2018 but the new ministry is not likely to start operating before 2019.

Metodika 2013 tends to spread thinly the resources with limited incentives for research excellence and without achieving critical mass. Starting from 2017 it should be replaced by Metodika 2017+, which is prepared by the CRDI and SRI. The funding decisions based on this new methodology are expected to happen in 2018.

Standards for R&I programmes evaluation continue to be fairly low and evaluations have limited strategic insight for policy makers but little attention is paid to this problem. The key challenge is to improve the underdeveloped evaluation culture.

5.2 Opening labour market for researchers

Description

Labour market for researchers is characterized by institutional autonomy, self-governing rights, decentralized decision-making powers and heterogeneous recruitment and promotion practices. However, the management of researchers is outdated (Arnold, 2011). Academic careers are hierarchical with limited competition and widespread in-breeding. Opportunities for early career researchers are unattractive (National Training Fund, 2012).

Horizontal mobility of academic staff is low with more than 50% of non-mobile researchers as compared to 30% in UK, Sweden or Belgium and 44% in Slovakia and Hungary (Science Europe, 2013). Only Italy, Romania, Poland, Lithuania and Croatia shows a higher sedentary researcher rate than the one in Czech Republic. Moreover, labour market is internally oriented (SRI, 2016b). Only 6% of researchers in the public R&D sector are foreigners, many of which are Slovaks (Eurostat, 2016). Public funders support almost exclusively resident researchers.

Gender problems in research are daunting (NKC – ženy a věda, 2015). The share of female researchers is far below the EU28 average and decreasing. Career progression path is difficult in particular for young female scientist. After maternity leave the restoration to the same position is guaranteed. However, an extension of the contract due to maternity leave is not guaranteed if the researchers works in a fixed-term contract. This is a significant barrier for female researchers' career.

Policy response

The higher education reform initially involved bold plans for modernization of conditions for human resources development. However, the drafting process has been derailed due to political instability and disagreements among the stakeholders. Eventually, the reform plans were abandoned and only the accreditation system has improved. Several measures are in place to attract foreign researchers. Inward flows of researchers are supported by the EURAXESS network Scientific Visa Package simplifies inward mobility of researchers from the non-EU countries. CAS awards the Fellowship J. E. Purkyně to attract outstanding scientists from abroad. NÁVRAT, i.e. "return", programme administered by the MEYS improves conditions for re-integration of top researchers coming back from abroad. Gender issues have been for long ignored in R&I policy. SRI (2016a) is the first major strategic document that pays attention to gender equality and gender mainstreaming and outlines a target for increasing the share of female researchers.

Policy Assessment

Human resources management practices in the public sector could be improved reducing in-breeding, intensifying competition and making careers more attractive for young people. Horizontal and vertical mobility could be incentivized by reducing the barriers for circulation of people in the innovation system. Public research internationalization could be supported by an internationalization strategy, which is lacking. Awareness of gender issues is increasing, however, there are no regulations addressing gender imbalances and there are no public sector funding or other instruments targeting female researchers. Reform of the higher education system is long overdue, the higher education act has been amended eighteen times and it is acknowledged that comprehensive changes in the approach to human resource management in the public sector are necessary.

Limited availability of qualified human resources on the labour market is likely to become a major bottleneck for success of the new research centres and infrastructure projects. Some of the new staff will have to be poached from the existing infrastructures and probably the majority will have to come from abroad. Attracting large numbers of top foreign researchers in short time will not be easy given the above mentioned problems and the competitively low remuneration of scientists in the national system. Finally, the quality of the new research infrastructures has to be coupled with other soft measures in order to stimulate researchers to seek employment in the regions where those infrastructures are located.

5.3 Strengthening public-private linkages

Description

Underdeveloped public-private research linkages are a major weakness of the national innovation system (SRI, 2015). As discussed in Section 4.2 only 3% of the domestic business R&D funding is contracted out to the public sector. Formal methods of intellectual property rights (IPRs) protection remain underutilized, despite that state-of-the art IPRs legislation is in place. The only exception is the Institute of Organic Chemistry and Biochemistry of CAS that accounts for a lion share of national income from patents licence fees. The propensity to public-private co-publication is below the EU28 average and with a decreasing trend (European Commission, 2016a).

The public sector produces results with low application relevance and low patenting activity (SRI, 2016b). There is a space for improvements in the commercialization of research outputs, in the knowledge transfer practices and develop further an entrepreneurship culture (MIT, 2011). The business sector lags behind the technology frontier with domestic firms mostly absorbing existing technologies rather than interacting with academics. Poor mobility of human capital across sectors reinforces the problem.

Policy response

The improvement of public-private linkages has been for long a top objective of R&I policies (SRI, 2016a). TA CR provides a portfolio of programmes, namely ALFA, Competence Centres, DELTA and EPSILON, which main goal is to promote collaboration of enterprises with research organisations in the public sector, GAMA is specifically designed to support practical application and commercial use of R&D results, ZÉTA supports horizontal mobility of young researchers. MIT operates TRIO program supporting applied research and public-private cooperation and the CzechInvest runs programmes stimulating knowledge transfer and the creation of science and technological parks and technology transfer offices. The OP EI and OP RDI in the previous programming period 2007-2013 also included several smaller programmes supporting knowledge transfer. Follow-up measures of this kind are also foreseen in the upcoming programmes under the OP EIC and OP RDE. Tax credits that enable enterprises to deduct R&D expenditures carried out in-house have been extended to the purchase of external R&D services from research organisations. This measure deepens

public-private linkages. Most regional governments have implemented innovation voucher programmes, though funding channelled through this route has been limited.

Policy Assessment

The policy effort has been remarkable resulting in a wide portfolio of support measures that have not yet been evaluated and streamlined. Nevertheless, the linkages between public and private R&D sectors could be further improved. IPRs continue to be underused. Policy measures supporting horizontal mobility such as traineeships or integration in the organization of industry-oriented PhD programmes are too few. More emphasis on supporting joint public-private research projects in subsidy programmes and the new tax credit seem promising. Poor commercialisation of public R&D outcomes requires systematic attention. Public sector researchers have low incentives to commercialise research results. The evaluation system at both the organization and individual level relies on indicators of scientific output and incentivise scientists only marginally to commercialize activities (see Pillar III of Metodika 2013).

Major unsolved problems are the lack of supporting institutions, insufficient supply of mediation services and shortage of qualified human resources for knowledge transfer. The lack of rules, the inadequate enforcement of the existing ones and ineffective administrative processes create ground for opportunistic behaviour of researchers when deciding on who owns IPRs. Knowledge transfer incentives are set through internal regulations established at the level of individual organizations without following standards of behaviour. National strategy of knowledge transfer is lacking.

5.4 Deepening innovation capabilities and demand for innovation

Description

The business sector is structurally advanced with a large share of industries considered to be high- and medium-high-technology (European Commission, 2016a). However, it specializes in low value added segments of global value chains (TA CR, 2015). BERD has grown but tends to concentrate downstream for domestic companies. The demand of research input is limited and innovation is focused on absorbing foreign technologies. Patenting is low and path-breaking innovations are rare. Domestic sources of knowledge generation have not been established as the main driver of growth (OECD, 2016). More than 50% of BERD is performed by foreign affiliates (Eurostat, 2016). Several MNCs have invested in R&D centres but the core research is done in the headquarters abroad (MIT, 2011).

Birth rate of innovative start-ups is low (MIT, 2011 and CRDI, 2016). Limited access to external private sources of finance and venture capital is an obstacle for improving the innovativeness of SMEs (European Commission, 2016d). Demand for innovation, as a pull factor, is below potential (SRI, 2016b) from both the business sector towards the publics sector and vice-versa (European Commission, 2013 and 2015).

Policy response

R&D in the business sector is stimulated with tax credits and direct R&D subsidy programmes such as IMPULS, TIP, ALFA, EPSILON and TRIO (EY, 2014). TA CR and MIT subsidy programmes have not been devoted to support innovation in SMEs. Nevertheless, measures are increasingly designed to boost public-private collaboration and technology transfer from research organizations. This should stimulate the innovativeness of SMEs providing human resources and infrastructure. Regional bodies support SMEs with innovation voucher programmes. European structural funds OP EIC are foreseen to address these challenges.

CzechInvest, an agency of MIT responsible for attracting R&D related FDI, provides specialized services to entrepreneurs with CzechAccelarator targeted on internationalization of innovative companies and CzechEkoSystem couching young

entrepreneurs. Moreover, there have been bottom-up efforts to promote start-ups of university students, such the InovaJET, xPort and Point One business incubators.

Venture capital market is underdeveloped. INOSTART programme by the commercial bank Česká spořitelna and the MIT remains the only instrument supporting start-ups with loan guarantees for innovative projects. Plans to boost the access to venture capital through public-private seed fund failed under the previous OP EI but they are being re-launched under the OP EIC in the new programming period with the government approval to establish a National Innovation Fund. Public procurement is not seen as an instrument to promote innovation.

Policy Assessment

Policies have shifted from a traditional focus on science and research to boost technology transfer and innovation. Still, the current policy mix is dominated by R&D subsidy programmes with limited efforts devoted to support venture capital or business angels and revolving funds. The existing measures have had only a partial success. Rigorous evaluation of public R&I support programmes is not conducted hindering policy learning.

The new programming period 2014-2020 foresees a larger portfolio of funding measures. It needs to be designed taking into account the problems with the public-private seed fund and revolving measures in the 2007-2013 programmes. CzechInves has managed successfully to integrate management of the EU Structural Funds with FDI and innovation programmes but the creation of the new Agency for Entrepreneurship and Innovation may have an impact on the coordination of those policies.

The RIS3 agenda provides much needed platform for improving coordination between the various policy instruments, including within the supply side and between the government and regions, and for better exploiting their synergies (European Commission 2016g). More measures that go beyond the direct R&DI subsidies, including public innovation procurement, are desirable in the future.

6. Focus on creating and stimulating markets

This section aims at describing and assessing national level efforts to introduce demand-side innovation policies to stimulate the uptake of innovation or act on their diffusion, including public procurement and regulations supporting innovation. It also analyses policy measures aimed at internationalisation of companies with the aim of increasing the innovativeness of the economy.

Already in 2011 the National Innovation Strategy (MIT, 2011) pointed out that the R&I policy lacks demand side measures, which is a still persisting issue (TA CR, 2016a). In 2015, the total market of public procurement was equal to €20.4b or 12.4% of the GDP (MRD, 2016). In 2014, for which detailed data are available, the procurement contracts for R&D were limited to €41m, i.e. about 0.2% of the total. Public tenders, except of those for R&D, are seldom recognised as the opportunity to promote innovation and a national target on public procurement of innovative goods and services has not been announced.

Official statistics of R&D intensive FDI investments does not exist. Nevertheless, given that the largest R&D spenders are foreign affiliates (see Section 3.2), it is evident that the Czech economy managed to attract sizeable amount of R&D related FDI. Moreover, CzechInvest, promotes general investment incentive programme, organizes matchmaking events between foreign investors and indigenous actors, and encourages the internationalization of Czech firms with a series of projects (Foreign Cooperation Programme, Gesher/Most programme and the Czech Accelerator project).

Public procurement in R&D for the needs of public administrations has been centralised under the BETA programme of TA CR with an allocated budget of €25m over 2012-2016. The program has been used by the government to obtain research contracts for which all

the eligible costs have been financed. BETA2 is a follow-up programme with a budget of €59m over 2017-2021.

To promote the internationalization of company several public (or publicly owned) organizations provide support to exporting firms. CzechTrade, an agency of MIT operating worldwide via 47 foreign representatives, promotes export through country marketing and information sharing. Czech Export Bank is a state-owned banking institution that supports mainly SMEs in providing financial services related to exports. Export Guarantee and Insurance Corporation offers credit insurance connected with exports of goods and services against political and commercial risks.

R&I policies continue to neglect the potential of using demand side instruments and remain to be rooted in the linear model of innovation. Public procurement does not consider the objective of supporting innovation. It is far behind the EU best practice (European Commission, 2016bc) and it suffers from an excessive use of the lowest price criterion for awarding contracts. Public officials are reluctant to deviate from this mechanism for fear to trigger corruption allegations.

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List of abbreviations and definitions

AIE	Association of Innovative Entrepreneurship *(Asociace inovačního podnikání ČR)*
API	Agency for Entrepreneurship and Innovation *(Agentura pro podnikání a inovace)*
AVO	Association of Research Organizations (*Asociace výzkumných organizací)*
BERD	Business Expenditure on Research and Development (*Výdaje na výzkum a vývoj v podnikatelském sektoru)*
CAS	Czech Academy of Sciences (*Akademie věd ČR)*
CHEI	Council of Higher Education Institutions (*Rada vysokých škol)*
CRC	Czech Rectors Conference (*Česká konference rektorů)*
CRDI	Council for Research, Development and Innovation (*Rada pro výzkum, vývoj a inovace)*
CZK	Czech koruna (*Česká koruna)*
CZSO	Czech Statistical Office (*Český statistický úřad)*
EC	European Commission (*Evropská komise)*
ELI	Extreme Light Infrastructure (*Extreme Light Infrastructure)*
ERA	European Research Area (*Evropský výzkumný proctor)*
ERDF	European Regional Development Fund (*Evropský fond pro regionální rozvoj)*
ESF	European Social Fund (*Evropský sociální fond)*
ESFRI	European Strategy Forum on Research Infrastructures (*European Strategy Forum on Research Infrastructures)*
ESIF	European Structural and Investment Funds (*Evropské strukturální a investiční fondy)*
EU	European Union (*Evropská unie)*
EU28	European Union including 28 Member States (*Evropská unie s 28 členy)*
FP	European Framework Programme for Research and Technology Development (*Evropský rámcový program pro výzkum a vývoj)*
FP7	7th Framework Programme (*7. rámcový program pro výzkum a technologický rozvoj)*
GA CR	Czech Science Foundation (*Grantová agentury ČR)*
GDP	Gross Domestic Product (*Hrubý domácí product)*
GERD	Gross Domestic Expenditure on R&D (*Celkové výdaje na výzkum a vývoj)*
HEI	Higher education institutions (*Vysokoškolský sector)*
ICT	Information and Communication Technologies (*Informační a telekomunikační technologie)*
IOCB	Institute of Organic Chemistry and Biochemistry of CAS (*Ústav organické chemie a biochemie AV ČR, v.v.i.)*
IPR	Intellectual Property Rights (*Práva duševního vlastnictví)*

MEYS	Ministry of Education, Youth and Sports of the Czech Republic (*Ministerstvo školství, mládeže a tělovýchovy ČR)*
MIT	Ministry of Industry and Trade of the Czech Republic (*Ministerstvo průmyslu a obchodu ČR)*
NIF	National Innovation Fund (*Národní inovační fond)*
OP	Operational Programme (*Operační program)*
OP EI	Operational Programme Enterprise and Innovation (*Operační program Podnikání a inovace)*
OP EC	Operational Programme Education for Competitiveness (*Operační program Vzdělávání pro konkurenceschopnost)*
OP EIC	Operational Programme Enterprise and Innovation for Competitiveness (*Operační program Podnikání a inovace pro konkurenceschopnost)*
OP HRE	Operational Programme Human Resources and Employment (*Operační program Lidské zdroje a zaměstnanost)*
OP PGP	Operational Programme Prague – Growth Pole of the Czech Republic (*Operační program Praha – pól růstu ČR)*
OP RDI	Operational Programme Research and Development for Innovation (*Operační program Výzkum a vývoj pro inovace)*
OP RDE	Operational Programme Research, Development and Education (*Operační program Výzkum, vývoj a vzdělávání)*
PROs	Public Research Organisations (*Veřejné výzkumné organizace)*
R&D	Research and development (*Výzkum a vývoj)*
RDI	Research, Development and Innovation (*Výzkum, vývoj a inovace)*
SRI	Section for Science, Research and Innovations at the Office of the Government (*Sekce pro vědu, vývoj a inovace vznikla při Úřadu vlády)*
TA CR	Technology Agency of the Czech Republic (*Technologická agentura ČR)*

Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016
GDP per capita (euro per capita)	14100	14900	15600	15400	15000	14900	15800	
Value added of services as share of the total value added (% of total)	61.41	61.54	60.6	60.48	60.62	59.37	59.71	
Value added of manufacturing as share of the total value added (%)	22.87	23.45	24.44	24.73	24.83	26.76	26.97	
Employment in manufacturing as share of total employment (%)	25.3	24.76	25.73	25.87	25.75	25.94	26.41	
Employment in services as share of total employment (%)	59.81	60.27	59.67	59.65	60	60.25	60.11	
Share of Foreign controlled enterprises in the total nb of enterprises (%)	2.41	2.21	1.53	1.33	1.33			
Labour productivity (Index, 2010=100)	97.9	100	101.9	102.4	102.3	103.7	108.2	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	1.08	0.98	1.1	1.22	1.11	1.16		
Summary Innovation Index (rank)	20	20	20	20	21	21	21	
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				43.9		42		
Innovation output indicator (Rank, Intra-EU Comparison)			17	16	14	15		
Turnover from innovation as % of total turnover (Eurostat)		15.3		13.4				
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						33	36	27
Ease of getting credit (WB GII) (Rank)						22	27	
Venture capital investment as % of GDP (seed, start-up and later stage)	0.001	0.007	0.005	0	0	0.004	0.002	
EC Digital Economy & Society Index (DESI) (Rank)						18	15	17
E-Government Development Index Rank		33				53		50
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	26	23	42	30	29	37	32	36
GERD (as % of GDP)	1.3	1.34	1.56	1.78	1.9	1.97	1.95	
GBAORD (as % of GDP)	0.59	0.57	0.64	0.64	0.65	0.63	0.59	
R&D funded by GOV (% of GDP)	0.62	0.6	0.65	0.66	0.66	0.65	0.63	
BERD (% of GDP)	0.73	0.77	0.86	0.96	1.03	1.1	1.06	
Research excellence composite indicator (Rank)				19				
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		6.61	6.54	6.65	7.3			
Public-private co-publications per million population	25.32	25.62	27.75	19.42	16.64	13.79		
World Share of PCT applications	0.15	0.11	0.09	0.1	0.11	0.11		

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