

# National Research and Innovation Strategy for Smart Specialisation of the Czech Republic (National RIS3 Strategy)

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## List of Abbreviations

AS CR	Academy of Sciences of the Czech Republic
AVO	Association of Research Organisations
BI	Balassa index
CERIT	Centre for Education, Research and Innovation in ICT
CTT	Technology Transfer Office
CR	Czech Republic
CSO	Czech Statistical Office
EGAP	Export Guarantee and Insurance Corporation
EC	European Commission
ELI	Extreme Light Infrastructure (ESFRI project)
ERA	European Research Area
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	2014–2020 European Structural and Investment Funds
EPO	European Patent Office
EU	European Union
FTE	Full Time Employee Equivalent

GCI	Global Competitiveness Report
GEM	Global Entrepreneurship Monitor
GPTs	General Purpose Technologies
GDP	Gross domestic product
GVA	Gross value added
HW	Hardware
ICT	Information and Communication Technology
IROP	Integrated Regional Operational Programme
R&D IS	Research and Development and Innovation Information System
IT4I	IT4Innovations (National Supercomputing Centre – Ostrava)
KETs	Key Enabling Technologies
LTE	Long Term Evolution wireless broadband technology
MRD	Ministry for Regional Development
MIT	Ministry of Industry and Trade
SMEs	Small and medium-sized enterprises
MEYS	Ministry of Education, Youth and Sports
MI CR	Ministry of the Interior of the Czech Republic
MoA	Ministry of Agriculture
NACE	Statistical classification of economic activities
NATO	North Atlantic Treaty Organisation
NGA	Next-generation access
NIS	National Innovation System
MNCs	Multinational corporations
NPISH	Non-profit institutions serving households
NTF	National Training Fund
OECD	Organisation for Economic Co-operation and Development
OPEI	Operational Programme Enterprise and Innovation
OP EIC	Operational Programme Enterprise and Innovation for Competitiveness
OP PGP	Operational Programme Prague the Growth Pole of the Czech Republic
OP RDI	Operational Programme Research and Development for Innovation
ECOP	Education for Competitiveness Operational Programme
OP RDE	Operational Programme Research, Development, and Education
OP EMP	Operational Programme Employment
RES	Renewable Energy Sources
PCT	Patent Cooperation Treaty
pp	Percentage point
PIAAC	Programme for International Assessment of Adult Competencies
PISA	Programme for International Student Assessment
FDI	Foreign direct investment
RIV	Information Register of R&D Results (data part of the R&D Information System, R&D IS)
RIS3	Research and Innovation Strategy for Smart Specialisation
RDIC	Research, Development and Innovation Council
SF	EU structural funds in the period 2007–2013
SITC	Standard International Trade Classification

SS	Secondary schools
SW	Software
TA CR	Technology Agency of the Czech Republic
TEP	Territorial Employment Pact
USPTO	US Patent and Trademark Office
v.v.i.	Public research institution
R&D	Research and development
R&D&I	Research, development and innovations
WEF	World Economic Forum
RO	Research organisations
STP	Science and Technology Park
HEI	Higher education institutions
PS	Primary schools



# 1. Introduction

## 1.1. The purpose and focus of the National Research and Innovation Strategy for Smart Specialisation of the CR (National RIS3 Strategy)

The purpose of the National Research and Innovation Strategy for Smart Specialisation of the CR (hereinafter the “Smart Specialisation Strategy of the CR” or the “National RIS3 Strategy”) is to effectively target funds – European, national, regional, and private – at activities that lead to strengthening the research and innovation capacity and at promising areas that have been singled out as priorities in order to fully utilise the knowledge potential at the national and regional level and at a combination of both and, in turn, to promote the reduction of unemployment and strengthen the competitiveness<sup>1</sup> of the economy.

As stated by the European Commissioner for Regional Policy Johannes Hahn:

*„To help Europe recover from the economic crisis, we need activities and investments that help countries and regions to release a new potential for growth and increase their role in innovation, improve productivity and competitiveness.*

...

*Rather than a “top-down” approach, which comprises mainly public institutions and authorities, the new concept of investment in innovation requires a “bottom-up” approach that is shaped in a joint process of “entrepreneurial discovery”, which includes the private sector and the academic community and builds on internal strengths of each region, its entrepreneurship, and competitive advantages. Through this process, smart specialisation strategies can unlock economic transformation through modernisation, diversification and radical innovation in all regions of the European Union.”*

*Johannes Hahn, Smart Specialisation and Europe’s Growth Agenda*

The RIS3 strategy is to be understood in a wider context of European public policies. In this context, smart specialisation strategies are a precondition to the fulfilment of EU regional and cohesion policies and Europe 2020 objectives. These have been formulated in response to the economic crisis that hit Europe after 2007–8 and strive to restore European economic growth. However, it must be emphasized that this is economic growth that is based on new foundations so that it is consistent with other important social objectives. Smart specialisation strategy is a strategy for growth that is based on the principles of intelligent solutions (“smartness”), sustainability and inclusiveness. Within an outlined European strategy, key areas of intervention represent effective investments in education, research, development and innovation; a shift to a low-carbon economy; and an emphasis on job creation and poverty reduction.

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<sup>1</sup> Unless specified otherwise, the National RIS3 Strategy uses the term competitiveness to refer to *economic* competitiveness.

The existence of a sophisticated RIS3 strategy also represents a precondition for implementing European Union regional policy interventions (EU structural and investment funds, ESIF) in the area of support for research, development and innovation. According to the General Regulation (Regulation (EU) No 1303/2013 of the European Parliament and of the Council), the obligation to prepare and submit to the European Commission a strategy for smart specialisation applies to those Member States or regions wishing to invest EFIS resources in the following thematic objectives:

1. **Strengthening research, technological development and innovation**
2. **Improving access to information and communication technologies (ICT), usage and quality of ICT**

In that sense, the smart specialisation strategy is not only a precondition to interventions financed by ESIF within the given thematic objectives and investment priorities, but also the coordination mechanism for interventions that are to be implemented within the given area, regardless of the source of financing. The primary purpose of RIS3 is not to distribute ESIF resources, but **to support economic growth and transformation towards a knowledge economy, taking into account the societal challenges and conditions existing in member states and their regions**. A special and important feature in designing and implementing the RIS3 strategy is an emphasis on the “entrepreneurial discovery process” that includes – besides public administration – the participation of entrepreneurs, researchers and other socio-economic groups, including civil society in the role of an innovation user (the “quadruple helix”). This process applies not only to defining the strategy’s objectives, but it must take place throughout the implementation of the strategy in order to bring not only feedback and verification of implemented interventions but also new suggestions and recommendations for targeting upcoming interventions and refining the proposed areas of specialisation at which interventions will be oriented.

The main objective and purpose of RIS3 is to ensure economic growth and competitiveness that are based on the utilisation of knowledge and innovations (as opposed to competitiveness that is based mainly on efficiency). The “smart or intelligent” use and development of specialisation, combining economic specialisation and knowledge specialisation, is an instrument to promote economic growth. In this sense, RIS3 is a partial economic strategy. **Despite that, RIS3 cannot be limited to a narrow economic dimension, even if it constitutes its main purpose**. This is for several reasons: (i) responding to societal challenges and problems (e.g. environmental sustainability, social cohesion, in the narrow sense e.g. a low-carbon economy and technologies leading to greenhouse gas reduction) and finding ways to address them often also has direct economic effects and, of course, mediated and indirect effects, which is why the Smart Specialisation Strategy focuses on them; (ii) the conditions in society strongly influence business, research, education and its quality; the functioning of institutions is an important precondition for the trust of companies, and the Smart Specialisation Strategy therefore also focuses on these conditions, which are not directly related to business or research and development but rather serve as a framework for the effective implementation of activities that constitute the core of RIS3.

## 1.2. The links of RIS3 to other conceptual and strategic documents

The Smart Specialisation Strategy formulates, among others, interventions and proposals designed to improve the application of primarily public research and development. It is in no way a strategic document, the purpose of which would be to affect the entire research and development policy in

the CR. There are other strategic and conceptual documents serving this purpose, for example the National Research, Development and Innovation Policy 2009–2015 and its updates, and others.

Interventions in the field of education are also formulated in the Smart Specialisation Strategy. This is because education is considered the most important cross-cutting factor for developing specialisation domains and, more broadly, for developing innovative business and improving quality and research and development<sup>2</sup>.

### **An overview of strategic and policy documents of the CR, which are explicitly listed in the National RIS3**

<b>Document title</b>	<b>Date of preparation</b>	<b>Prepared by</b>
Analysis of the State of Research, Development and Innovation in the Czech Republic and their Comparison with Foreign Countries in 2012	2012	Office of the Government of the CR (OG CR) – RDIC
The Updated National Policy for Research, Development and Innovation of the Czech Republic for 2009 to 2015 with a view to 2020	2012	OG CR
Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic	2011	MEYS
Digital Czech Republic v2.0 – The Road to the Digital Economy	2013	MIT
Export Strategy of the Czech Republic for the period 2012-2020	2012	MIT
International Audit of Research, Development & Innovation in the Czech Republic	2011	MEYS
National Innovation Strategy of the Czech Republic	2011	MIT
National Research, Development and Innovation Policy of the Czech Republic for 2009–2015	2009	OG CR
National Priorities of Oriented Research, Experimental Development and Innovations	2012	OG CR – RDIC
National Reform Programme of the Czech Republic 2014	2014	OG CR
Economic Growth Strategy of the Czech Republic	2005	OG CR – RDIC
International Competitiveness Strategy of the Czech Republic for 2012–2020	2012	MIT
Human Resources Development Strategy for the Czech Republic		
Education Policy Strategy of the Czech Republic up to 2020	2014	MEYS
The working draft of the main conclusions of the analytical foundation for establishing the research specialisation of the Czech Republic	2014	RIS3 Facilitator
Priorities of the MIT for industrial research, development and innovation – working version	2014	MIT

### **1.3. The creation of the Smart Specialisation Strategy in the CR**

The preparation of the National RIS3 Strategy and its regional annexes began in May 2013 with analytical work in the regions. This work was accompanied by establishing partnerships in the regions for the purposes of regional RIS3, often with the use of existing structures, e.g. for regional innovation strategies. The outputs of the work and discussions that have gradually emerged in the

<sup>2</sup> Interventions in education are governed by the Education Policy Strategy of the Czech Republic up to 2020 and the Long-Term Plan for the Development of Higher Education, which is an ex-ante conditionality for higher education. However, it should be emphasized that RIS3 does not constitute a precondition for the area of education.

regions since May have been one of the sources for the proposal of the national RIS3 document, to which regional documents are annexed.

However, the National RIS3 is a separate document, it is not a summary or an excerpt of the regional annexes. The national RIS3 is the defining national document and the regional annexes specify and clarify its focus, especially in the case of the proposed specialisations, and – in some cases – they also add proposals for specific interventions that reflect the specific conditions existing in each region.

The regional annexes and their contents were coordinated with the National RIS3 and, throughout the process of document preparation at both levels, there was intensive discussion within the implementing teams.

The work on the national document was launched in November 2013 after the work of the RIS3 facilitator had started. The National RIS3 was prepared in connection with existing strategic documents of the CR, including mainly the following:

- National Innovation Strategy of the Czech Republic
- International Competitiveness Strategy of the Czech Republic for 2012–2020
- Update of the National Research, Development and Innovation Policy of the Czech Republic for the period 2009–2015 with an outlook to 2020
- National Priorities of Oriented Research, Experimental Development and Innovations
- National Reform Programme of the Czech Republic 2014
- and others

In addition to the above documents, partial analytical works that had been previously prepared by different entities were also used, including specific regional strategies and also analyses prepared at the regional, national and international levels, as well as other documents.

In order to propose selected domains, within which the CR has a strong potential for smart specialisation, separate analyses have been prepared to provide the framework for more accurate targeting of interventions. Data and analyses were updated as of 31 July 2014. Subsequent updates will be carried out throughout the implementation of RIS3. The sources for the proposal of specialisation domains also included underlying documents that were prepared for that purpose from June to September 2014:

- The working draft of the main conclusions of the analytical foundation for establishing the research specialisation of the Czech Republic, prepared by the Technology Centre of the AS CR for MEYS group III.
- MIT priorities for the area of industrial R&D and innovation – working version, prepared by MIT

Proposals coming from both documents were taken into account within the relevant chapter of the specialisation proposal.

The areas of specialisation, as described analytically and proposed in a special chapter of the National RIS3, were refined in the regional annexes within on-going discussions with entrepreneurs, researchers and representatives of public administration that were started in the regions in the period from September 2013 to February 2014 (the “*entrepreneurial discovery process*” at the regional level). This process continued in the regions until July 2014 and it is envisaged to continue further after the start of RIS3 implementation. ***The National RIS3 used the “entrepreneurial***

***discovery process” in the regions to complement, or more specifically to specify the specialisation domains at the national level***, as evident from the chapter on the research and economic specialisation of the Czech Republic.

In 2014, the national RIS3 strategy underwent a multi-cycle and multi-stage discussion and comment process, on the basis of which it was adjusted until the current version was refined: the document was discussed three times and approved by the National RIS3 coordination council (January, June and October 2014) and it was also discussed within the “*entrepreneurial discovery process*” in the form of a round-table meeting with representatives of leading companies and research organisations (January 2014) and the subsequent 4 innovative platforms (October 2014).

The **regional annexes** mentioned above are part of the National RIS3. The purpose of the regional annexes is to identify the peculiarities of regional innovation systems<sup>3</sup> in the different regions and explain their context, while taking account of and placing emphasis on the specific effects of existing or potential specialisation in the regions. Despite a considerable homogeneity of the economy in the Czech Republic the regional innovation systems in the Czech regions vary considerably, not only in terms of the structure/nature of the individual parts of the innovation system, but also in terms of institutional development and grounding. Both of these reasons are strong arguments for proposing specific regional interventions that will reflect regional peculiarities and complement the extensive interventions implemented at the national level.

The regional RIS3 managers, who started their activities in May 2013, were tasked with preparing the RIS3 regional annexes. **The progress of the development of regional annexes** of the National RIS3 and the **progress of the establishment of regional partnerships** for the preparation and implementation of interventions for smart specialisation **is currently different in each region**. These differences primarily reflect the *institutional situation* in the different regions, namely the readiness of each player within the triple/quadruple<sup>4</sup> helix and the political leadership in the regions for this type of partnership. Some regions are better prepared than others from both perspectives because they have already developed and implemented their innovative strategies in the past. In some regions, it is more difficult to kick-start activities for the preparation of regional annexes because they have so far never been preparing activities and interventions to support R&D&I (and smart specialisation) and have never dealt with them. The newly submitted RIS3 concept thus requires

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<sup>3</sup> According to Cooke (2002) or Etzkowitz and Leydesdorff (2000), the concept of innovation systems includes the knowledge-utilisation subsystem (the corporate sector, public administration) and the knowledge-production subsystem (research subsystem) that includes e.g. public research organisations, universities, private research organizations and businesses implementing research, etc. Where the National RIS3 mentions research, it is deemed to include both of the above subsystems.

<sup>4</sup> The concept of the triple helix (Etzkowitz, 1993, Etzkowitz and Leydesdorff, 2000) is an analytical tool suitable for analysing the organisational and institutional arrangement of key actors within the innovation system, which determines the competitiveness of regions (for more information see Blažek and Uhlíř, 2011). The term quadruple helix was introduced into scientific literature relatively recently, mainly in connection with the concept of smart specialisation. It is an extension of the original concept of triple helix to include the role of the non-profit sector, which may also play a significant role in some innovation systems (national or regional). See also Etzkowitz, H. and Leydesdorff, L. (2000): The dynamics of innovation: from national systems and „Mode 2” To a triple helix of university-industry-government relations. *Research Policy*, vol. 29, pp. 109–123) or Blažek, J. and Uhlíř, D. (2011): *Theory of regional development*. Karolinum, Prague.

often considerable changes in the attitude of these regions to promoting regional development and competitiveness.

**However, all 14 regional annexes were successfully approved by regional assemblies in June–September 2014.**

#### **1.4. The participation of entrepreneurs, researchers and partners from the triple/quadruple helix in the preparation and implementation of Smart Specialisation Strategy**

##### **Entrepreneurial Discovery process**

###### **The “Entrepreneurial Discovery Process” in the period of RIS3 preparation in the regions**

In the regions, the preparation of RIS3 started in the first half of 2013. *Since September 2013, the “entrepreneurial discovery process” has started*, i.e. a process engaging individual entrepreneurs, researchers and representatives of other entities of the triple/quadruple helix in RIS3 preparation at the regional level. The participation of entrepreneurs and researchers, representatives of public authorities, and the non-profit sector took place in different ways and at different levels:

- Business/innovation platforms represent groups, in which entrepreneurs prevail and in which researchers and other representatives of the triple/quadruple helix participate;
- Regional councils for innovation, which represent the management structure of regional RIS3s, but these also generally include – among other members – the representatives of entrepreneurs;
- Ad-hoc meetings and gatherings with entrepreneurs and researchers, which were organised by regional RIS3 managers in cooperation with regional governments;
- Visits to companies and research institutions, discussions about the needs of and barriers to the innovation process in the region;

More detailed information about the process of participation of entrepreneurs, researchers and other stakeholders in the regions during the preparation of regional annexes and the National RIS3 are always mentioned in the relevant regional annex.

The participation of entrepreneurs, researchers and other representatives of the triple/quadruple helix was organised in each region in a somewhat different manner that was adequate and that corresponded to the conditions existing in the given region. In addition, in some regions the effort to mobilise the representatives of the non-profit sector failed, which is why we refer to the triple/quadruple helix rather than just the quadruple helix.

The consultation and participation of entrepreneurs and researchers (and others) were organised in each region in different ways. In some regions, sectoral innovation platforms for the selected knowledge or economic domains of specialisation were established. In others, it concerned – at this

stage – platforms that were organised thematically, e.g. platforms on human resources, entrepreneurship etc.

Representatives of entrepreneurs, researchers and other stakeholders in the regions were consulted and participated in the RIS3 preparation in several rounds, continuously and repeatedly throughout the preparation of regional annexes until their approval by regional assemblies. **Overall, in 14 regions, hundreds of stakeholders** (both business and research, but also entities from the non-profit sector and public administration) **participated in various forms in preparing the RIS3, prioritising and proposing measures and interventions and, in particular, in proposing the specialisation domains.**

In the regions, mainly the regional annexes were consulted, but the participants also had the opportunity to comment on the National RIS3 proposals. Their suggestions were consulted through RIS3 managers and they were adequately incorporated into the National RIS3, **especially in the case of recommendations and proposals for the specification or further definition of (or addition to) the specialisation domains** that were being proposed at the national level. **The specialisation domains at the national level are thus the result of a combination of identifying the needs and specialisations at the national level and reflecting the needs, opinions and recommendations at the regional level.**

#### **The “Entrepreneurial Discovery Process” in the period of the RIS3 preparation at the national level**

The National RIS3 was discussed at a **round-table meeting of entrepreneurs and researchers in January 2014**. This round-table meeting gave birth to innovation platforms at the national level.

**National innovation platforms** were prepared and established from May to July 2014. Their first meeting took place on 6 and 7 October 2014. National innovation platforms were convened for the following specialisation domains, combining the knowledge and economic specialisations as identified in the RIS3 below:

- Engineering, electricity production and distribution, electrical engineering
- IT services and software, electronics, electrical engineering
- Production of means of transport
- Pharmaceuticals and medical technology

The innovation platforms focused on verifying and, above all, **supplementing the National RIS3 proposals, with an emphasis on proposing priorities and recommendations from which the focus of the planned interventions will ensue.**

Innovation platforms at the national level discussed in particular the following:

- Analytical findings from the National RIS3; this discussion was preceded by a structured evaluation of the analytical findings by members of the innovation platforms through an online survey focusing on the members of the quadruple helix.
- Recommendations for interventions that are the most important for addressing problems and causes of problems that were identified in the analytical part and verified by members of innovation platforms.
- Preliminary specification of interventions according to the needs of each innovation platform’s specialisation domains.

Innovation platforms confirmed the National RIS3 Strategy in the form in which it was proposed and discussed during 2014 at a round-table meeting (January 2014) and at meetings of the RIS3 National Coordination Council. Innovation platforms promoted significantly the National RIS3 concept that combines interventions aimed at completing the innovation system of the Czech Republic and its regions (i.e. horizontal interventions) and interventions aimed specifically at strengthening selected specialisation domains (i.e. vertical interventions). Innovation platform stressed the importance of human resources as one of the most important conditions for the further development and growth of the knowledge economy. At the same time, discussions at innovation platforms showed that horizontal interventions have certain sector-specific aspects that must be respected in preparing individual operations.

The focus of interventions aimed at strengthening the specialisation domains will be discussed at further meetings of innovation platforms in the first half of 2015 and beyond. Specifying interventions to take account of the needs of specialisation domains within discussions between entrepreneurs, researchers and representatives of public administration will be an important activity of innovation platforms from 2015 onwards.

The next meeting of national innovation platforms is planned for January/February 2015. In the first year, the national innovation platforms will meet more frequently than generally proposed in the chapter on implementation, i.e. with a frequency of approximately 3 to 4 months. In the subsequent years they will meet as needed, usually twice a year.

***The role of national innovation platforms and regional innovation platforms is described in detail in the chapter on implementation.*** The coherence of national and regional innovation platforms is ensured through the participation of some members of the regional innovation platforms in national platforms, as well as through the opportunity for representatives of the national level to participate in meetings of regional innovation platforms.

#### **The “Entrepreneurial discovery process” during RIS3 implementation.**

The process of participation of entrepreneurs and researchers, and other representatives of the quadruple helix in the search for opportunities to strengthen and develop specialisation will be ensured **mainly within innovation platforms at the national and regional levels**, and also within regional innovation councils. The key role of innovation platforms comprises specifying the proposed specialisation domains, discussing and proposing their profiles, identifying the needs in selected domains, ***identifying opportunities in selected specialisation domains and recommending interventions to strengthen the specialisation domains and their economic benefits***. In this sense, a process that engages mainly entrepreneurs and researchers through innovation platforms is absolutely crucial and irreplaceable for implementing RIS3, targeting interventions, and accomplishing the results of RIS3.



## 2. The starting-point for Smart Specialisation Strategy in the CR

### 2.1. The starting-point for evaluating competitiveness

In the first period of transformation from about the mid-nineties until the first decade of the twenty first century, the Czech Republic drew competitive advantage from the resources based on the availability of skilled labour, which was (and is) more cost-effective than in western neighbours. The massive influx of foreign investment employed large numbers of people, while a gradual increase of management efficiency in foreign companies operating in the Czech Republic and a gradual shift of more sophisticated activities led to an improvement in productivity and export performance. At that time, the Czech Republic had a unique position in the foreign direct investment market, mainly due to the technological advancement of the labour force, the well-managed Czechinvest agency, government incentives, the Czech Republic's accession to NATO and the EU, and its position in the centre of Europe near the main European markets. These conditions, working together, ensured that the CR had a leading position among the countries of the former Eastern Bloc.

The Czech economy has developed its position as a quality manufacturing base for the common European market, within the gap between the higher-cost countries of Western Europe and, at the same time, the more cost-competitive countries in Central and Eastern Europe and in emerging economies. Between 2002 and 2008, despite the on-going restructuring process, the Czech Republic maintained high employment in industry<sup>5</sup>, driven largely by production-type FDI (similarly to Poland, Slovakia and Hungary). This industrial specialisation within Europe was the main source of the country's high economic growth in that period was. However, the gap between the cheaper and lower-quality countries and the higher-cost countries, which the Czech Republic occupies, begins to narrow as the prices of inputs in the Czech Republic grow and, at the same time, as the ratio between quality and production cost improves in other Eastern European and Asian countries.

The fundamental starting point for the above development of the Czech economy is the changing character of the organisation of the world economy. It is increasingly connected not only through international trade, but also through global production networks<sup>6</sup>. These networks are arranged in such a way that, where possible, they are able to service the constantly changing worldwide consumption demand with increasing efficiency. The main organisational force behind these production networks are large multinational companies that use pricing, regulatory and other (e.g. the availability of specific knowledge or competence) differences between countries and regions to optimise the manner in which their own activities and their location are organised. Also, the above optimisation also includes deciding, which activities are to be performed in-house and which are to be outsourced. The manner in which global production networks are organised affects the resulting geographic distribution of specific types of activities (sub-parts of the value chain). The growing degree of vertical disintegration of value chains has increased the importance of supplier-customer relationships and enabled domestic companies to participate in global production networks.

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<sup>5</sup> See table 10 in the annex for more information.

<sup>6</sup> The concept of a global production network or a global value chain includes not only production activities, but also an entire range of service activities of companies from the companies' perspective (financial services, consulting, logistics etc.)

However, from the viewpoint of the above developments, the Czech Republic has been paradoxically moving against the logical shift of the sources of competitive advantage<sup>7</sup>. There was often a downgrading – the restructuring of Czech industry and the inflow of manufacturing FDI enabled the Czech economy and the companies operating there to participate in global production networks, but only at low positions in the production of simple products with lower added value, using less-skilled labour. In some cases there was even a deskilling of workforce due to the predominant use of less-skilled workers for routine tasks with minimal knowledge requirements.

Employment in large industrial enterprises controlled by foreign owners who use the best available workforce has narrowed the space for the establishment of new knowledge-based, high-growth Czech companies. This results in a situation where a class of talented people with the prerequisites for an entrepreneurial career are employed in middle and upper management of foreign companies rather than becoming entrepreneurs. In a longer run, the added value of these people for the Czech economy does not have the same impact as if they established rapidly growing innovative companies focusing on the global market.

A high dependence on foreign companies, in the sense as described above, and the previous decades-long interruption of private enterprise (1939–1989) resulted in the virtual disappearance of entrepreneurship as a craft. The loss/non-development of experience in managing companies in the international competitive environment is a crucial starting point in terms of the development of the economy's innovation potential. In addition, entrepreneurs have a bad image in the Czech society (especially those who are successful) and the reputation of entrepreneurship is harmed by some of them. This further discourages successful and experienced individuals in employee positions from becoming entrepreneurs<sup>8</sup>.

In addition to the low intensity of the setting up of companies<sup>9</sup> and the stagnating rate of new business activities<sup>10</sup>, there has been inadequate development of entrepreneurial skills, the system for providing venture capital and the environment for the development of globally oriented companies with products and services intended for end customers. New, fast growing manufacturing companies are often formed around foreign enterprises and are connected directly or indirectly (through exporting their components or even complex modules to foreign manufacturers of end products) to foreign companies operating in the Czech Republic and abroad. This benefited the economy as a whole, as well as domestic companies. They gained access to know-how, experience and indirectly also to markets, although they often did not get direct access to the core knowledge of end customers/users and their needs, which is one of the main barriers to successfully anticipating innovative demand. Another important consequence for the present is the fact that it is difficult for Czech domestic companies to develop independently, or more precisely to compete (with well-

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<sup>7</sup> The Global Competitiveness Report (WEF) distinguishes globally three stages of development of economies, through which countries gradually go: 1) competitive advantage of economies based on the availability of factors; 2) competitive advantage based on improvement in resource-use efficiency; 3) competitive advantage based on innovation.

<sup>8</sup> For more information see the results of the Global Entrepreneurship Monitor 2011 for the Czech Republic.

<sup>9</sup> The number of newly established companies in the Czech Republic declined in the period 2000–2005, i.e. at the time of the main FDI influx (see Table 11 in the annex).

<sup>10</sup> According to the Global Entrepreneurship Monitor, new business activity includes individuals who carry out specific steps to establish a business or lead companies less than 42 month old – the rate of such activity in the group of people aged 18–64 years declined by 0.21% between 2006 and 2011.

established foreign companies) in demanding markets and enter new markets, in terms of both product and territory. The above situation has led to a deepening specialisation of the Czech processing industry, whose position is being attacked by countries with lower costs that gradually improve the price-quality ratio within industries that are crucial to the Czech Republic – automotive<sup>11</sup>, electronics, electrical engineering, mechanical engineering.

Especially in the past 10 years, there have been an increasing number of *endogenous champions*, i.e. rapidly growing companies established, owned and managed by Czech citizens. They base their growth on knowledge generated in the Czech Republic and on increasing its evaluation through innovation<sup>12</sup>, rather than borrowing know-how and using foreign entrepreneurship. Although the number and power of these companies has been gradually increasing, they have not achieved significance within the Czech economy comparable to that of foreign companies. It is a more robust and more powerful sector of endogenous companies that should form a fundamental pillar of sustainable economic growth in the Czech Republic.

At the same time, our previously lagging competitors (especially Poland) have been improving in the cultivation and presentation of their own institutional and business environment, while – *according to independent assessments – the quality of the Czech environment for entrepreneurship, in a broad sense, has been declining*. According to the Global Competitiveness Report<sup>13</sup>, the overall position of the Czech Republic has been consistently declining in comparison to other countries. In the general competitiveness index, the Czech Republic dropped from the 29th place in 2006 to the 46th place in the 2013–14 edition of the rankings (out of the total of 148 countries). A slight improvement in its position (37th place) in the latest WEF list (2014–2015) cannot yet be seen as a reversal in the trend<sup>14</sup>. Although the number of countries being compared has increased, the Czech Republic's overall competitiveness also declined in absolute terms over the same period (competitiveness index dropped from 4.7 to 4.4). We are most lagging behind innovation-driven economies in the area of institutions (by 1.4 points) and innovation (by 0.8 points). The worst-evaluated individual aspects of the institutional environment include, above all, public confidence in politics (146th place), the burden of government regulation (135th place), the effectiveness of the legal framework (126th place), favouritism-based decision-making of public administration (123rd place), the use of public funds (115th place), and ethics in the conduct of companies (109th place). Yet, a poor quality of the institutional environment is probably one of the major causes underlying the negative balance of talent mobility in the Czech Republic, even though talents are a key condition for the development of innovation-based competitiveness. At the same time, poor talent mobility also directly reduces the competitiveness of companies. In the area of innovation, low government demand for advanced

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<sup>11</sup> The automotive industry is the branch of the economy dealing with the manufacture of motor vehicles and their accessories.

<sup>12</sup> Unless stated otherwise, the National RIS3 uses the term innovation to refer to economic innovation, i.e. in the narrower sense of a measurable economic benefit.

<sup>13</sup> The rankings published by the World Economic Forum compare the competitiveness of individual countries on the basis of the evaluation by managers from the most important companies in each country, which is accompanied by primary statistical data. The rankings are somewhat subjective – e.g. respondents from Western Europe may be more sensitive in evaluating the quality of the institutional environment than those from countries in the Middle East or post-Soviet republics. Despite that, the results are widely respected. Detailed values and rankings are listed in the annex, Table 15 and 16 and Chart 13.

<sup>14</sup> The improvement is primarily due to improvements in several indicators within the pillars: Institutions, Macroeconomic environment and Financial markets, within which there are indicators in which the Czech Republic moved about 50 places up the rankings. The improvement is probably associated with government austerity measures in recent years, the legal environment is also evaluated more favourably.

technology solutions (124th) is seen as the biggest problem, and the availability of high-quality researchers and engineers (64th place) is also rapidly deteriorating, which is related to the negative balance of talent and the quality of the educational system (especially its outputs). This reduces the chances for companies operating in the Czech Republic to develop globally usable knowledge and apply it through innovation, and the country's attractiveness for R&D activities of MNCs<sup>15</sup>. Managers of companies most often mention corruption (17.2% of the responses) and inefficient government bureaucracy (12.6%) as the biggest barriers to business.

Between 2006 and 2013, the Czech Republic experienced the biggest drop in the overall evaluation of conditions for conducting business (the Ease of Doing Business Index<sup>16</sup>) in comparison to other countries in Central Europe. It fell from the 41st place to the 75th place (out of 189 countries evaluated), while the positions of surrounding countries and the Czech Republic's competitors have either improved (Slovenia, Poland, Romania, Austria) or slightly declined (Hungary, Germany, Slovakia). In comparison to other countries, with respect to the individual conditions for doing business the worst situation in the Czech Republic concerns establishing a business (the processing of an application for electricity connection to a company takes an average of 279 days and requires 6 different permits; to establish and register a company, 9 procedures are required taking an average of 19 days<sup>17</sup>). Other areas contributing most significantly to making doing business in the Czech Republic difficult, are the administrative burden in paying taxes and the problematic investment protection.

International rankings that monitor competitiveness and business environment confirm that, in recent years, the Czech Republic has been losing ground to its main competitors in Central Europe and the rest of the world. Although these evaluations have their methodological pitfalls, the Czech Republic's decline in some of their aspects is so obvious that it must be taken into account.

At this time, some large and important investment projects (such as Hyundai) are still being completed and the technologically advanced workforce is distributed and engaged in global value chains. *However, the Czech Republic ceases to be an attractive destination for manufacturing-type FDI as it was in the previous 10 years.* The reason is the above-mentioned deterioration of the environment for business (both absolutely and relatively with respect to its main competitors) and also the fact that the supply of cheap basic factors of production in the world markets continues to grow; the Czech Republic is thus exposed to increasing competition from developing countries. There is minimal foreign investment flowing into the Czech Republic for specific, globally applicable competencies and know-how. However, there has been a gradual increase in companies that place knowledge-intensive activities in the Czech Republic<sup>18</sup> that require the involvement of skilled workers (construction, development, design). The importance of the EU ESIF funds – which represent a tremendous opportunity to accelerate the commenced structural changes in the economy and strengthen the potential to build a competitive advantage driven by innovation – has been growing along with the onset of the global economic crisis, but a large portion of them is used in the construction sector (including those that were intended for promoting innovation).

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<sup>15</sup> MNCs = multinational corporations

<sup>16</sup> The Doing Business rankings compiled by the World Bank monitor the quality of the conditions for business from the perspective of the regulatory framework and the protection of property rights. Detailed data and rankings are listed in the annex.

<sup>17</sup> The Doing Business rankings.

<sup>18</sup> Whether new or replacing less knowledge-intensive manufacturing activities.

Research and consequently development are one of the basic prerequisites for developing competitiveness and sustainable development. In the 2007–2013 programming period, 40 regional R&D centres and 8 European Centres of Excellence were built in the Czech Republic. These R&D centres are important for the further development of the Czech Republic's research base and have significant potential for enhancing the international competitiveness of the Czech Republic, provided that research results are successfully implemented in practice. Due to their sectoral focus and strategic location, the regional R&D centres can become important sources of the development of applied research in the Czech Republic's regions and they also represent potential for developing cooperation between the businesses and research.

Although the problem-based orientation of research funded by public resources has gradually strengthened, there are still gaps in communication between research organisations and the business sector. It is necessary to enhance the dialogue between the two spheres, which would result in a better transfer of knowledge into practice and the establishment of genuine cooperation in research with an emphasis on strategic research, problem-oriented choice of topics, interdisciplinary scope and consistency with social challenges. In addition to developing cooperation and excellence in research, it is also necessary to develop an environment for high-quality research management and for transferring research results into practice in order to increase the benefits of research to both society and the economic sphere, as well as the conditions for disseminating the results of high-quality research and development through their popularisation.

At the beginning of 2014, the Czech Republic is thus in a situation where industrial specialisation is the main catalyst of the economy, to which a number of commercial services are linked. So far the least importance<sup>19</sup> within the domestic economy is attributed to knowledge-intensive services (KIS), where developed economies concentrate a significant part of innovations. Positive examples in the Czech Republic include IT and software services, where both their importance within the Czech economy and their export performance are increasing. Activities with the highest added value are most often implemented at the beginning (R&D) and at the end (marketing, sales, customer contact) of the production chain and it is exactly the establishment of these activities that needs to be encouraged or they need to be attracted to the Czech Republic and further developed. By contrast, the development of industry and technical skills of the workforce can become a strength in connection with the envisaged partial re-industrialisation of Europe<sup>20</sup>. The objective of the Smart Specialisation Strategy is to create such an environment and activities at the national and regional levels that will unlock opportunities for the development of Czech companies growing as a result of a rising global demand of end customers for locally generated innovations, which will increase the Czech Republic's ability to influence its own economic growth and reduce its dependence on the import of entrepreneurship and strategic management from abroad. Such a growth and its contribution to the Czech GDP are – in terms of both quality and longer-term sustainable competitive advantage – more important than a mere shift in the value added and the knowledge intensity of activities implemented in the Czech Republic by foreign companies, unless these companies utilise local knowledge. However, it is important to also focus on branches of foreign companies and their

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<sup>19</sup> In the EU, KIS account for an average of 40% of employment, while in the Czech Republic this is only 32% (2011). The convergence occurs very slowly.

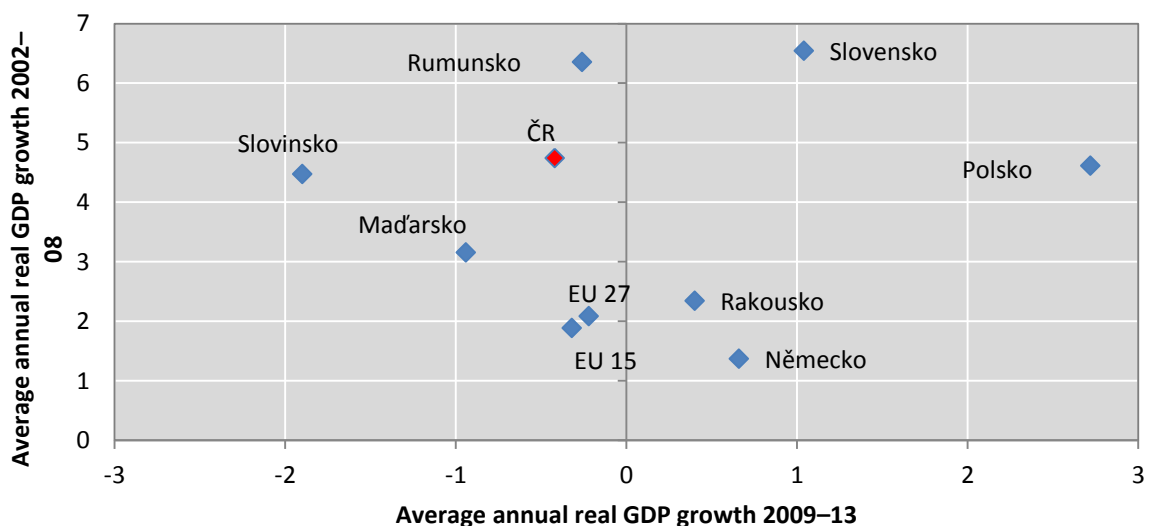
<sup>20</sup> The envisaged partial return of manufacturing activities to the EU is a response to rising costs in China and other rapidly growing primarily Asian economies, greater automation of production, the growing need for a more flexible response to the needs of customers in the EU, and tighter links between production and research and development.

upgrading<sup>21</sup> within value chains and on increasing the knowledge intensity of their activities, because they play a significant role in the Czech economy. In connection with certain global organisational trends, new opportunities and threats arise in this area for the Czech Republic<sup>22</sup>.

## 2.2. Macroeconomic framework

In macroeconomic terms, the period between 2002 and 2008 was one of the most successful in the Czech Republic's history. Real annual GDP growth ranged between 2% and 7% and was among the highest in Europe. On the supply side, the main source of the Czech economy's competitiveness and growth was an increase in labour productivity (per person employed), which contributed 3/4 of GDP growth in that period. The main cause was the massive influx of foreign direct investments<sup>23</sup> and the subsequent utilisation of their production capacities in the growth in global demand after 2004. Through their demand, foreign companies also indirectly influenced domestic companies. The fact that the inflow of FDI was a decisive factor in the growth of aggregate productivity has been shown by various on-going studies<sup>24</sup>. They presented a big difference in productivity and export performance between segments of foreign companies and companies without foreign capital.

Chart 1: Average annual real GDP growth in the period 2002–2008 and 2009–2013, selected EU countries



Source: Eurostat (Annual national accounts – Real GDP growth rates), own modifications

Nevertheless, labour productivity growth was lower in the Czech Republic compared to some other Eastern European countries. This is particularly evident in the period after 2008 when labour productivity in the Czech Republic stagnated (between 2009 and 2012 it even decreased, both in real terms and relative to the EU-27 average). By contrast, in Poland, Romania and (except for 2009) also in Slovakia labour productivity grew faster than the EU-27 average<sup>25</sup>.

<sup>21</sup> A movement up the hierarchy of value chains closer to end markets/customers.

<sup>22</sup> Described in more detail in the section on global organisational trends.

<sup>23</sup> The inflow of FDI was mainly supported by the on-going transformation of the Czech economy, the government's policy of attracting FDI but also the Czech Republic's accession to the EU.

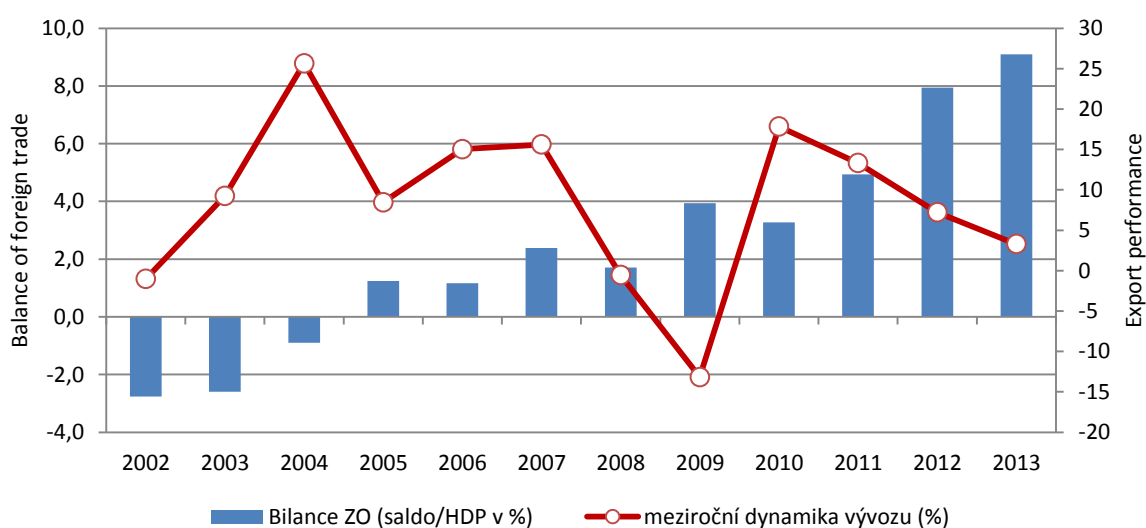
<sup>24</sup> For example CSO (2012) – Companies with foreign equity participation in the Czech Republic's economy: decline or further strengthening?

<sup>25</sup> The trends in labour productivity are shown in Chart 8 in the annex.

On the expenditure side of the economy, the main source of economic growth were net exports, which contributed more than 45% of GDP growth in the past 10 years. The above-average impact of foreign trade on the Czech economy is evidenced by the comparison with the EU 27, where – in the same period – net exports contributed only 21% of GDP growth. The positive impact of exports also continued in the period after 2008, with an overall trend of increasing trade surpluses (the growth of exports outpaces that of imports). This indirectly suggests that the production of relatively complex components with a higher added value and of final products has been gradually increasing within the manufacturing and assembly activities of MNCs in the Czech processing industry, while a significant portion of simple parts is imported. A gradual shift in activities with a higher added value at MNCs branches is still mainly driven by cost efficiency<sup>26</sup>, rather than access to unique and globally applicable know-how and knowledge. Paradoxically, the model of “hired labour” thus persists, with only a gradual shift in qualifications, namely from the use of assembly workers to engineers employed in design and development activities. Although there are exceptions (and their number is growing), most development activities of MNC branches in the Czech Republic are located at the lower end of the value chain (more complex design tasks, adaptation of products to local markets etc.); those are not key corporate R&D capacities.

The main driver of the Czech Republic’s high export performance was foreign demand for products from the Czech Republic that was satisfied by branches of production-type MNCs, which also benefited domestic companies through subcontracts. To a lesser degree, the increasing competitiveness and export performance of endogenous companies also contributed.

**Chart 2: Trends in Czech Republic’s foreign trade, 2002–2013**



Source: CSO – foreign trade (cross-border concept), CSO – national accounts (GDP, production method)

The EU remains the main target export market where more than 80% of the export value is going. Over time, its share has been slightly declining, mainly due to economic stagnation of EU countries and their lower demand for products produced in the Czech Republic. The highly active balance of foreign trade with most EU countries is due to the location of production capacities of foreign

<sup>26</sup> A very good ratio between technical competence and the cost of labour force is one of the main reasons for the placement of functions such as development, construction and design that are more sophisticated and more important within the corporate hierarchy .

(mainly European) companies in the Czech Republic, where the ability to occupy these challenging foreign markets lies in activities that are located abroad; in most cases these activities are not managed from the Czech Republic and they do not use local abilities to occupy these markets. In recent years, however, there has been a gradual reduction in the Czech Republic's previously highly passive balance with other advanced economies, which may indicate the increasing ability of local businesses to occupy demanding foreign markets outside the EU as well. Still, the volume of foreign trade with other developed economies outside the EU remains low relative to their size. In a global perspective, rapidly growing Asian markets are not yet successfully occupied by Czech companies on any larger scale. It is likely that some Czech outputs are implemented in these markets through re-export where foreign companies supply products to these markets, for which Czech companies supply intermediate products. However, Czech companies themselves do not have opportunities in Asian markets under control and, in turn, cannot take full advantage of them.

The cost competitiveness of the Czech economy has gradually been depleted. Real unit labour costs<sup>27</sup> increased by 3.4% in the Czech Republic between 2003 and 2012, which is the fifth highest rate within the EU 27 and, after Estonia and Slovenia, the third highest value among the new member states (see Chart 12 in the annex). Labour in relation to the value of the manufactured product has become more expensive in the Czech Republic. The Czech Republic's growth rate of unit labour costs is much higher than in Poland, Slovakia, Hungary and Romania, but also higher than in most Western European countries. The absolute cost of employment is still much lower in the Czech Republic than in Western European countries, but it is higher than at its direct competitors, i.e. in Poland, Slovakia, Hungary and Romania, and the difference between the Czech Republic and these countries is increasing. The attractiveness of the Czech Republic as a destination for production-type FDI declines and this is also reflected in the declining value of FDI and their structure (reinvested profit prevails over investments in equity with the construction of new production capacities).

### **2.3. World trends**

The Czech economy and its competitiveness are influenced by many global trends that have a character of opportunities or threats and, in many cases, act in a contradictory manner. The trends can be decomposed into changes in the organisational structure of the world economy and, on the other hand, into megatrends, which mainly affect the global society and global demand. Neither of these two groups can stay unnoticed in preparing the Smart Specialisation Strategy, since these trends have the potential to significantly strengthen or weaken the chances of success and the positive effects of our efforts and investments. Organisational trends are important because the core of Czech economic activities for growth is a part of global value chains. Global consumer megatrends are important because the value chains are mostly controlled by companies or groups of companies that are in direct contact with global demand dictated by end customers. The list of trends is not exhaustive and their force and the way in which they will affect the competitiveness of the Czech economy is different and mutually interdependent.

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<sup>27</sup> Real unit costs compare the costs for labour (costs per employee at current prices) and productivity (GDP at current prices for employment).



### 2.3.1. Organisational trends

The phenomenon of **globalisation** has been fully apparent in the Czech Republic in the past 20 years. The main driving force behind economic globalisation was the disintegration of value chains that, thanks to decreasing trade barriers, enabled strong MNCs that control global production networks to place/outsourcing their activities in different parts of the world as needed and to optimise the way in which their own activities are organised. The new form of globalisation translates into a situation where MNCs are currently not only looking for cheap factors of production around the world, but they are also increasingly searching for sources of knowledge and unique know-how and especially for key experts and talents. This increases the global fluctuation of talents and key experts that is not controlled only by MNCs, but by the talents themselves. This increases the pressure on individual countries (even the Czech Republic) to be able to keep/improve their position in the market niches in which they can be globally competitive and provide their key knowledge sources (R&D organisations, universities, and key talents, experts) and, at the same time, become attractive for the influx of outside sources of knowledge.

This is related to the **transformation of the organisation of the MNCs' R&D activities where one of the two main trends is the concentration of own R&D only to a few places around the world** in which the above combination of knowledge sources is available. The aim is not only to improve cost-effectiveness, but also the process of creating knowledge and innovations. Networks of cooperating research organisations and other entities are used for cooperating and to obtain external (from the company's viewpoint) knowledge from other important "hot spots". For the Czech Republic, this process can be an opportunity with regard to MNCs that have been operating there for a long time and in the fields where the Czech Republic has a globally competitive research capacity. In contrast, for MNCs that are less rooted in the Czech Republic and that operate in fields where key research capacity is lacking, this trend may lead to the continuation of less knowledge-intensive production with obsolete technologies, where there is a high risk of such production being relocated to countries with lower input costs or to the proximity of MNCs' corporate research and development centres.

The intensive global movement of talents carries a risk for the Czech Republic, namely the drain of talent<sup>28</sup> that is not sufficient offset by talent coming from abroad. The availability of talent is a critical prerequisite for innovation-based economy, and changes in the organisation of global production networks increase the importance of competition for talent and its special competence. Unless we find a way to succeed in this competition, our economic position in the world will continue to weaken.

**Another current trend in companies' R&D activities is open innovation, which takes place in parallel to the concentration of MNCs' core R&D activities**<sup>29</sup>. The main objective of the open innovation process is to use networks and new sources of knowledge to identify new opportunities

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<sup>28</sup> The Global Competitiveness Report (WEF) can serve as indirect evidence – in that report, the Czech Republic ranks below average in the brain drain indicator and its position is deteriorating rapidly (from the 44th position in 2009 to the 84th position in 2012).

<sup>29</sup> These two trends are often happening simultaneously within one company. The core R&D activities leading to higher-order innovations are implemented by the company internally (but can be carried out in collaboration with research organisations). At the same time, it delegates lower development activities or activities on the border of its current specialisation to cooperating entities and, thus, uses a distributed knowledge network. However, within these lower-order innovations there is also a demand for cooperation with research organisations, albeit not as strong.

outside the main sphere of companies' operation. The purpose is – in the world of distributed knowledge networks – to utilise not only internal sources, but also external sources and to also seek incentives for innovation outside the companies. Companies become more open about their needs and problems and work with external partners (companies, research organisations, suppliers/customers) to address them and create innovations, which allows them to find a way to new solutions and applications as well as to new areas of operation that they cannot identify by themselves. In particular, large MNCs often provide technology and a portion of their intellectual property to external partners and, thus, probe new areas of application. The concept also envisages that knowledge of companies/research organisations that is not or cannot be used effectively in the market should be provided to external entities via licensing/spin-offs/joint-ventures.

Open innovation can also benefit Czech companies and R&D institutions, provided that they are able to offer attractive and unique knowledge to global players and, conversely, provided that the Czech economy has companies that are able to absorb knowledge from the outside. In this respect, there are very heterogeneous companies operating in the Czech Republic. Companies that build their competitiveness on knowledge and on creating and accepting knowledge (“endogenous champions”). On the other hand, there is a relatively large group of companies that base their competitiveness on the price advantage. The largest group consists of companies that are somewhere between the above categories and for some of them the *open innovation* trend can mean the start a positive cycle of growth, which can place them among the “*endogenous champions*”.

**Distributed knowledge networks.** The trend complements the concept of open innovation and is, in a broad sense, based on a systemically interconnected set of knowledge across economic and social institutions, including individuals. It uses the openness of both the innovation process and interdisciplinary exchange of knowledge, which allows companies to gain competitive advantage in the form of unique combined knowledge. Technological advances in IT may result – among other things – in an impetus for development in agriculture, namely through developing software that will for example improve harvest efficiency or allow harvest quality control. KETs<sup>30</sup> play a key role in knowledge-based networks. Knowledge in these technological areas has a high variability of use across economic sectors and its application (not only separate but especially the combination of individual KETs) enables the development of innovations in different production chains. KETs are a great opportunity for the Czech economy, as innovations created based on these knowledge domains can also be applied in fields that might, at a first glance, seem to require little knowledge or to be rather distant. The trend of distributed knowledge networks provides potential for Czech R&D teams having unique expertise in some specific knowledge domains that can be used by MNCs for their own innovative activities.

**“Endogenous champions”** (companies owned and controlled by Czech citizens showing rapid growth driven by global demand) – the identification of such companies, their integration into the global economy, and their shift to higher positions within global production networks. The ability of the economy to create/generate endogenous champions is very important for long-term competitiveness, the ability to respond to external shocks and adapt to them in a positive sense.

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<sup>30</sup> KETs (Key Enabling Technologies) are key broad technological knowledge domains of a systemic nature, whose use in various economic fields makes it possible to generate product, production process and service innovations. These include nanotechnology, microelectronics, advanced materials, photonics, industrial biotechnology, and advanced manufacturing technology.

Fields, in which these champions operate, can generally be described as engines of the economy, to which companies from driven sectors connect and which benefit from the prosperity of the champions. In the Czech Republic, this category is comprised of a small but growing number of companies that, however, have not had any major importance within the economy thus far. It is their development that should be one of the main pillars of the Czech Republic's future competitiveness. Endogenous champions also have a vital role in creating a positive image of business and the development of the entrepreneurial environment. However, supporting and educating such companies is a long-term process that requires a systemic approach and long-term fieldwork that is necessary for identifying these companies and gaining their trust.

### 2.3.2. Global consumer megatrends

Below is a description of the most important global consumer megatrends that will increasingly affect global demand and, in turn, the Czech economy. Each of those trends will be indirectly reflected in the Czech Republic, with a different intensity and in a structured manner within various economic fields. The influence of megatrends on individual companies and entities in the Czech Republic will be individual and its intensity cannot be precisely predicted in advance because it depends on many factors and microeconomic aspects of each company. Companies will be forced to follow these trends, anticipate their possible impacts and adjust to them proactively.

**Resources tension on the planet.** The growth of the population and its demand on a global scale increases the pressure on basic resources (water, food, land) and traditional energy sources. This increases the pressure on nature and, along with climate change, biodiversity declines and the frequency of extreme weather events increases, which worsens the availability and quality of basic resources. The growing number of people without access to safe drinking water and basic food poses a threat to socio-political stability. The main challenges include long-term sustainable use of resources, elimination of poverty, and improvement of the quality of life. Global growth of demand for innovative solutions in these areas will lead to the growth of business opportunities and jobs in the field of long-term sustainability (reducing the energy and material intensity of industry, ecological and efficient transportation, clean technologies, renewable energy resources, efficient and productive agriculture) all over the world, including the Czech Republic. At the same time, there will be a growing need to generate applicable results of research in this area. In the Czech Republic, there is an expert and research background and facilities in the energy sector, which can be used for the development of technologies that use traditional energy sources and alternative sources in an innovative way. The Czech Republic can offer similar capacities and expertise in the field of agriculture and material research.

**Growth to the east of us.** Asia has not only taken competitive advantage of the increasing use of resources and productivity growth, but it also generates and concentrates wealth, experiences population growth, and it gradually becomes an increasingly important player in the field of research, technology and innovation and a centre of global production and consumption (at the expense of the "Global Triad" – North America, EU, Japan, which also loses ground geopolitically). Massive increase in the standard of living and, in turn, in consumption in Asian countries is an opportunity (not only) for cooperation between European and Asian countries and an opportunity for applying specialised knowledge of Czech companies and becoming successful in those markets. The increasing standard of living also massively increases the cost of production in Asian countries. In combination with the persisting lack technical skills of the local workforce, some companies will be relocating their

capacities back to Europe, which also has other benefits for them (flexibility of supplies, proximity to key R&D departments of companies and leading RO that represent key sources of knowledge, and proximity to the still significant and rich markets within the EU). Growth in Asia will thus very likely lead to the partial and selective re-industrialisation of Europe, which can benefit the Czech Republic due to its industrial tradition and the continuing favourable ratio of production costs and labour force skills relative to Western Europe.

**Urbanisation of the world.** The number and proportion of the population living in cities in developed and, even more so, in less developed countries has been increasing over the long term. At present, the global proportion of people living in cities has exceeded 50%. High economic activity and a high number of people will concentrate within limited areas. People living in these cities will demand better services, better housing, better transport, better management, and a better living environment. There will be growing demand for innovative solutions, technologies and products intended for people living in cities, especially in the fastest growing cities in developing countries. The problems and risks that are caused by urbanisation in the area of mobility, the environment and social issues will present key challenges that will need to be addressed ever more often. In this regard, the concept of “smart cities” is important, as it focused on innovative solutions to urban problems and on improving the functioning of cities and offering new services. The need for key expertise and supplies in the area of transport systems, capital equipment and construction in rapidly growing cities within less-developed countries may be an opportunity for Czech companies (or those operating in the Czech Republic) that should not be missed.

**New ageing.** The number and proportion of elderly people has been increasing in developed countries and demographic ageing gradually also affects emerging economies. The main manifestations of demographic changes include the declining number of countries with young populations, accelerated cross-border migration, the growth of the global middle class and urbanisation. Globally, the structure of elderly people also changes – their wealth, technological knowledge, activity and involvement are growing. This significantly changes their requirements for an active life in elderly age, which creates new, rapidly growing demand for services, products and technologies tailored to their needs, which is also the case of the Czech Republic. The unsustainability of pension system funding, increasing demands on health and social care, tensions in society between the young and the elderly and problems with the employability of young people with no work experience (at the expense of older skilled workers) constitute the main threats to the public sector. These are the main challenges that accompany population ageing, which affects not only developed countries but it will also rapidly accelerates in developing countries.

**Technology for the future.** Growing digitalisation and automation and the development of new technologies will continue to change the organisation and productivity of traditional value chains. It will also result in lower use of non-specialised labour in production and distribution, which can be a threat to employment in this group of people. This will concern not only developed countries, but increasingly also developing countries. New technologies are changing the methods of consumption, work, business and production, methods of becoming successful in the markets, social relations and the way of life. Key technologies<sup>31</sup> act as broad knowledge domains and can be used in an extensive portfolio of fields and products even far beyond the original area of operation, with a high potential

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<sup>31</sup> In particular KETs (explained above), or the more generally conceived GPTs (General-purpose technologies), which have the character of radical technological innovations that affect the whole economy (for example the Internet or nanotechnology).

for innovation. Their combination with other knowledge represents one of the key capabilities of the world's economies to enable new applications and ways of fulfilling specific needs arising from new trends in global demand.

**The power of individuals.** Global economic growth, cross-border trade and the spread of political and social changes have contributed to the growth of the global middle class, which will eventually become the largest population group in most countries. The global competition for talent and the increasing importance of the human factor for competitiveness have increased the significance of the "global class of experts" who are the key bearers of knowledge and implementers of change, and even the Czech Republic is under increasing pressure to succeed in this competition. One of the consequences is also the gradual widening of the income gap and the increasing concentration of power and wealth in the hands of a limited number of individuals. Technologies eliminate information asymmetries, as individuals have information and tools of mass dissemination of information. The ability of individuals to create a mass wave of support or resistance has increased exponentially. At the same time, the possibilities of individuals and small groups to influence global demand and to further personalise it are increasing. Fragmented demand increases the importance of market niches and it will be important for companies to analyse and service these trends.

## 3. Analytical section

### 3.1. Business and innovation

#### 3.1.1. Introduction

Over the past two decades, innovation has become the centrepiece of corporate strategies. As a result, it has also become part of professional discussions concerning the nature of competitive advantage and, by extension, the economic growth of countries and individual regions. Innovation is a complex phenomenon that takes many forms – this complicates its perception, measurement and, in turn, the design of innovation support by the public sector.

For the purposes of this section<sup>32</sup> of the RIS3, we define innovation as a ***change that brings value to customers, for which they are willing to pay*** (e.g. Christensen, 1997; Tidd et al., 2005). From the perspective of economic policy objectives (especially employment targets) the key aspect of innovation is its reception in the market. That alone ultimately decides on the effectiveness of innovation policy<sup>33</sup>. Many misunderstandings arise from the fact that technical solutions (e.g. a prototype) produced by research organisations are sometimes referred to as innovations, without being sufficiently verified in terms of the specific needs of the market and without having a chance of being received by customers. This perception of innovation as technical solutions often leads to concentrating attention on research, development and cooperation between the business and the academic sectors. However, it also leads to underestimating the role of an overall corporate strategy, non-technical innovation (including marketing, organisational innovation) and other in-house processes that have a significant impact on the ability of companies to grow and innovate.

Most innovations thus arise in the markets and are implemented by companies. Research organisations are also an important subject of innovative processes of companies, especially in the case of higher-order technical innovations of various types. This is especially true in areas where there is a creative interaction of research organisations, companies and markets. The National RIS3 pays specific attention to promoting innovation that provides the most room for using research results. At the same time, account is also taken of the structure of the local economy with a high proportion of traditional industries and the importance of non-technical innovation for obtaining/maintaining competitive advantage of companies. In addition to innovations generated by companies, attention is also focused on innovation in the public and the non-profit sectors.

The structuring of both the problem areas and the proposal part largely reflects the following starting points. The innovation performance of companies and, in turn, of entire economies depends primarily on (i) entrepreneurship, (ii) new knowledge, and (iii) a favourable regulatory framework for business. Within the RIS3, entrepreneurship is understood as an “active force that interconnects the resources needed for successful innovation” (Fagerberg, 2005). As the bearers of this force,

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<sup>32</sup> Innovation can also be understood in a broader sense, i.e. as a change that brings value to users (e.g. innovation in public administration or innovation that reduces negative externalities). In other parts of the text, innovation is understood in that broader sense – adequately to the context – but always with the condition that there must be manifested/acquired value to the user.

<sup>33</sup> Investments in research that are carried out in order to promote innovation are seen as a tool of innovation policy. However, research policy also has objectives other than to promote innovation and economic growth.

entrepreneurs and managers seek to interconnect markets, knowledge and specific technical solutions within the innovation process. The innovation process comprises the following:

- (i) Identifying new customer needs;
- (ii) Finding technical solutions to satisfy them;
- (iii) Searching for, acquiring and coordinating the management of necessary resources (including research results, if needed) and competences;
- (iv) Launching the innovation onto the market so that it is well received by customers and so that the launch takes place ahead of the competition.

The above indicates that ambitions and goals of entrepreneurs and managers are an important aspect of entrepreneurship (and, by extension, of innovation). To a large extent, these reflect local (not only business) culture, the overall atmosphere in the society, and the functioning of the regulatory framework for business. Innovation is essentially a very demanding investment with a very uncertain return. The cost of the investment, the uncertainty of return and its delay in time increase proportionately to the increasing order of the innovation. Entrepreneurship and cultural environment within the society significantly affect which opportunities entrepreneurs and corporate managers do or do not want to use in the context of the costs and risks associated with using them.

With respect to new knowledge as a specific input into the innovation process, innovations that are successful in the market require a purpose-based interconnection of the various forms of such knowledge. New knowledge that is necessary for innovation (including technical innovation) usually has the character of “a new combination of already existing knowledge or information” (Jensen et al., 2007). The novelty lies in the actual combination (targeted application) of available knowledge. Research and development for innovation is thus highly targeted and is very different from research that focuses on pushing the boundaries of knowledge of the society. New knowledge in the form of strategic information about the situation and trends in the markets (the needs and behaviour of customers, the possibilities of suppliers, the steps taken by competitors etc.) are of crucial importance, even within the company itself.

At the level of the entire economy, especially in the longer run, innovation relies on new knowledge that expands the overall level of knowledge and thus the potentially achievable technological possibilities of the society (see the chapter on research and development). Knowledge gained through industrial research and development leads to technological solutions to specific needs and problems during the innovation process. New knowledge gained from the markets through interaction with customers, suppliers, competitors etc. as well as knowledge about the functioning of the in-company environment makes it possible to identify new opportunities and to find effective ways of using such opportunities for innovation and building the company’s competitive advantage and market position. The specific combination and importance of the above kinds of new knowledge for successful innovation vary from case to case. There is no simple, direct link between the technical demands of innovation and its economic benefits for the subject carrying out the innovation (Hirsch-Kreinsen et al., 2008).

The regulatory framework for business includes both general rules for business (e.g. for setting up or winding up a business) and legislatively set conditions affecting its profitability (e.g. the level and form of taxation). Industry-specific regulation is also very important (e.g. rules on GMOs or industry standards of quality). The regulatory framework has an important impact on the entrepreneurial initiative of individual citizens and on companies’ investment decisions. This makes it an important

part of the innovation environment. It is mainly the stability and predictability of the regulatory framework that has a substantial impact, because frequent changes disrupt expectations of economic actors and make the environment difficult to predict and, by extension, affect personal motivation and investment decisions.

Based on analyses, research and discussions with stakeholders (key actors) the following main problem areas have been identified:

- Low level of entrepreneurship and inadequate performance of the endogenous entrepreneurial sector
- High dependence of the Czech Republic's economic development on the activities of foreign-owned companies<sup>34</sup> that only use the Czech Republic as a manufacturing base
- The instability of the regulatory framework and the administrative burden associated with complying with the regulatory rules.

### **3.1.2. Problem area 1: Inadequate endogenous entrepreneurial sector and entrepreneurship**

#### **Manifestations and subproblems**

- The endogenous<sup>35</sup> business segment has undergone dynamic development over the past decade. Despite that, only a small (though growing) portion of companies are able to keep up with global market leaders, both commercially and technologically (Berman Group, 2010). In terms of real economic and financial strength, the endogenous business sector consists mainly of companies that are small on a European or global scale, even though some of them have over 250 employees. There are very few truly large companies with many thousands of employees within the endogenous business sector. A lot of mature companies are still dealing with the heritage of huge internal debt that was incurred back in the period of a centrally planned economy. The majority of them have undergone very complicated privatisation. Some of them have only recently been acquired by owners who are interested in the long-term development of the company rather than in restructuring it in order to sell off its liquid assets. Both the internal debt and the complicated search for a strategic owner have negatively affected the current innovation capacity within this business segment. In terms of generally available data, these problems are documented e.g. by the significant difference in value added per employee or the notable lagging-behind in business R&D investments in comparison to foreign controlled companies.
- There are a number of dynamically growing companies within the endogenous business sector. Some have gradually become important players in their respective markets (usually in special niches of markets otherwise occupied by large multinational companies). This dynamic sub-

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<sup>34</sup> There are significant differences among foreign-controlled enterprises operating in the Czech Republic and many of them constitute technological leaders of the Czech economy. At the same time, however, there is a significant group of companies (known popularly as "assembly plants") that contribute significantly to the Czech Republic's exports but are characterised by activities that are not very sophisticated and have low added value. The above problem area addresses both types of foreign-controlled enterprises as specified, knowing that even small businesses with unsophisticated manufacturing and service activities may, over time, strengthen their position within the parent company and bring activities with high added value to the Czech Republic.

<sup>35</sup> An endogenous company is understood as a company whose strategies and business are controlled from the Czech Republic.



segment mainly consists of small and medium-sized enterprises whose innovative capacity is limited by their size. Moreover, available statistical data are increasingly distorted by the growing number of successful local companies that have relocated their headquarters outside the Czech Republic (mainly the Netherlands, Cyprus, Luxembourg etc).

- The sales of a large portion of endogenous enterprises in the manufacturing industry<sup>36</sup> are strongly dependent on demand from branches of foreign companies that are based within or near the Czech Republic (with the dominant position of Germany as the main export destination). A large portion of endogenous companies have limited ability to penetrate demanding and/or distant markets on their own<sup>37</sup>. For some of them, this is due to lack of interest or the perception of too high risks and limited competences. For others, this is due to their size and development stage in which it has – thus far – been natural to primarily target the domestic and neighbouring markets as a relatively easier expansion method. The dependence of the endogenous business sector on foreign companies' demand through which their products usually penetrate into the European/global markets shows that the Czech Republic's economic growth is strongly dependent on "importing" entrepreneurship from abroad.
- At the same time, R&D expenditure of Czech small and medium-sized businesses has been growing rapidly over the past seven years, thus creating the conditions for the development of innovative, globally competitive production. Due to a high level of interconnection between the Czech and foreign economies, even Czech small and medium-sized businesses are increasingly engaged in international value chains.
- The innovation capacity of endogenous companies has also been affected significantly by relatively limited growth- and innovation-related ambitions of entrepreneurs and managers of such companies. Widespread characteristics of competitive and market strategies of endogenous companies include (Berman Group, 2010): (i) building competitive advantage based on low costs and the adoption of foreign technologies instead of innovations that are new to the market, (ii) relying on future demand of existing customers instead of looking for new markets, (iii) preferring maintaining the status quo to striving for further growth, (iv) relying on one's own competences only and distrusting the benefits of cooperation – limited ability to utilise the open-innovation concept, (v) perceiving problems as obstacles rather than opportunities. Due to the above facts, domestic companies have limited potential for growth that is based on knowledge-oriented activities.

### Causes

- The business sector as a whole entered the process of transition to a market economy in a condition when it was lagging significantly behind in technology, management, business strategies etc. Under such circumstances, it was just a matter of time until a major part of the corporate sector became part of multinational companies through acquisitions. Even today, companies with no foreign capital are still tackling the consequences of the above situation, although they have managed to eliminate them gradually.

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<sup>36</sup> At the level of economic sectors, the manufacturing industry constitutes the main driving force of economy in the Czech Republic.

<sup>37</sup> The World Economic Forum (WEF) carried out a comparison of 144 countries based on managers' answers to the question "To what extent are international distribution and marketing from your country owned and controlled by domestic companies?". The Czech Republic ranked 112th. There were 159 managers representing the Czech Republic in the survey.

- Preceded by the world war, four decades of central planning virtually destroyed the “craft” of entrepreneurship and the specific knowledge and skills associated with it. Globally, enterprise and management underwent dynamic development over that period. Unfortunately, the Czech Republic was not part of that development. As a result, it lacked any experience with strategic corporate management, especially with managing dynamic growth, the transition from a small family business to a large international company, and innovation. Even more than two decades after the demise of the centrally planned economy, entrepreneurial and management experience is still relatively limited. Due to massive growth of the demand for components on the part of foreign companies, local entrepreneurs have long profited from focusing mainly on developing technical competence in production and technical development<sup>38</sup>, which has further slowed down the spontaneous development of enterprise, i.e. the ability to find and utilise new business opportunities independently<sup>39</sup>.
- As opposed to the trends common in established market economies, a specific culture of employment-based society has developed that can currently be observed e.g. in the fact that the most successful university graduates strive en masse to find a job in a branch of a world-renowned foreign company or even in the public sector instead of trying to establish their own business. This sets the local entrepreneurial culture notably apart from the entrepreneurial culture in the countries that occupy the top ranks in international competitiveness or innovation performance rankings. Insufficient motivation of people to establish new business is apparent mainly in technology-intensive fields. The conditions for developing a business in technology-intensive fields are perceived as problematic (GEM, 2011). Limited self-confidence of the majority of the population and very low knowledge and experience required for starting a new business significantly affect the process of setting up new businesses, especially in cases where the technology-intensity of such a business significantly increases the business risk. Nevertheless, the establishment of new companies, mainly knowledge-intensive ones is the key ingredient for the long-term strengthening of the endogenous business sector.
- Another notable cause of the weakness of the endogenous business segment is limited motivation of local entrepreneurs to further expand their companies (Pavlínek, Ženka, 2011; Berman Group, 2010). There are multiple causes for the limited motivation for further expansion and it is difficult to generalise. Besides the absence of successors to whom the growing companies could be handed over, this lack of motivation also reflects the local culture. The majority of the population still perceives entrepreneurship as a means of obtaining material wealth (often not entirely ethical) and not as a resource enabling the development of the society, technologies and overall welfare. This motivation for enterprise along with a high risk aversion among the Czech population (Bosma et al., 2012) (the “a bird in the hand is worth two in the bush” approach) reduce the overall effort of economic actors to further grow and look for new business opportunities. Another problem is the general image of successful entrepreneurs. The

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<sup>38</sup> Many owners of SMEs confirmed that between 2003 and 2007 it was not necessary to look for new customers. The demand from branches of foreign companies in the Czech Republic and surrounding countries or their direct suppliers was so high, that the only thing required for business success was to meet their technical requirements.

<sup>39</sup> See footnote 8. Another example is the fact that the Czech Republic ranks as low as 57th out of 144 countries in terms of how much significance companies attach to customer care and customer requirements – see WEF: Global competitiveness report 2012/2013.

perception of their success and their social role is the second worst of all 54 countries that were assessed in the latest round of the Global Entrepreneurship Monitor survey (Bosma et al., 2012).

### Consequences

- One consequence of the weak endogenous business sector is the specific innovation demand of companies. The very low number of endogenous companies that are able to push the technological boundaries in their respective fields in combination with the fact that the top foreign companies operating in the Czech Republic have their research and strategic facilities located mostly outside the Czech Republic (see below) cause low innovation demand in the segment of higher-order innovations. These innovations usually require significant inputs in the form of new knowledge obtained through research and development. Low demand in the higher-order innovation segment means that companies have limited need for cooperation with research organisations. From the perspective of the academic sector, this reduces the potential for commercialising the results of their research, as the majority of cases of successful commercialisation of public research results are driven by demand from the application sector.
- Another consequence is the fact that the development of the technical competences of companies (technical development, organisation of production etc.) is way ahead in comparison to non-technical competences (strategic management, marketing, innovation management) that are at least equally important for the successful development of companies and innovations. The prevailing character of the participation of the endogenous business sector in value chains<sup>40</sup> widened the gap between the level of the development of technical and non-technical competences even further. Excellent technical competences and the ability to also address complex technical issues are a prerequisite for participation in supply chains. However, business and managerial competences are necessary in order to penetrate into end-consumer markets and move higher in the value chains. Therefore, inadequately developed non-technical competencies (i.e. limited experience with their practical use) significantly reduce the potential of most members of the domestic business sector to capitalise on their highly developed technical competencies in foreign markets. While this problem mainly concerns SMEs, as they usually cannot delegate individual functions to specialised teams, it is not limited to SMEs only.
- The endogenous entrepreneurial sector is not yet strong enough to offset the declining contribution of FDI to growth and employment. This fact, too, is one of the reasons why it is necessary (especially in the long term) to support the development of endogenous companies, especially those that are able to expand their presence (through exports and foreign direct investments) on foreign markets. In the long term, the scope and quality of the endogenous business sector will affect both the growth potential of the Czech Republic's economy and its vulnerability to cyclical fluctuations and structural problems, whose frequency and intensity increases in connection with globalisation.
- The weakness of the endogenous business sector is connected with the dependent position within global production networks as well as with a limited ability to penetrate into demanding end-consumers markets. The ability to move up global production networks and penetrate

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<sup>40</sup> The prevailing position of an endogenous company is that of the supplier of components (less often complex modules), where the customer defines the product (service) parameters in very specific terms. The customer also very often defines the manufacturing technology and the materials used. If the company is dependent on this type of customers, its room for innovation is greatly narrowed, namely to innovation whose purpose is to reduce unit costs.

demanding markets is associated with the widely-conceived entrepreneurship of local businesses. This includes both entrepreneurship meaning the ambitions of existing companies to grow and innovate, as well as entrepreneurship meaning the setting up of new companies with high growth potential that is usually associated with developing or applying<sup>41</sup> new technologies..

### **3.1.3. Problem area 2: High dependence of Czech Republic's economic development on the activities of foreign companies**

#### **Manifestations and subproblems**

- Foreign companies as a segment are the main driver of the economy in the Czech Republic, both directly through their performance and through creating extensive demand for the production of companies within the endogenous segment. These companies are the main actors through which the Czech Republic participates in the European and, by extension, the global economy. Branches of foreign companies as a whole achieve significantly higher productivity and export growth rates than the endogenous business sector. At the same time, they are the main source of the transfer of advanced technologies, management methods and other proven practices (trade, innovation management etc.) to the Czech Republic, thus greatly contributing to the growth of productivity of the local economy.
- The high dependence of the domestic economy on foreign companies' activities is evidenced by the trends in the balance and structure of the current account of the balance of payments. While in 1996 the balance of trade deficit equalled 9.2% of GDP, within mere 10 years the balance of trade reached a surplus that currently amounts to 5% of GDP. This significant and quick change in export performance is unique within the global economy, especially as regards economies with industrial tradition whose exports are not driven by raw materials. The rate and scope of the change in the balance of trade are clearly indicative of external causes (Pavlínek, Ženka, 2011)<sup>42</sup>.
- The expansion of foreign companies' activities has led to increased job creation, including the endogenous business segment. In terms of the Smart Specialisation Strategy, there are two significant problems that are linked to the above economic trends. First, the strategic decisions of a large portion of companies concerning their further orientation (including investment, innovation etc.) are made outside the Czech Republic. While these companies differ in terms of autonomous decision making, most of them are limited with respect to issues relating to their strategic response to new business opportunities and risks. Second, most foreign companies in the Czech Republic only fulfil some corporate functions. Most often these include organising production, assembly and logistics between the manufacturing plant and warehouses located both in the Czech Republic and abroad, these being the activities with the lowest share in the overall added value of products and services on the market. Although development and other design and engineering activities are gradually being developed in many manufacturing plants, most strategic activities at the base of value chains and business activities at the end of value chains are implemented outside the Czech Republic. It is these activities that concentrate most of

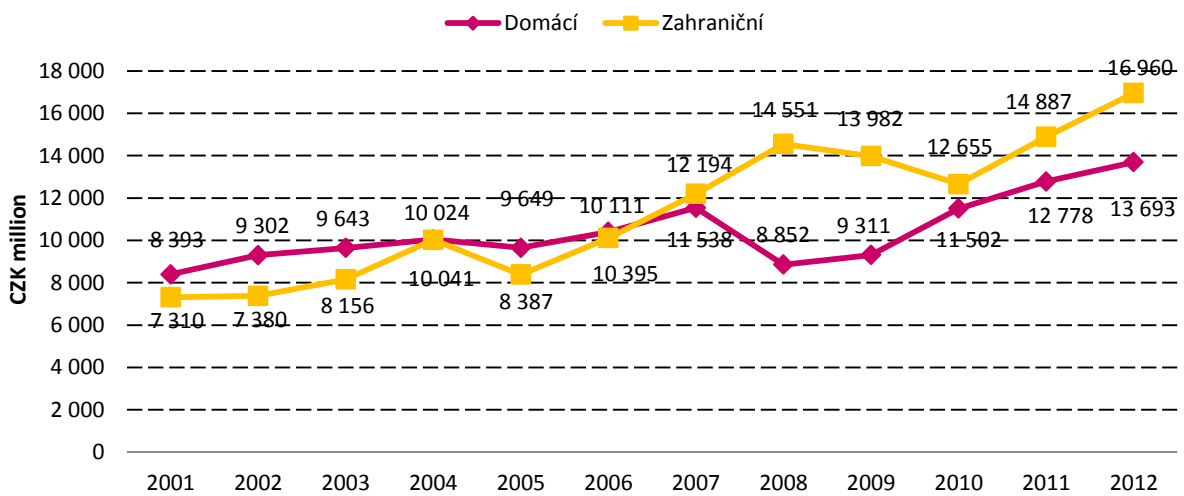
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<sup>41</sup> The application of new technologies in traditional fields provides significant room for innovation. A large portion of medium-sized and large companies within the endogenous business sector operate in traditional fields.

<sup>42</sup> A special analysis carried out by CSO in 2003 showed that productivity and export performance in foreign-controlled companies notably exceed the level of both of these indicators in companies within the endogenous segment.

the added value of the products and services, and strategic decisions of the companies concerned on the direction of the innovative process are linked to them.

**Chart 3: Comparison of trends in R&D expenditure – domestic and foreign companies in the Czech Republic**



Source: Research and development, CSO. Note: The values in the chart show non-capital R&D expenditure that better illustrates the trends in corporate R&D intensity over time.

- The scope of these problems is evidenced by the following statistics. In 2012, out of 281 private companies with more than 1000 employees, 62.8% were foreign-owned and, with increasing headcount, the proportion of foreign companies rapidly increases. The proportion of foreign companies is even higher in the manufacturing industry, which is the main driving force of the domestic economy. As regards the increase of the knowledge intensity of enterprise, dependence on foreign companies can be illustrated by the trends in the structure of business R&D expenditure (see Chart 3). The foreign business segment has been consistently increasing its share in R&D expenditure of the entire business sector. While in 2012 their share was 55.3%, 10 years ago it was 46.6%.
- Despite the above problems, the increase in foreign companies' R&D capacities constitutes a significant opportunity for the future. This trend signals the attractiveness of the Czech Republic as a destination for developing activities with higher added value that require high quality engineers and facilities for technical development. Some global technology leaders are developing these activities in the Czech Republic and rely on the Czech Republic as the centre of their further development<sup>43</sup>. In this respect, the opportunity lies in the presence of successful manufacturing plants of numerous foreign companies, where targeted support can be used to intensify expansion of more demanding activities with higher added values in the Czech Republic. Another important trend in the development of global value chains is the concentration of corporate R&D activities and their location near successful manufacturing plants, where there are favourable conditions for the expansion of such activities. The risks that might result in a failure to use this opportunity include growing instability of the entrepreneurial environment in combination with a high administrative burden on companies (see problem area 3 below) and the declining level of education (see the problem area education).

## Causes

<sup>43</sup> For example Siemens, Honeywell, ABB etc.

- The original causes of the current condition of the economy and, in turn, of the business sector lie in a four-decade-long (1948–1989) interruption of private enterprise. Along with that, the causes include the historically specific combination of internal factors and external conditions in the early 1990s when the Czech economy started to integrate into the market-based global economy. The internal factors mainly included (i) a favourable ratio between labour price and qualification, (ii) strong industrial tradition and relative technological advancement, (iii) high-quality infrastructure compared to other Central European countries, and (iv) a weak domestic sector capable of very limited competition. The external conditions further enhanced the importance of the Czech economy's attractiveness for the expansion of foreign companies' activities – they mainly included (v) closeness to developed European markets, later with the prospect of accession to the EU, and (vi) changes in the organisation and, by extension, the territorial configuration of transnational production systems<sup>44</sup>.
- In 1997–2003, the Czech Republic was the main FDI haven (per capita) within the transitive economies of Central and Eastern Europe. Investments of foreign companies took the form of both greenfield investments and acquisitions of local (mainly) large businesses. Strong growth of the global economy after 2003 then led to full utilisation of such newly-created (and other new) capacities of foreign companies, which is evidenced by the reversal of the Czech Republic's balance of trade over a very short period between 2003 and 2005. Another evidence is the rapid growth of the passive factor income balance, which includes the repatriation of foreign companies' earnings to their owners. External causes<sup>45</sup> are also documented by the fact that this reversal occurred despite the trend of the long-term strengthening of the Czech crown.
- There was a large inflow of foreign investments (FDI) into the Czech Republic and subsequent growth of foreign companies' demand for Czech subcontractors, which significantly benefited endogenous businesses. These are now often directly or indirectly (through their exports of components – often complex ones – to foreign manufacturers of final products) linked to foreign companies operating in the Czech Republic and the neighbouring countries. This benefited both the economy as a whole and domestic companies, as they gained access to know-how, experience etc., and – albeit indirectly – to global markets. This resulted in the extraordinarily strong growth of the Czech economy in 2004–2008<sup>46</sup>. On the other hand, the development of such dependence on foreign companies created or reinforced some barriers to the development of endogenous companies (see problem area 1).

### Consequences

- The Czech economy is now at a stage where it gradually loses the advantage of price competitiveness, especially in the manufacturing industry, which has been caused by the domestic growth in the cost of labour, energy and services and amplified by the increasing attractiveness of the conditions for locating certain types of activities in developing countries. Thus far, the loss of competitiveness only concerns some types of activities and fields, but it is likely to further expand. Given the continuing decline in the conditions for enterprise (deepening

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<sup>44</sup> Dominant managerial procedures leading to the focus on brand and key activities and thus extensive outsourcing and delocalisation of production (see e.g. Stiglitz, 2002; Dicken, 2011).

<sup>45</sup> The gradual development of the Czech Republic's functional specialisation within the global production networks as a manufacturing base for European markets (see footnote 9).

<sup>46</sup> See CSO (2009), Statistical Yearbook of the Czech Republic; CES, NTF (2011) The Competitiveness of the Czech Republic 2010–2011

political instability that makes tax and other conditions difficult to predict, high administrative burden, demographic ageing, declining quality of school graduates etc.), the sector of foreign companies is very likely to experience the outflow of investments and a change in the structure (and volume) of incoming investments. Trends in the volume and structure of FDI show that the Czech Republic is gradually entering a new stage in the development of its economy. The intensity of FDI inflow has been decreasing significantly<sup>47</sup>.

- As a result, the Czech Republic's economic growth – both potential and real – has slowed down considerably and the above factors may also have a negative impact on economic growth in the future. The endogenous sector is currently too weak to offset the envisaged decline in the contribution of foreign companies and FDI inflows towards economic growth and job creation in the near future. Local companies' capacity, resources and potential to increase productivity through innovation and a generally greater emphasis on knowledge-based economy are limited (see above). Further economic growth of the Czech Republic therefore depends on its future attractiveness for activities of foreign companies. With respect to gradual loss of ability of the Czech Republic to compete through the price of local production inputs the importance of non-price competition factors increases significantly. In some of these factors (education attainment and the education system, institutional environment, public research quality etc.), the Czech Republic is ahead of its current competitors among transition and developing economies. However, it is considerably lagging behind in comparison to established market economies. This is a problem, because if the Czech Republic is to grow and create jobs in the long term, it must compete with developed economies rather than transition and developing economies.
- Given the expected decrease in the rate of FDI inflows, potential growth of disinvestments of foreign companies and the Czech Republic's limited success in competing for higher-quality FDI, there is a risk of long-term stagnation and a considerable worsening of the situation in the labour market. These impacts may be especially strong if the above three phenomena occur at the same time, which cannot be ruled out. The trends as described above point to the necessity of strengthening the endogenous business sector, even though it cannot replace the effect of FDI in the short or medium term. The economy's high dependence on foreign companies also has specific consequences for the area of cooperation between the corporate and academic sectors. A decisive amount of knowledge-intensive and also strategic activities of local branches of foreign companies (such as trade, marketing or communication with customers) takes place outside the Czech Republic. As a result, these branches – including their local suppliers – have very limited room for innovation, which is often limited to process and technological sub-innovations in production and assembly. Where local branches are included in syndicate R&D, this inclusion usually involves providing fragmentary information from the manufacturing process or implementing final customer solutions, yet it does not involve participation in main R&D capacities. The above situation limits the scope of companies' demand for cooperation with research organisations in the Czech Republic. On the other hand, foreign companies that carry out R&D in the Czech Republic (e.g. Honeywell, Siemens etc.) provide an extraordinary opportunity for local research organisations in terms of cooperation with the application sphere, including the potential to secure significant income from the private sector.

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<sup>47</sup> Although the decline in the inflow of foreign investments is partially attributable to the economic crisis in recent years, the decline is striking, especially in terms of building new production capacity. Nevertheless, even the ratio between reinvested profits and dividends is changing in favour of dividends.

### 3.1.4. Problem area 3: Complexity, instability and subsequent high administrative demands of the regulatory framework for enterprise, limited effectiveness of strategies and tools to support enterprise

#### Manifestations and subproblems

- The instability of the tax and regulatory framework for enterprise poses a serious problem for the Czech Republic's entrepreneurial environment. Pursuant to a regular international survey by the World Economic Forum<sup>48</sup> local entrepreneurs and managers consider (i) corruption, (ii) administrative burden, (iii) tax rates and tax collection, and (iv) regulations relating to employment to be the main problems. With the exception of corruption, these problems are nothing exceptional, as the other three items dominate among the problems of entrepreneurial environment in most OECD countries. However, a regular international survey by the World Bank<sup>49</sup> shows that the severity of these problems is considerably greater in the Czech Republic than in most OECD countries and, in some aspects, the conditions existing in the Czech Republic are significantly worse than in many developing economies.
- According to the latest summary index of regulatory conditions for enterprise, the Czech Republic<sup>50</sup> ranked 75th out of 189 countries assessed. In 2006 it ranked 41st, and in 2009 it ranked 66th. This drop is a signal that regulatory conditions for enterprise in the Czech Republic are getting relatively worse<sup>51</sup>. The reason is that, in many other countries, larger numbers of positive changes are implemented faster. The Czech Republic ranks worst in the following areas: setting up businesses and connecting businesses to electricity (both 146th), tax rates and tax collection (122nd) and investment protection (98th). By contrast, the situation is relatively better in the area of access to credit (55th)<sup>52</sup>.
- In the Czech Republic, there are a wide spectrum of tools to support enterprise and innovation, covering areas ranging from support for exports<sup>53</sup>, to access to loans for start-up entrepreneurs<sup>54</sup> to a range of subsidy programmes within the OPEI that are targeted at the absorption of new technologies, the use of IT, the implementation of innovation etc. The problem of all these tools is the inadequate assessment of their actual benefits. The evaluations that are performed are often formal, while the implementing entities have no adequate "policy – learning" cycle in place that would lead to a permanent improvement in the efficiency of the support tools. The overall strategic framework for activities focusing on support for enterprise and innovation is also

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<sup>48</sup> WEF (2013): World Competitiveness Report 2013-14

<sup>49</sup> World Bank (2013): Doing Business 2014.

<sup>50</sup> World Bank (2013): Doing Business 2014.

<sup>51</sup> To some degree, this assessment may be affected by subjective factors (a part of the indicators assessed are based on the subjective assessment by respondents from the business sector), while the current political situation may also cloud partial successes (e.g. the gradual simplification of legislation on enterprise, or the digitisation of Czech public administration).

<sup>52</sup> In certain thematic areas, studies by WEF (see note 45) and WB (see note 46) are partly based on subjective assessment by the respondents, whose opinions may thus be affected by differences in their socio-cultural environment and their different perception of problems in certain areas. Nevertheless that, the Czech Republic's declining position in these rankings cannot be disregarded.

<sup>53</sup> Services of the Czech Export Bank, the EGAP insurance company and support for participation in trade fairs within the Operational Programme Enterprise and Innovation for 2007–2013 (hereinafter the OPEI).

<sup>54</sup> The Start, Guarantee and Progress programmes under the OPEI.



inadequate. The parallel existence of a large number of strategies, many of which are implemented only temporarily and to a limited degree or not at all, creates a chaotic situation that makes it impossible to plan effective support and reduces confidence of target groups in the public administration's ability to set up and correctly implement these support tools.

- Positive examples of support may include tools for the tax deduction of R&D costs, which were further extended to include the purchase of external R&D services from research organisations at the beginning of 2014. Nevertheless, even here the deficiencies of the practical implementation of this support are experienced in cases where the unclear interpretation of the rules for deducting cost items result in lawsuits between companies and the state.

### **Causes**

- The absence or slow implementation of reforms to improve the regulatory framework for enterprise has been caused by high personnel turnover within the central authorities of state administration and in the management of organisations established by them. The persistence of this situation in conjunction with insufficient protection of top officials in relation to politicians have led to a gradual loss of expert experience and, by extension, the capacity to carry out public administration with high quality.
- Political instability results in frequent partial changes in tax laws and other regulatory rules. Such changes are motivated by short-term objectives rather than by the country's long-term economic strategy. An extreme example of instability is the situation in 2012 when the VAT rate for the upcoming year was still uncertain 1 month before the end of the year. Other examples include the implementation and quick abandonment of the so-called Super Gross Salary or frequent changes of the VAT rate.
- Another notable cause is the absence of a shared long-term vision and strategy for the Czech Republic's economic development, which has been repeatedly pointed out by many public authorities in the media<sup>55</sup>. Within the confrontational style of Czech politics, the absence of a shared long-term strategy makes it easier to promote partial short-term solutions, regardless of their long-term impact or consistence with steps taken in other areas.
- A specific cause underlying the limited efficiency of tools to support enterprise and innovation is the approach to drawing funds from the EU Structural Funds. The emphasis on using up all allocated funds is understandable. Given the high turnover of human resources and the on-going loss of expert experience (see above), the emphasis on using up SF resources results in supporting some tools that are targeted or set up incorrectly. The volume of funds that have to be used by these tools leads to their figurative "inflation" and sometimes even discrediting among representatives of the target groups<sup>56</sup>.

### **Consequences**

- The unstable and complicated regulatory framework for enterprise in conjunction with the high level of perceived corruption create behavioural patterns that provide little support for innovation, the development of businesses and, by extension, the entire economy in general. A

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<sup>55</sup> For the latter, see prof. Lubomír Mlčoch in an interview for Ekonom magazine no. 50/2013.

<sup>56</sup> Examples may include clusters or business incubators. Besides successful and well-functioning clusters and incubators, there are others that have failed to deliver the originally declared benefits. However, successful examples show that the idea of establishing and supporting clusters and incubators – in itself – is correct for the Czech economy, provided that a system is set up to ensure greater competitiveness of entities.

serious example is entrepreneurs' increased motivation to protect what they have already created<sup>57</sup>, which naturally reduces motivation for further growth of companies. The seriousness of this consequence stems from the fact that local entrepreneurial culture can be characterized by a higher risk aversion<sup>58</sup> than in other European countries that are better performers in terms of innovation.

- The instability and complicated predictability of taxation makes strategic planning of companies difficult, as it complicates the calculations of expected trends in return on investments, thus making the investments riskier.
- The relative drop in the Doing Business rankings signals a rigidity of the local regulatory framework for enterprise. The relative deterioration of the conditions may negatively impact on foreign companies' decisions regarding the location of their activities. One strength of the Czech Republic is the presence of successful manufacturing plants of multinational companies and the supply of high-quality engineers at a favourable price. The above trends jeopardise the opportunity lying in the development of R&D and related activities at local manufacturing plants. This is because activities with higher value added are more sensitive to the quality of the entrepreneurial environment.
- Poor conditions for setting up or winding up a business (144th according to Doing Business) are a significant barrier to increasing the amount of entrepreneurship in the society. However, fulfilling this objective has been one of the long-term prerequisites for higher dynamism and innovative performance of the endogenous business sector (see problem area 2).

### 3.1.5. Digital agenda and entrepreneurship

#### Problems

- In the Czech Republic, inadequate development of physical infrastructure for the spreading of high-speed and high-capacity Internet connection is an essential barrier to the development of a full-scale digital economy<sup>59</sup>. Due to very low investment activity of Internet providers, availability of next generation networks (NGA, incl. LTE) is very limited and, as a result, only 20% of the population is connected to the proclaimed high-speed Internet (more than 30 Mbit/s)<sup>60</sup>. However, in reality the connection speed is even lower and only 3% of population have access to the proclaimed speed of 30 Mbit/s<sup>61</sup>. Moreover, only one fifth of the population have any hope of seeing their Internet connection speed increase<sup>62</sup>. In and of itself, the speed and distribution of quick Internet connection is not an explicit barrier to the development of enterprise in general, but given the advent of the digital economy, the importance of speed and coverage with

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<sup>57</sup> There are an increasing number of cases where the headquarters of Czech companies are registered abroad, in countries with more favourable regulation and better protection of investments – these are being justified as a response to the increasing instability of the local environment and the perceived risks for further development by owners of successful companies.

<sup>58</sup> See the Global Entrepreneurship Monitor 2011.

<sup>59</sup> National Policy in Electronic Communications – Digital Czech Republic v2.0 – The Road to the Digital Economy, Ministry of Industry and Trade, 2013

<sup>60</sup> The European Commission, Digital Agenda for Europe <http://digital-agenda-data.eu/>

<sup>61</sup> IHNED.cz, The map of the Czech digital wasteland: Only 3 per cent of people have a truly fast internet connection <http://byznys.ihned.cz/zpravodajstvi-cesko/c1-61402650-mapa-ceske-digitalni-pustiny-opravdu-rychly-internet-maji-jen-3-procenta-lidi>

<sup>62</sup> Czech Telecommunication Office, Mapping infrastructure for the provision of high-speed Internet access in the Czech Republic

high-speed Internet for economic activities increases. Even today, the development of specialised digital services and knowledge-intensive activities in various segments of the national economy are dependent on Internet speed and coverage.

- Low utilisation of electronic communication between business partners (both in sharing information within the supply chain, and in exchanging business documents) ranks the Czech Republic among the weakest EU countries in this comparison<sup>63</sup>, despite the fact that the digitisation of value chain management and supply chain relationships can be a source of significant savings, especially in terms of corporate fixed costs. The use of digital technologies for communication between business partners together with the digitisation of the entire production process can lead and, in many cases, has already lead to the development of new knowledge domains within the economy.

### **Causes**

- Insufficient investments in the physical infrastructure for high-speed connection have led to the ageing of the infrastructure, especially in terms of its capacity. Internet connection providers have not been motivated to develop the infrastructure and, as a result, they used their available funds for other purposes.
- Until recently, the low demand for digital services was attributable to the high prices of Internet connection and end devices. However, this factor is now marginal and there is an opposite trend. Demand for end devices using digital services has been growing considerably. Along with the above trends, new room is created for economic activities with high added value and a potential for high profits.
- The unclear definition of powers at the central level led to low activity in the field of digital agenda. The departmentalism and strong vertical hierarchy of individual ministries poses a limitation to effectively addressing horizontal issues, incl. the digital agenda.
- The (lack of) confidence in the safety of using electronic communication is a key factor of the digital economy. Unless users of digital services and technologies have confidence in their security, it cannot be expected that either digitised supplier chain relations or the digital economy itself will develop.

### **Consequences**

- Maintaining the physical infrastructure for the provision of Internet connection in its current condition may finally lead to the exclusion of the Czech Republic and, in turn, the Czech business sector from the digital economy-based global markets. Investments in physical infrastructure thus have major influence on keeping the Czech Republic present in global markets and, at the same time, they can support domestic economic activity, i.e. not only in the segment of new technologies and digital services, but also in the construction segment focusing on the construction of the required infrastructure.
- The growing demand for end devices and digital services leads to the emergence of new market segments and thus also the establishment of new business entities operating in these markets. Such new digital services are often knowledge-intensive, especially the creation of expert and entertainment SW. In combination with the existing economic structure, their development thus provides the basis for the emergence of new economic domains.

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<sup>63</sup> The European Commission, Digital Agenda for Europe <http://digital-agenda-data.eu/>

## 3.2. Research and development

### 3.2.1. Introduction

High-quality research is a key source of new knowledge that extends the scope of available technological possibilities that can be used for innovation. Within their activities, research organisations also significantly contribute to the professional training of a new generation of researchers and their further education. There is a direct link between research quality and the quality of tertiary education graduates (see the analysis for the area of human resources). Research and training of researchers ensure the ability of the society and the economy to adopt and utilise a growing volume of existing and already available knowledge that has been produced on a global scale. The ability to maintain a high level of knowledge in the economy constitutes an important source of innovations and a prerequisite for the business sector's ability to succeed in international competition (see the analysis for the area of enterprise).

The quality of research and its practical relevance (applicability) are not in contradiction, as proven by many analytical studies. If the research system is managed adequately and both basic and applied research and university education are anchored within research agendas focusing on long-term strategic challenges, it is possible to achieve mutual synergies that contribute to the quality of research and increase its benefits for the society and the economy<sup>64</sup>. As regards the practical relevance of research, it must be emphasized that this does not exclusively concern research in technological fields but also research and dissemination of knowledge in the field of social sciences that constitute key expertise necessary for non-technical innovations, including social innovations and innovations in services (i.e. knowledge necessary for identifying the changing needs of public and private sector demand, including marketing expertise, innovation management etc.).

The main strategic documents of the Czech Republic perceive suitable conditions for high-quality public research<sup>65</sup> as one of the fundamental prerequisites for competitiveness and – in the long term – consider it a key precondition for the innovative efficiency of the economy that creates stimuli for the development of new application directions<sup>66</sup>. Despite the existence of some top-ranking facilities and research teams, in most areas the overall quality of research in the Czech Republic lags significantly behind the most developed countries<sup>67</sup> due to a range of factors<sup>68</sup>. The limited number

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<sup>64</sup> For an overview of studies focusing on detailed documentation of dependence between both, see Arnold, E. and Giarracca, F. (2012): *Getting the Balance Right: Basic Research, Missions and Governance for Horizon 2020*. EARTO. (<http://www.earto.eu/european-news/detail/article/technopolis-report-getting-the-balance-right-in-public-rd-investment.html>).

<sup>65</sup> Public research is understood as research that is implemented within the public sector, i.e. mainly in the government and university sectors.

<sup>66</sup> See e.g. the *National Innovation Strategy of the Czech Republic*, p.3, or the *International Competitiveness Strategy of the Czech Republic for 2012–2020*, p. 41.

<sup>67</sup> *Analysis of the existing state of research, development and innovation in the Czech Republic and a comparison with the situation abroad in 2013*.

<sup>68</sup> Decades-long isolation of Czech science, small number of world-renowned scientists, non-existence of strong partners from the private sector, inadequate instruments and equipment, frequent “inbreeding”, i.e. lifelong career of scientists and teachers within one university etc. (see the results of the *International Audit of Research, Development & Innovation in the Czech Republic*, <http://audit-vav.reformy-msmt.cz>).

of high-quality research teams in the Czech Republic affects the limited attractiveness of Czech research organisations for top foreign research organisations, companies and even high-quality domestic and foreign researchers and talented young scientists. This further strengthens the lack of openness of Czech research and, as a result, the barriers that prevent improving the quality of Czech research to an internationally comparable level remain in place. The relatively weaker position of many Czech research organisations is also the reason for the insufficient participation of Czech teams in international research projects that require top-level facilities meeting, among other things, the European standards for research infrastructures. Although there has been an improvement in this respect, owing to investments in research infrastructures supported by the Structural Funds (namely from Operational Programme Research and Development for Innovation) in recent years, there are still some deficiencies in this area, both in the management of these infrastructures and in the increasing deficit of top-quality research infrastructures in the capital city of Prague.

While the area of R&D policy management has its specifics in every country, in the Czech Republic this area has long been plagued by many deficiencies and has been the subject of long-term criticism and political discussions. Launched in 2008, the reform of the research, development and innovation system brought many partial improvements, but there is still room for improvement in this respect, including putting into practice the recommendations drawn up within the project entitled International Audit of Research, Development & Innovation in the Czech Republic<sup>69</sup>.

The above characteristics of public research in the Czech Republic are further detailed and explained in a breakdown by problem area or theme:

- Inconsistent quality of public research
- Digital agenda and public research
- Low relevance and underdeveloped cooperation between public research and the application sector
- Low international openness of the Czech research environment
- Deficiencies in R&D policy management and governance

This breakdown is necessary, because only a detailed description of each problem area makes it possible to analyse the causes of the current situation, its consequences and possible development risks. However, at the same time it is necessary to be aware of the strong mutual conditionality of the problem areas, where the management system setting affects the quality and relevance of research and significantly influences the openness (or lack of openness) of the research environment. Similarly, the degree of the openness of the research environment is – to a large extent – both a cause and a consequence of the low quality and relevance of research and the problematic setting of R&D policy management.

### **3.2.2. Problem area 1: Inconsistent quality of public research**

#### **Manifestations and subproblems**

- *The volume of research results* in the Czech Republic has shown *an increasing tendency* in recent years and, in terms of the number publications produced, it reached values that are comparable

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<sup>69</sup> *International Audit of Research, Development & Innovation in the Czech Republic*. Final report. Prepared for MEYS by Technopolis Group, Prague 2011 (<http://audit-vav.reformy-msmt.cz>). Hereinafter the International Audit.

to or even exceed those of the most developed countries<sup>70</sup>. This is clearly a consequence of the long-term trend of increasing public investment in research and development that began at the beginning of the 21st century and, despite minor fluctuation in the crisis years 2008–2010, has maintained its growth dynamics – this trend ranks the Czech Republic among fastest growing EU countries in the last decade.

- *The level of the Czech Republic's scientific production in terms of average quality* that is measured through the citation rate of publications<sup>71</sup> has been gradually improving since 2000, but it *still lags behind the EU-27 average*<sup>72</sup>.
- However, there already are *strong and top-quality research teams* in the Czech Republic that take part in developing scientific publications in collaboration with the best research teams abroad and that have the world's highest citation rates<sup>73</sup>. Due to that, the Czech Republic has maintained an overall solid position in international comparison.
- However, it can be generally concluded that the level of Czech research is varied, there are few internationally competitive teams and the dominant mass of research does not stand up to international comparison in terms of quality. *Overall*, the Czech Republic is thus characterised by an *average level* (despite the existence of some top-quality facilities) that is associated with low attractiveness for both Czech and foreign top-ranking scientists. The causes that must change for there to be any hope of a significant improvement in the quality of Czech research include the following:
  - Czech research suffers from *a lack of critical mass and fragmentation* that undermines a number of other aspects that are important for research quality: limited opportunities for interdisciplinary research, limited capacity for addressing long-term strategic projects, limited possibility to address grant projects and cooperate with the practical sector at the

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<sup>70</sup> Between 2000 and 2010, the Czech Republic's proportion in global production of publications increased from 0.52% to 0.74%. As regards the number of scientific publications per FTE of a person employed in research and development, the Czech Republic achieved values even greater than Germany or the USA (see the *Analysis of the existing state of research, development and innovation in the Czech Republic and a comparison with the situation abroad in 2012*).

<sup>71</sup> It needs to be emphasised that the significance of the citation rate indicator differs in various fields and comparison between different fields is very difficult.

<sup>72</sup> In terms of the citation rate of publications by Czech authors per FTE of persons employed in R&D, the Czech Republic lags behind developed EU countries and even some post-communist countries (see the *Analysis of the existing state of research, development and innovation in the Czech Republic and a comparison with the situation abroad in 2013*).

<sup>73</sup> In the period from January to October 2012, the share of publications by Czech authors in the top 1% of the most cited works reached a value of 1.32%, i.e. 32% more than what might correspond to the theoretical value. This indicator is one of the highest values overall. Van Norden, R. (2012): 2012 in Review. *Nature*, vol. 492, pp. 324-327. Although bibliometric methods cannot be viewed as the sole authoritative tool to determine quality in research, in 2003–2009 the Czech Republic showed above-average bibliometric values and, at the same time, generated a minimum volume of scientific production in the fields that have direct application relevance: instruments and instrumentation, nuclear physics and technology, aviation and engineering, computer science, mathematics, selected sub-disciplines of chemistry, electrical engineering and telecommunications, the environment, clinical medicine and biomedical sciences (see Vaněček, J. (2011): *Field-based and institutional analysis of R&D results in the Czech Republic* [www.vyzkum.cz/Priloha.aspx?idpriloha=645356](http://www.vyzkum.cz/Priloha.aspx?idpriloha=645356)). As regards participation in the 7th Framework Programme, the Czech Republic shows a higher rate of participation in the fields of nuclear research, transport (including aviation), nanoscience, material research and production technologies, bioeconomy (food, agriculture and fisheries, biotechnologies) and partially also in the environmental area.

same time results in the preference of the “more secure” grant resources<sup>74</sup>. The absence of a critical mass is further exacerbated by a lack of incentive mechanisms for networking and cooperation between facilities (the methodology of registering scores in the Information Register of R&D Results discourages the creation of joint R&D results).

- Generally, it can be concluded that – due to fragmentation – *Czech research lacks the formulation and subsequent implementation of long-term research agendas*<sup>75</sup>. There are no teams that would consistently address the research of crucial scientific and social challenges in the long term and could thus become the bearers of breakthrough findings.
- The financing system still fails to sufficiently differentiate between high quality and poor quality, thus failing to create favourable conditions for developing truly excellent research teams. These mainly require long-term stability of financing (see the previous bullet).
- The cases when Czech research teams achieve *international success*, are usually cases based on *personal ties with a strong foreign partner*, often based on the reintegration of Czech scientists who have worked in a prestigious institution abroad. However, these ties are often unstable as Czech research organisations scarcely create conditions or programmes that might make it possible to build – around such personal ties with a strategic foreign partner – a critical mass of a team able to develop the research theme and guarantee long-term financing for it.
- A positive example driven by an effort to concentrate resources and excellent research effort is the activity to support “*large infrastructures for research, experimental development and innovation*” (hereinafter “large RDI infrastructure”)<sup>76</sup>. This activity focuses on supporting completely unique research facilities with high financial and technological demands operating on the “open access” principle. The specific importance of large RDI infrastructures within the Czech Republic’s national research and innovation system is amplified by the fact that, pursuant to the Czech legislative framework of support, individual projects of large RDI infrastructures are approved by the Czech government. Large RDI infrastructures play an important integrating role in the currently fragmented system of support for research, development and innovation in the Czech Republic and, in turn, allow for concentrating a critical amount of capacities and resources for performing excellent research, development and innovation activities of extraordinary international overlap. As majority of large RDI infrastructures are directly connected to foreign research infrastructures (e.g. ESFRI), they are a means of integrating the Czech Republic’s national capacities into foreign research infrastructures of pan-European or global importance, which also positively impacts on stimulating excellence in Czech research. The activity to support large RDI infrastructures was launched in 2010 when the Czech Republic’s continuously updated strategic document for the given field was adopted – the Roadmap for Large RDI Infrastructures

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<sup>74</sup> The results of a survey carried out within the International RDI Audit prove that the size of the research group in Ř correlates positively with the intensity of cooperation with the application sector (Annex 5 to the Final Report: Science-Industry Linkages, p. 107)

<sup>75</sup> The International Audit identifies the following basic factors undermining the quality of Czech research: fragmentation, lock-ins, resistance to interdisciplinary and application-oriented research.

<sup>76</sup> A large infrastructure for research, experimental development and innovation is a “*unique scientific facility – including its purchase, associated investments and organisation of its activities – that is necessary for research and development activity as a whole having high financial and technological demands and that is approved by the government and established by one research organisation to be also used by other research organisations*”. The definition pursuant to the provisions of Section 2(2)(f) of Act No 130/2002 Coll., on support for research, experimental development and innovations from public funds and on the amendment to some related acts (Act on Support for Research, Experimental Development and Innovations), as amended.

in the Czech Republic<sup>77</sup>. In the coming period, the key challenge will still lie in securing long-term framework for financing large infrastructures in order to ensure their stability, allow for their further development and, last but not least, allow for their connection to foreign research infrastructure (e.g. ESFRI).

- Other positive examples that are driven by the *effort to concentrate resources and research effort* include additional infrastructure investments implemented with support by the Structural Funds within the framework of the Operational Programme Research and Development for Innovations (“R&D Centres”<sup>78</sup> that include both centres of excellence and regional R&D centres) and also Centres of Competence in applied research<sup>79</sup> financed from national sources. In both cases, these are resources allocated on the basis of long-term financing of research through oriented research and, in the case of Centres of Competence and regional R&D centres, with a link to the needs of the application sector.
- In the case of *R&D Centres*, this also includes an effort to introduce long-term financing on the basis of performance contracts and, at the same time, to differentiate R&D centres depending on their mission and ambitions:
  - centres that may become a part of an international network for division of labour in research and a gateway to the international research community (a total of 8 *centres of excellence*), and
  - centres whose mission is to interconnect and provide findings in their fields of specialisation to users/the application sector within the Czech Republic and increase their absorption capacity via cooperation and contract research (40 *regional R&D centres*).<sup>80</sup>
- By concentrating resources, *R&D centres* have created the conditions for a long-term strategic direction in research. Crystallisation cores of scientific teams with solid material conditions have thus been created in selected research areas, making the Czech Republic attractive even to foreign researchers. The introduction of performance contracts contributed to a clearer orientation and measurability of research effort towards top-class scientific results, or towards closer links with the practical sector (possibly a combination of both metrics). Even though there are continuing concerns about the financial sustainability of supported centres, successful R&D centres and research infrastructures should undoubtedly become *key building blocks within the National RIS3*. At the same time, it will be necessary to create favourable conditions for their closer links with the needs of the application sector (Hebáková, Granger, 2013) and to ensure sufficient resources for the long-term development of the centres once they are established.
- Similarly, projects included in the Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic constitute key elements of the Czech Republic’s

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<sup>77</sup> *Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic*. MEYS, 2010, and its further updates. <http://www.msmt.cz/vyzkum-a-vyvoj/ceska-roadmap>.

<sup>78</sup> See <http://www.opvavpi.cz/cs/siroka-verejnost/projekty.html>

<sup>79</sup> <http://www.tacr.cz/index.php/cz/programy/centra-kompetence.html> It is a programme focusing on support for implementing long-term strategic research agendas in the partnership of research organisations and companies.

<sup>80</sup> This is analogous to differentiating between *general purpose technologies* that require a high concentration of resources to advance the boundaries of knowledge (to explain the fundamental principles of functioning) and the effort to utilise the findings obtained in the area of *general purpose technologies* in a wide range of possible applications that require a large amount of applied research and experimental development (see *The Role of Community Research Policy in the Knowledge-based Economy*, EC, 2010, chapter 1.4. and subsequent all-European discussion focusing on Key Enabling Technologies: [http://ec.europa.eu/enterprise/sectors/ict/key\\_technologies](http://ec.europa.eu/enterprise/sectors/ict/key_technologies)).



research system, which require a specific approach within the national strategy, especially with respect to the need for stable long-term financing of operations, including necessary technological upgrading.

- The above investments have led to the improvement of the equipment of research facilities in the Czech Republic, which creates opportunities for concentrating high-quality research and innovation activities and also for closer links between Czech research and the European research area.
- It is clearly positive that – as part of an assessment using alternative methodology – the International Audit<sup>81</sup> concluded that despite the generally unsatisfactory situation in a number of areas as described above, at least one case of a good practice example has always been found. It already exists in the Czech institutional environment and can be used as a model to improve the quality of research throughout the entire system within other reform efforts<sup>82</sup>. The newly developed assessment methodology (2013) takes into account some proposed elements (taking account of area-specific aspects in assessing and introducing the element of international peer-review<sup>83</sup> during quality assessment, at least to a limited extent).
- A specific problem of the Czech research environment lies in the fact that the capital city of Prague is increasingly lagging behind in terms of research infrastructure availability (because it is impossible to use resources to support research within key operational programmes in 2007–2013 under the Convergence objective), even though more than a half of public-sector research capacities are concentrated there. Prague-based research capacities provide a significant portion of their expert capacity to the application sector on a nationwide scale; in some cases these are unique research facilities whose expertise cannot be replaced from other sources on a national scale.

### Causes and evidence

- The causes underlying the poor quality and low attractiveness of Czech research in comparison to foreign countries lie both in the deficiencies of the regulatory framework, and in areas requiring interventions at the level of research organisations.

#### a) Regulatory framework

- In many respects, the current *quality assessment*<sup>84</sup> system and the related *system for the financing of research* in the Czech Republic have thus far acted contrary to the efforts to improve research quality. The assessment system was set to count outputs, i.e. the quantity rather than quality of the results achieved, which motivates the production of useless results. This fact was criticized, among others, in the International RDI Audit in the Czech Republic<sup>85</sup>. In 2013, assessment methodology was modified to newly include peer review elements and the

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<sup>81</sup> The International Audit also included the pilot verification of alternative methodology using international peer review, which was applied on a sample of 18 high-quality research facilities of various types and orientations (see International Audit, annex 3).

<sup>82</sup> International Audit, annex 3, p. 28.

<sup>83</sup> The process of reviewing scientific work, research or project by others who are experts in the same field.

<sup>84</sup> This is the RIV (Information Register of R&D Results) and its methodology, on the basis of which institutional support is distributed through mechanical calculation (for more information see e.g. the *International RDI Audit in the Czech Republic*).

<sup>85</sup> *The Final Report of the International Audit of Research, Development and Innovations in the Czech Republic*. MEYS, Prague, 2012

assessment method was differentiated for research in various scientific disciplines. In the future, the specific effect and further development of the new methodology will require increased attention so that the assessment system consistently differentiates between high (international) quality and poor quality research and so that it takes increased account – besides excellence – of the application relevance of research, international participation and the assertion of the third role of research organisations<sup>86</sup>.

- The prevalence of special-purpose resources (taking the form of a large number of small grants) over institutional resources leads to the *short-term nature of research, the instability of financing, and the fragmentation of finances*. This is the consequence of a shift from the prevalence of institutional financing to special-purpose financing that is anchored in the objectives of the Reform of 2008<sup>87</sup>, which was criticized in the findings of the International RDI Audit in the Czech Republic (a proposal to increase the proportion of institutional resources to at least 50%).
- As a side effect, the large proportion of grant resources *generates excessive administration* (grants require reporting, submitting additional grant applications, which decreases the success rate and leads to considerable lost investments), which makes it impossible to formulate long-term, ambitious research agendas and to set up (and retain in the long-term) high-quality research staff.
- The standard practice in *project assessment* at the level of providers shows a number of deficiencies, including low openness to foreign assessors. The system supports aversion to risk (e.g. it does acknowledge the possibility that research may be unsuccessful, results must be reported administratively for each grant, in some cases the number of planned results is assessed as the measure of quality) and discourages from cooperation with other institutions (the need to share points in the Information Register of R&D Results), which reduces interest in interdisciplinary topics.

#### b) Research organisations

- Deficiencies in the strategic and operational *management of both research organisations and research activity itself* arise mainly from the absence of systematic education in this area and generally from the undervalued role of management in research<sup>88</sup>.
- In day-to-day activities, the negative consequences of inadequate operational management are reflected in the *low quality of supporting processes*, which concerns the area of HR management (inadequately developed processes for the recruitment and career growth of research staff), grant support (absence or low professional level of grant support), supporting activities for cooperation with the application sector (absence or insufficient experience of employees responsible for commercialising results and establishing partnerships with the application sector), as well as general administrative processes (financial and technical support of research).
- Management deficiencies are also negatively reflected in the lack of strategic approach to *research activity planning* (lack of ambitious research objectives, inadequate analysis of competition in research planning, low interdisciplinary and inter-institutional cooperation) but

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<sup>86</sup> Measures within the updated National RDI Policy for 2009 to 2015 with a view to 2020 have also been designed in this sense.

<sup>87</sup> See *R&D system reform in the Czech Republic* (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=495405>).

<sup>88</sup> *International audit*, Annex 3.

also in *inadequate promotion of achievements* and limited room for career growth of talented individuals<sup>89</sup>, which substantially undermines the quality of research activities.

- *Material conditions* represent another cause of the low quality of research in the Czech Republic. In terms of available instruments and equipment, the situation has been gradually improving, mainly thanks to considerable investments by the Structural Funds in recent years (with the exception of Prague, which has been excluded from funding through Operational Programme Research and Development for Innovation owing to its high GDP level).
- There still persist deficiencies in the area of *unique research infrastructures*, which are still not fully available, even though they may become the key motivating factor attracting researchers from abroad, provided that stable and long-term resources are secured for their operation and subsequent technological upgrade. Nonetheless, the Czech Republic has advanced significantly in this respect in recent years (e.g. by defining the Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic and providing a subsidy title to support their operation<sup>90</sup>). Although the consequences of these steps have not fully shown yet, it can be expected that, in the coming years, they will translate positively into the increased attractiveness of Czech research organisations. However, the future success of this effort will depend on the following factors:
  - Adequate setting of *infrastructure management*, including the provision of open access to users from both the academic and corporate sectors<sup>91</sup>.
  - Securing *stable long-term financing of infrastructures* (including technological upgrade) and information sources.
  - Motivating *remuneration and further education of key management personnel* and especially the new generation of future scientific management (middle management) as well as qualified *technical staff*.
  - Establishing adequate strategies to *strengthen their cooperation with the application sector*.
- In material terms, there are still deficiencies *in the area of researcher's salaries*<sup>92</sup>, especially in the case of younger researchers (where the salaries in the university and government sectors strongly depend on the length of work experience<sup>93</sup>) and doctoral students, which – in combination with unattractive career prospects and insufficient use of the achievement principle – discourages talented students from pursuing careers in science, i.e. prevents them from focusing fully on research work. However, there are also deficiencies in the ability to retain qualified technical personnel that is necessary for seamless operation.
- Within the context of the Czech Republic, a specific problem lies in the fact that key public research capacities that are required for implementing the Smart Specialisation Strategy in most areas are located in Prague, where the possibilities of financing by ESIF in the period 2014–2020 are very limited, as Prague is an economically developed region.

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<sup>89</sup> *International audit*, Annex 3.

<sup>90</sup> *Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic*. MEYS, 2010, and its further updates. <http://www.msmt.cz/vyzkum-a-vyvoj/ceska-roadmap>

<sup>91</sup> For more information see the *National Innovation Strategy of the Czech Republic*.

<sup>92</sup> National Training Fund (2011): *Motivation of graduates for research work. Underlying materials for assessing the National RDI Policy: Area of human resources*.

<sup>93</sup> NTF (2011): *Attractiveness of R&D jobs in salary terms. Background studies for the preparation of national RDI priorities*. (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=15138>)

### **The specific position of the capital city of Prague in the Czech Republic's research and education system**

Prague is the educational centre of the entire Czech Republic with supraregional importance. For the most part, Prague-based universities *provide education to students living outside Prague*. About 70% of the students of Prague-based universities have their residence outside the territory of the capital city of Prague. The number of students from outside Prague illustrates the attractiveness of Prague's universities to students from all over the Czech Republic – they come to Prague to study disciplines that are unique and available only at Prague-based universities, but they are also attracted by the prestige of studying at universities that rank among the world's most successful universities.

Prague-based universities and research institutions also play a key role in *developing human resources for research and innovation in the Czech Republic*. Every year, Prague-based public universities produce over 36% of all master's degree graduates from the Czech Republic's public universities. For research, doctoral graduates are crucial. In this regard, Prague-based universities produce 40–50% (the figure varies each year) of all doctoral graduates in the Czech Republic.

The data clearly indicate that *Prague-based universities produce highly-qualified experts for the research, development and innovation sector throughout the country*.

Prague-based research organisations deal with similar problems as entities outside Prague. In addition, they are considerably underfinanced due to the limited availability of resources from the Structural Funds in the period 2007–2013 as compared to the rest of the Czech Republic. Nevertheless, the analysis of Prague-based capacities shows *the potential of Prague-based universities and research teams to achieve research excellence on an international scale*.

This can be illustrated for example on the concentration of key research organisations that provide *links between the Czech Republic and the European research area*. Prague-based research institutions are represented in European research infrastructures and their (in the context of the Czech Republic) high success rate within the 7th Framework Programme shows that *Prague-based research teams are the key drivers of high-quality research in the Czech Republic*.

From the analysis of national programmes of support for applied research, it can be inferred that *most projects within applied research programmes include Prague-based organisations and businesses that are based outside Prague*. Most results of supported project are subsequently implemented outside Prague. This is due to the structure of the economy where the business sector, i.e. the potential user of R&D results, is mainly based outside Prague.

***Prague-based research capacities provide a significant portion of their expert capacity to the application sector on a nationwide scale***; in some cases these are **unique** research facilities whose expertise cannot be replaced by other sources on a national scale. Nevertheless, these are fields that clearly contribute to competitiveness. Therefore, the involvement of Prague-based research teams will also be crucial in terms of implementing the priorities of the upcoming Smart Specialisation Strategy.

## Consequences

- The consequences of the above situation include *the continuing inability of Czech research to win more notable international recognition for its quality*, despite gradually increasing public investments in research and partial successes of a limited number of high-quality teams. Unless the building of a critical mass of high-quality research is reinforced at least in some research areas, the mission of research organisations is differentiated more clearly, and corresponding benchmarks and metrics of quality are defined, it is unrealistic to expect any significant improvement in the quality of research in the Czech Republic.
- The failure to address structural problems that affect the improvement in the quality of and the unsatisfactory framework conditions for Czech research will lead to *low social return on future investments in research*. As a result, Czech research would only have limited ability to produce sufficient original results to make it attractive on an international scale. Its *ability to provide significant impulses for the application sector in the Czech Republic would be limited*, and it would not become a sought-after partner for important corporate clients abroad.
- Without a systematic effort to improve the framework conditions, it can be expected that a significant portion of already implemented investments (especially investments by the Structural Funds) will not bring the expected benefits for improving research quality. Without a clear perspective of further reform steps within the entire system, the *risk of brain drain*, which has been mitigated through recent investments<sup>94</sup>, may become acute again and it may also result in the loss of those high-quality researchers that have been attracted to the Czech Republic through investments in recent years.
- Prague-based research organisations contribute significantly to the training of human resources for research in the application sector in other regions within the Czech Republic and they represent natural partners for a major part of the Czech Republic's application sector. In the context of the Smart Specialisation Strategy, the inability to draw resources from ESIF in the period 2014–2020 constitutes a fundamental problem, especially in priority fields of smart specialisation (see the chapter on specialisation). The exclusion of Prague-based research organisations from support may negatively affect the availability of suitable research partners for companies, thus limiting their innovative capacity.

### 3.2.3. Problem area 2: Digital agenda and public research

#### Manifestations and subproblems

- In terms of research quality, *ICT infrastructures* are of special significance. Digital infrastructures are important to research activity in two respects: firstly, in terms of providing sufficient data storage, transfer and processing capacity; secondly, in terms of digital content and access to information and available findings and scientific results.
- Since 1996, the CESNET organisation has been providing *digital infrastructure for the needs of research organisations in the Czech Republic* – it provides transfer and data services for research organisations and, at the same time, it implements its own research activity in this area. In recent years, major investments in digital infrastructures have been implemented in the Czech Republic

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<sup>94</sup> 40% of key personnel of research organisation that were interviewed in the survey carried out by the International RDI Audit believe that the international mobility of researchers causes the Czech Republic to lose more necessary experts than it gains (Kostić, Pazour, Pokorný, 2012).

(including strengthening CESNET's core infrastructure); a part of these investments were implemented thanks to Structural Fund support: within priority axis 3 of the OP RDI, in part also thanks to the construction of centres of excellence under priority axis 1 and regional R&D centres under priority axis 2 in the IT field. These investments, too, allow the Czech Republic to maintain a long-term *solid level in the research area associated with e-infrastructures* (tools for high-speed networks, data transfer and network traffic monitoring, highly parallel computing, distributed computing, cybernetic safety etc.), i.e. even in the form of commercially successful results.

- Access to scientific information in digital form in *expert databases and electronic scientific periodicals* constitutes a key prerequisite for high-quality research. Without that, it is not possible to maintain contact with the top international scientists. In the area of digital content, the fundamental prerequisite for high-quality research lies in the availability of expert information sources (access to expert databases and electronic publications) where there are still serious deficiencies in the Czech Republic, especially in the case of field-specific sources of information.

### **Causes and evidence**

- The basic element (the communication portion) of e-infrastructures administered by CESNET is of top global quality in the Czech Republic, whereas the distributed computing and storage infrastructure (grid) is at a very good international level organisationally but its capacity is limited (Ministry of Education, Youth and Sports, 2011). The existing infrastructures still *lack sufficient storage capacity* and there are no *supercomputing resources* in the Czech Republic (although their construction is in the implementation phase – IT4I in Ostrava and CERIT in Brno).
- Within the Czech Republic, the IT area is among the research areas that have been generating *significant numbers of commercially applicable results* in the long-term, including the establishment of technological companies and subsequent investment of venture capital. Thanks to the presence of several important Czech IT companies with international reach (e.g. Seznam, AVG and others) and a growing number of foreign companies that locate their R&D capacities in the Czech Republic, there is a considerable opportunity for further reinforcing specialisation and creating of synergistic links between the high-quality facilities and entrepreneurial activities.

### **Consequences**

- Insufficient prioritisation of investments in e-infrastructures to serve the needs of research, their continuous upgrade and also in the development of specialised human resources that are required for the administration and operation of e-infrastructures may cause Czech research to lag behind and reduce public investment efficiency.
- In terms of smart specialisation, the area of digital agenda for research has consequences both for the need to further strengthen the existing specialisation in the area of e-infrastructures and associated research areas (including the issues of cybersecurity and protection of critical infrastructures, storage and processing of large volumes of data, and data mining), and for the need to make digital content and scientific information available to research organisations and the business sector.

### 3.2.4. Problem area 3: Low relevance and underdeveloped cooperation between public research and the application sector

#### Manifestations and subproblems

- *In the Czech Republic, the level of cooperation between research organisations and the application sector is low*, it mostly includes short-term limited-scope cooperation whose scope and contribution to innovations is very limited. This is evidenced, above all, by the low share of revenues of universities and public research institutions coming from corporate sources<sup>95</sup>. Another part of this problem is the existence of a rather extensive but difficult-to-quantify “grey zone” of cooperation that does not take place through official channels and is therefore not kept on record by research organisations (either due to the inadequate setting of the legislative conditions at national level, inadequate internal rules of research organisations, or the lack of high-quality support services within research organisations).
- Another measurable effect of the low level of cooperation between the corporate sector and public research is – besides the amount of resources – the *low proportion of researchers with experience of working in the private sector*. In this respect, the Czech Republic ranks among the countries with the lowest values in the EU<sup>96</sup>. The deficiencies in the application relevance of public research in the Czech Republic and, in part, also the inadequate awareness of intellectual property issues in research organisations are also documented by the low level of patent activity of research organisations in the Czech Republic, which lags far behind the EU average.<sup>97</sup>
- In about the past 10 years, the Czech Republic has experienced *partial improvements* in the linkage between academic research and the application sector, especially as a result of implementing the Reform of the RDI system in the Czech Republic in 2008. Due to financial appraisal of applied results defined pursuant to the Information Register of R&D Results, there has been an increase in the attention on the application relevance and the number of applied R&D results. As regards R&D centres financed by the Operational Programme Research and Development for Innovation, there has been (thanks to performance contracts and project indicators) greater emphasis on cooperation with the business sector through contract research. Nevertheless, these positive efforts are accompanied by a range of negative side effects such as the deliberate generation of applied R&D results (e.g. patents) without any interest in their actual utilisation. In the case of contract research, the efforts are undermined by the unclear situation in public support.
- Another tool to support the forming long-term strategic partnerships between the public research sector and the corporate sector consists in the National Sustainability Programmes I and II that are used to support the development and sustainability of projects of centres that were

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<sup>95</sup>The share of corporate resources in the university sector’s R&D expenditure is only 1.0%, while for the government sector it is 3.4%. These values are way below the European average (Czech Statistical Office, *Cooperation between sectors in R&D in the Czech Republic in 2011*). According to the latest data published in November 2013 ([http://www.czso.cz/csu/redakce.nsf/i/statistika\\_vyzkumu\\_a\\_vyvoje](http://www.czso.cz/csu/redakce.nsf/i/statistika_vyzkumu_a_vyvoje)), even the rather considerable growth in corporate R&D investment in recent years did not translate significantly into the financial volume of contract research and it ranges around CZK 150 million/year in the case of universities and around CZK 1.7 billion/year for the government sector.

<sup>96</sup> It stands at 13%, with the EU average being 17 %. *Researchers' Report 2012*. EC, DG Research and Innovation.

<sup>97</sup> See the *International RDI Audit in the Czech Republic. Review of the IPR System* a Research, Development and Innovation Council (2012): *Analysis of the State of Research, Development and Innovation in the Czech Republic and a Comparison with the Situation Abroad in 2012*. Office of the Government of the Czech Republic.

built in the Czech Republic in 2007–2015 with financial participation of the European Regional Development Fund (ERDF). The provision of support from both programmes is conditional on the ability to achieve internationally competitive results and on evidencing active cooperation with foreign entities and the corporate sector<sup>98</sup>. By implementing these programmes, the Czech Republic also meets its commitment to ensure the sustainability of the constructed centres until 2020 and by reimbursing (merely) 50% of operating costs, i.e. costs of the renewal of these centres' equipment, from public funds it will actively stimulate their cooperation with the entrepreneurial sector.

- At least a *basic infrastructure for supporting cooperation with the users of results* (technology transfer centres, etc.) has been created in most research organisations, mainly thanks to support by the Structural Funds. Internal procedures for monitoring the intellectual property being created and methodologies for cooperation with the commercial sector are gradually being introduced, but often with limited ability to change the fundamental motivating factors within the academic environment. In many cases these entities fulfil the function of commercialising results and interconnecting both worlds *rather formally* (i.e. in terms of reaching the formal objectives of grant projects, especially those financed by the Structural Funds) without having adequate knowledge of the issues and without being sufficiently result-oriented.<sup>99</sup>
- Cooperation between public research and the application sector is one of the areas where the market failure can be felt and where most developed countries apply direct or indirect tools to support the interaction between both types of actors. In the Czech Republic, there are still serious deficiencies in this area. *Support programmes to improve research cooperation between public research and the business sector are poorly developed* in the Czech Republic.
  - The Centres of Competence programme (Technology Agency of the Czech Republic – CZK 9 billion, of which 70% national budget for 2012–2019, 33 centres supported) is in fact the first *programme supporting long-term strategic partnerships between research organisations and companies* that include all stages of research and development and, at the same time, support the mobility and common training of doctoral students – the programme has existed since 2011<sup>100</sup> and the support has proven insufficient so far. This is also evidenced by the large excess of demand, with the success rate of applicant in the programme being only about 10%. Besides R&D centres and projects of large infrastructures for research, experimental research and innovations, the existing centres of competence can be considered another key building block of possible specialisation on disciplines within the RIS3.
  - Tools to support *horizontal mobility* are still lacking completely in the Czech Republic, which negative impacts on the readiness of doctoral graduates to address practical problems;

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<sup>98</sup> The sustainability of centres built within the Operational Programme Research and Development for Innovation whose investment costs exceed EUR 50 million and that predominantly have the character of a large infrastructure for research, experimental development and innovation will be supported by the National Sustainability Programme II. The National Sustainability Programme I will then be used to support centres built using resources from the Operational Programme Research and Development for Innovation and the Operational Programmes Prague – Competitiveness with investment costs up to EUR 50 million.

<sup>99</sup> See the underlying analytical documents. Annex. Updated National RDI Policy, p. 93.

<sup>100</sup> Although support programmes have existed since the 1990s (MIT programmes and the MEYS 1M programme), their scope was limited and they failed to achieve the desired effect of establishing long-term cooperation and leveraging private funds.



- Programmes to support the commercialisation of RO's research results have been implemented within the Operational Programme Research and Development for Innovation, but their results have yet to be evaluated. In parallel, the new Gama programme (Technology Agency of the Czech Republic – CZK 2.77 billion, of which 64.9% national budget for 2012–2019, 10 projects have been selected thus far), which should have a similar focus.
- As a rare exception, there are high-quality programmes to *support entrepreneurship* of university students, implement their own business plans, or *establish technological companies* that have arisen from research results.
- The unsatisfactory situation is made even worse by the high rate of *dependence of Czech corporate R&D on the decisions of foreign parent companies* that scarcely give their Czech subsidiaries sufficient autonomy in the area of cooperation with the academic sector in the Czech Republic, and if they do, then only under conditions that are unilaterally favourable for the multinational companies. In recent years, there has been certain improvement due to the rather dramatic increase in R&D expenditure in the business sector in the Czech Republic (both in Czech branches of foreign companies and in the growing group of companies with Czech owners). Nevertheless *intervention measures* on the part of the public sector focusing on closer linkage between development capacities of foreign companies and public research in the Czech Republic *are insufficient* (absence of an elaborate system of subsequent care for foreign investors).

### Causes and evidence

- The causes for the low relevance of Czech research lie both in the framework conditions, including the structure of innovation demand in the Czech Republic, and in areas requiring interventions at the level of research organisations.

#### a) Regulatory framework

- The current *research evaluation methodology* and the allocation of institutional resources basically *discourage researchers in the public sector from continuous cooperation with the application sector*. The evaluation takes zero or limited account of contract research orders placed by the business sector, successful sale of intellectual property licences, the establishment of a spin-off company, or cooperation with companies in training students. In most research organisations, there is logically *no consensus as regards the role of cooperation with the application sector* within their mission and, by extension, no agreement on the adequate evaluation of this activity. Moreover, the application of an evaluation methodology often leads to the deliberate production of “applied results” pursuant to the valid evaluation methodology.<sup>101</sup>
- *Weak and poorly sophisticated innovation demand*, i.e. poorly sophisticated innovation needs within the Czech Republic's corporate sector (see the corporate sector analysis) only generate very limited professionally motivating challenges for research organisations. Therefore, in some areas of research, research organisations lack strong and relevant corporate partners able to formulate and co-finance long-term research cooperation. This is also evidence by the fact that most academic teams perceive the possibility of cooperating with the corporate sector mainly as a source of additional financial resources and not as a source of additional research stimuli or an

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<sup>101</sup> There are known cases of deliberate patenting, where research organisations have no real interest in further developing the protected results, but they only have them patented in order to increase the amount of institutional resources for their institution based on the number of patents reported.

opportunity to cooperate on a theme of mutual research interest<sup>102</sup>. The mismatch between the expectations of companies and those of research organisations thus constitutes one of the key barriers to cooperation.

- *Tax considerations* may be one of the reasons why cooperation between research organisations and the corporate sector has not developed to a larger degree, despite increasing R&D investment in the private sector. Until 2013, internal R&D expenditure was tax-deductible in profitable companies; due to the legislative conditions, the purchase of R&D services can only be deducted since 2014<sup>103</sup>.

#### b) Research organisations

- There are serious *deficiencies* even at the level of research organisations' management, which fully applies to specific skills for *managing relations with the application sector*<sup>104</sup>. There are no motivational incentives for this activity and there is also a lack of financial resources for the flexible financing of research depending on current demand in the application sector. The career rules of most research organisations and universities give little or no significance to high-quality applied results, even in technical areas. This results in the *low prestige* of applied research among researchers and the unwillingness to engage in this activity. Despite the fact that there are honourable exceptions of research teams that cooperate with the practical sphere on relevant and scientifically important themes in the Czech Republic, it is safe to generally conclude that research organisations in the Czech Republic are not well-prepared for cooperation with the application sector and they lack motivation for such cooperation<sup>105</sup>.
- *Awareness of intellectual property issues* is generally *very poor* among research personnel, which causes serious problems during cooperation (the risk of disclosure of corporate partner's intellectual property, signing of contracts under conditions unfavourable for research organisations etc.). In extreme cases this can even lead to researching areas that have already been researched, i.e. that are already protected by intellectual property rights.
- The setting of *conditions and internal processes* in the area of contractual research, the setting-up of spin-off companies, the evaluation and remuneration for this type of results are often inadequately regulated within research organisations, which is demotivating and, in some cases, researchers may be forced to look for alternative ways of commercialisation (the results are utilised commercially under conditions unfavourable for the institution or even without its knowledge).
- *Support services in the assessment and subsequent protection of intellectual property* (especially assessment of the novelty and application potential of the achieved results, assistance in protecting intellectual property) have been gradually evolving within research organisations in recent years, thanks to the establishment of technology transfer centres. Nevertheless *the level*

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<sup>102</sup> See the results of the survey carried out within the International RDI Audit (*Annex 5 to the Final Report: Science-Industry Linkages*).

<sup>103</sup> In the future, it will be important to monitor and assess the impact of this tax-deduction "equality" of purchases of R&D services on the volumes of these services implemented by universities and public research institutions.

<sup>104</sup> See especially the *International RDI Audit, Annex 5 Science-Industry Linkages*, or Berman Group (2010b)

<sup>105</sup> The best-known case is that of the Institute of Organic Chemistry and Biochemistry AS CR, but there are other cases, such as the Department of Cybernetics at the Faculty of Electrical Engineering, Czech Technical University, or the Research Institute of Textile Machines in Liberec and other, usually smaller facilities.

*of provided services is very varied*, they are scarcely on a satisfactory professional level and some organisations lack consistent support completely.

- At the level of research teams, in the vast majority of cases there are no *qualified capacities for the business development of the achieved R&D results*, i.e. for identifying promising results, searching for suitable partners for commercialisation, negotiating the content and conditions of joint projects of applied R&D. Most researchers are not prepared for such type of activity nor are they trained in this area; mechanisms that would aid such activities (e.g. regular meetings with corporate sector representatives) are scarcely institutionalised.
- The *mechanisms for verifying the commercial applicability of results* and for verifying technologies (proof of concept) are completely inadequate. The logical outcome is that even promising results of research fail to be utilised in most research organisations.
- *Awareness of the basics of entrepreneurship and training in this field* for university students and researchers are *inadequate and unsystematic*. Only very exceptionally are educational activities followed by practical support services for start-up entrepreneurs from among students and academic staff.
- *The mobility of researchers into and out of the corporate sector is very limited*. The mobility of researchers from the corporate sector to research organisations is a wholly exceptional occurrence. This creates a cultural barrier hindering closer cooperation and widens the gap between the two worlds.
- *Small size of research teams* and lack of long-term funding for research activity is also a factor that *reduces the ability to focus systematically on working with corporate partners*. Small teams suffer from lack of resources for parallel work on grant projects and high-risk contracts for companies, which is why they prefer the more secure grant resources<sup>106</sup>.

## Consequences

- The main consequence of this unsatisfactory state of cooperation between research organisations and the application sector is the generally low application relevance of research in the Czech Republic. This is also evidenced by the fact that Czech companies fail to sufficiently use public research as a source of expertise and possible innovation advantage<sup>107</sup>. Subsequently, the low level of interaction between public research and the application sector results in a situation where *pouring public investments into R&D within the Czech economy has little effect* and public investments in R&D have low economic return.
- A vicious circle emerges in this area, where low application relevance of public research, poor motivation to cooperate and *poor preparedness* (at the level of an institution and individual researchers) *for cooperation* discourages companies from cooperating with the academic sector, while – on the contrary – the poorly sophisticated innovation demand of companies and the unfulfilled expectations of a client approach on the part of companies discourage researchers from cooperating with the companies. Mutual expectations differ greatly and the parties rarely succeed in *breaking the initial distrust* without which it is not possible to develop any long-term strategic cooperation.

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<sup>106</sup>See e.g. *The International RDI Audit*, Annex 5, *Science-Industry Linkages*.

<sup>107</sup>See the underlying analytical documents. Annex. The updated National RDI Policy, according to which innovative companies do not use universities as a source of their innovative activities in two thirds of cases (p. 86).

- The practical consequence of the isolation of the two sectors is the *low number of R&D results* that are produced by research organisations and *that are actually commercially utilised* (e.g. the number of licences purchased by corporate entities from universities and research organisations, or the volume of contract research). A side effect of the low level of cooperation and relevance of public research, which should not be taken lightly, is also the dissatisfaction of employers with the quality of the practical knowledge of university graduates (NTF, 2011b), including doctoral programmes that should prepare the young generation of scientists for addressing research problems in practice.
- From the perspective of the Smart Specialisation Strategy, this problem area needs to be addressed both through removing selected regulatory obstacles and, above all, through a range of horizontal measures that will generally increase the inadequate level of interaction between research and the application sector. At the same time, the potential of existing capacities should be utilised, especially the potential of high-quality regional R&D centres (OP RDI) and competence centres as priority areas that should be targeted by vertical interventions (e.g. specialised programmes to support cooperation with technologically advanced companies, including branches of multinational companies).

### 3.2.5. Problem area 4: Inadequate international openness of the Czech research environment

#### Manifestations and subproblems

- The environment of research organisations in the Czech Republic is characterized by *a significant lack of openness*. In contrast to the entrepreneurial sector, which underwent significant internalisation of the Czech corporate sector (including the adoption of best management practices) due to the privatisation of Czech companies and globalisation of the economy, the environment of research organisations has not been subjected to any strong pressure calling for a change of the current practices and for rationalisation of its operation since 1989 (with the exception of the privatisation of some departmental research institutes).
- In the 1990s, public resources for research were sharply reduced, which acted as a “push factor” forcing a part of researchers (often the more active ones) to leave. Since the beginning of the 21st century, there has been a *gradual increase in the volume of public resources for research*, but it *was not accompanied by adequate emphasis on quality improvement* and, in turn, additional resources were in many cases invested in research teams that had survived the crisis of the 1990s thank to a belt-tightening strategy, without any ambition for growth or expansion. *Such research teams and organisations are often unprepared – psychologically and managerially – to substantially develop their facilities, they are not ready to open up, and they have low motivation and limited ability to attract and retain foreign experts*. This concerns both the lack of openness to foreign countries and entry of foreign researchers (or researchers with foreign work experience) and very limited mobility between research organisations within the Czech Republic, as well as mobility towards the application sector (see problem area 3). The lack of openness has translated into the very small share of foreign employees in science and technology<sup>108</sup>.

<sup>108</sup> The share of research experts in the Czech Republic ranges around 2%, by contrast e.g. in neighbouring Austria it is 11%. Eurostat 2012 – [http://epp.eurostat.ec.europa.eu/portal/page/portal/science\\_technology\\_innovation/data/database](http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/database)

- *The international mobility of researchers in the Czech Republic ranks among the lowest in the EU*<sup>109</sup> which is undoubtedly one of the reasons of the relatively *poor participation of Czech research facilities in international research cooperation*. Despite the improving trend, which translates e.g. into the growing participation of Czech scientists as co-authors of publications with other foreign authors, the lack of openness still poses a problem for many Czech research teams. The lack of (long-term) international mobility and exposure to different behavioural and working patterns often lead to rigidity, lack of openness to new approaches and, in extreme cases, even to the conservation of a culture that does not create a stimulating environment necessary for high-quality research (lack of openness to external stimuli, rigid hierarchical management structure instead of meritocracy, unsatisfactory age structure, unsound practices in recruiting new employees)<sup>110</sup>.
- With few exceptions, the Czech research environment is characterised by the tendency to stay at the home facility within the same research team for the entire scientific career, where changes in the team only occur due to generation replacement (so-called *in-breeding*). In 85% of research groups in the Czech Republic it is expected that their doctoral graduates will take researcher positions in the “parent” team<sup>111</sup>. Czech Republic ranks among countries with the greatest share of non-mobile researchers (a share of more than 50% as compared to less than 40% in most developed countries)<sup>112</sup>, which has unmistakably *negative consequences for achieving and maintaining top research quality*<sup>113</sup>.
- Compared to most European countries, in the Czech Republic there is rather generous mechanism for supporting the participation of academic facilities in the EU framework programme through providing additional financing for eligible project expenditure from national sources; the Czech Republic can also profit from the opportunities resulting from the *existence of a rather extensive international scientific diaspora*<sup>114</sup>. Despite these opportunities, the *possibilities for using international grants*, including EU framework programme grants, remain *poorly utilised* – this is not due to a low success rate of applications (which is roughly the same as the European average), but mainly due to *low interest* and low number of submitted projects with Czech participation (RDIC, 2013). The *opportunities for research cooperation with the neighbouring countries* are used only marginally and unsystematically, despite the possibility of using cohesion policy resources (cross-border cooperation programmes) for this purpose.
- In recent years the *openness to foreign employees has started to slowly improve* thanks to massive support for new tools that explicitly promote the coming of foreign researchers, or

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<sup>109</sup> Only 44% of Czech researchers have spent at least three months in a researcher position in another country, compared to the EU average of 56%. *Researchers' Report 2012*. EC, DG Research and Innovation. p. 96.

<sup>110</sup> The International Audit, Annex 3, pp. 19–21 (conclusions of the pilot verification of international peer-review).

<sup>111</sup> International audit, p. 54.

<sup>112</sup> *Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility*. Science Europe, 2013 (<http://www.scienceeurope.org/downloads>).

<sup>113</sup> See e.g. *Science Europe Position Statement: Horizon 2020: Excellence Counts*. Science Europe, 2012 (<http://www.scienceeurope.org/downloads>). Bibliometric data for Czech research also document that a Czech author without a foreign co-author has roughly half the citation rate of Czech publications with a foreign co-author (see the *International RDI audit*).

<sup>114</sup> The size of the Czech “research diaspora” is estimated to comprise 4–7% of scientists with Czech citizenship. When we include all researchers with Czech nationality, i.e. those who already have foreign citizenship, this number increases to 10–17% of all researchers in the Czech Republic (Kostecká, Y., Bernard, J., Kostecký, T., 2007)

researchers with experience of working abroad, to the Czech Republic (mainly from the Operational Programme Education for Competitiveness). Even though the effect of this tool will be felt with a delay, there are already cases where the quality of research has improved due to this measure, which will require strengthening in the future. In addition, the application of these tools coincides with the deepening economic crisis in some parts of Europe, due to which there are also foreign researchers not only from Asia and countries of the former Soviet Union, but also from South European countries on the Czech Republic's researcher market. In the case of R&D centres supported by the Operational Programme Research and Development for Innovation, there have also been international selection procedures for top management positions in several cases, which gradually opens at least some Czech research organisations to the international community. Nevertheless, these tools mostly prevent the participation of Prague-based facilities, which limits their impact on the Czech research system as a whole. *Also, incoming of researchers from abroad is not linked to long-term human resource development strategies* in the accepting institutions, including guaranteed long-term funding for newly-constituted research teams (e.g. in the form of a permanent contract if the integrated scientist proves useful).

### Causes and evidence

- The reasons for the lack of openness of Czech research lie both in the framework or regulatory conditions and in factors related to the nature of the internal management and operation of research organisations, especially in the area of HR management and career rules.
  - a) Regulatory framework
- At the top level, the Czech Republic still lacks a holistic strategy for RDI internationalisation that would include activities of all departments and agencies that are engaged in this area<sup>115</sup>. This is also connected with the low level of the Czech Republic's participation in European activities intended to strengthen the integration of the European Research Area (ERA) and generally in activities intended to strength ERA structuring (ERA-NET, ERA\_NET Plus and other projects).
- In the field of regulation at the national level, greater openness and mobility are hindered by *formal requirements for the acknowledgement of academic titles from abroad* and generally also too complex *procedures for approving career advancement*. In the case of universities, it is the requirement to teach in Czech that prevents any greater engagement of foreign academicians.
- *Immigration barriers* also constitute a notable obstacle, mainly in the case of researchers from countries outside the EU where there is no qualified central support service to provide support to foreigners coming to the Czech Republic (e.g. through representative offices of the Czech Republic in foreign countries). Even in the case of employees from EU countries, there are still a notable number of obstacles hindering the integration of foreign researchers into the Czech environment (e.g. problems in transferring retirement rights etc.).
- Lack of openness to foreign speaking scientists is illustrated by the fact that in most Czech grant programmes it is *obligatory to submit grant applications in Czech*.
- At national level, there is *no strategy to support international cooperation* with clearly defined priorities and objectives and with the definition of areas in which the Czech Republic wants to

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<sup>115</sup> See the updated National Research, Development and Innovation Policy of the Czech Republic for the period 2009–2015 with an outlook to 2020, measure 16.

cooperate, the countries and institutions it wants to cooperate with and why, supported by stable financing<sup>116</sup>.

- There are absolutely *no tools* to systematically *support the circulation of brains*, such as possibilities of sabbatical<sup>117</sup>, and tools supporting the setting up of new research groups open specifically to researchers coming from outside the research organisation are used very scarcely. It can be generally concluded that there are *minimal incentives or bonifications for internationally open research facilities* that actively strive to diversify the personnel “gene pool”. Recent exceptions include the Operational Programme Education for Competitiveness and international search committees<sup>118</sup> for large infrastructure projects under the Operational Programme Research and Development for Innovation. In the area of applied research, the new Delta programme (TA CR) launched in 2014 could bring some change.

#### b) Research organisations

- At the level of research organisations, there is usually *no international cooperation strategy*<sup>119</sup> or there is only a formal one. Such strategies only scarcely take the form of explicitly defined strategic partnerships, i.e. the definition of specific strategic partners and the clear content of research cooperation with these partners. This is also connected with the absence of the long-term financing of strategic research cooperation at the national level.
- Despite certain improvement thanks to using the pan-European network called Euraxess to advertise research jobs<sup>120</sup>, research organisations in the Czech Republic still show *serious deficiencies in their HR management policy* and in their procedures in *recruitment and filling vacant positions*<sup>121</sup>. These are felt as the low number of researchers with foreign experience (or even experience from another research organisation within the Czech Republic) and subsequently *encourage in-breeding*<sup>122</sup>.
- most research organisations in the Czech Republic *lack qualified services to facilitate integration of foreign researchers and students* (soft services), most support and internal processes are only available in Czech and the responsible employees are not prepared for working in English (typically e.g. HR agenda).
- While *international research cooperation* in the form of participation in international projects and *long-term mobility* (i.e. more than three months) is preferred by research organisations, it is *scarcely supported*. In the case of mobility, this is often probably due to concerns about brain drain.

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<sup>116</sup> This problem is targeted by measures of the updated National Research, Development and Innovation Policy of the Czech Republic for the period 2009–2015 with an outlook to 2020, where the need for an interdepartmental strategy for RDI internalisation is explicitly formulated in Measure 16.

<sup>117</sup> Sabbatical – paid, partially paid or unpaid leave provided by universities to university teachers for the purpose of scientific work, self-education, work on a publication and/or mental hygiene.

<sup>118</sup> An internationally staffed committee of assessors.

<sup>119</sup> Only about 40% of research organisations have a similar strategy in place. Boekholt et al. (2011): International Co-operation in R&D. Final Report – 6. International Audit of Research, Development&Innovation in the Czech Republic. Manchester Institute of Innovation Research&Technopolis Group

<sup>120</sup> See EC (2012): *The Researchers Report 2012: Monitor human resources policies and practices in research*. Scorecards.

<sup>121</sup> See e.g. the International audit, Annex 5 – results of the pilot verification of the new assessment methodology.

<sup>122</sup> A practice where a university produces graduates who then remain in the “home” working group, which promotes intellectual stagnation.

- In the case of research cooperation in the form of international grants, there are often inadequately-set internal procedures that are associated with greater administrative demands and, in some cases, even a higher rate of payment to the central budget<sup>123</sup>, which often discourages research teams from cooperation. High-quality, client-oriented *support in the form of grant management* is rather scarce within research organisations.

### Consequences

- The absence of a *supra-departmental strategy for RDI internationalisation* together with the understaffed state administration bodies responsible for this area result in poor participation in pan-European research cooperation and, in the future, may jeopardize the drawing of resources from the Horizon 2020 programme and undermine potential synergies between H2020 projects and cohesion policy resources in 2014–2020.
- High quality of research is not conceivable without *the circulation of brains* and systematic creation of *conditions for absorbing new stimuli from different environments*. One of the consequences of the low openness of Czech research organisations is their low attractiveness to researchers with different experience (i.e. poor ability to retain such researchers in the long-term) and the ensuing negative impacts on overall research quality. The Czech research environment is not very attractive from international perspective due to its language specificity and – compared to the countries with the most advanced research systems – it is also unattractive due to low salaries. Inability to ensure greater openness and permeability of the career system of Czech research impacts on its poor ability to attract and retain a critical number of researchers with experience from different environments.
- The low “genetic diversity” of Czech research organisations is intensified by their conservative HR practices. Eventually, it may lead to the *drain of talented young researchers* who are not given adequate condition for their development, and to the *gradual re-emigration of employees from abroad*, i.e. even in the case of researchers who have been attracted to the Czech Republic in the previous years. Unless the barriers to the arrival of researchers from abroad and to scientific mobility in general are gradually removed in the Czech research environment, the selection of talents for research carers will remain limited to the Czech Republic (and possibly Slovakia) in the future as well. Persisting lack of openness would mean losing any hope of achieving top international research quality.
- International openness and mobility of researchers has a clearly positive impact on the degree of *participation in international research cooperation*. In this respect, the Czech Republic’s results are unsatisfactory in the long-term<sup>124</sup>. Unless sufficiently robust mechanisms are put in place to support the circulation of brains from and to the Czech Republic and to anchor the foreign scientists that are already present, there is unlikely to be any increase in the activity of Czech research teams in international research cooperation, including future participation of Czech research teams in Horizon 2020.

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<sup>123</sup> Underlying analytical documents. Annex. Updated National RDI Policy, p. 83.

<sup>124</sup> According to the results of the International Audit survey, as many as 84% interviewed directors of research organisations reported that their facility had no income from international grants (*International audit, Annex 6A International cooperation in R&D*). By contrast, facilities that have received foreign key personnel for research groups within the Operational Programme Education for Competitiveness show high activity in the area of international grants.



- The low openness of the Czech research environment and the low number of researchers with experience from a different research environment also translate into *low openness to good practices in the development and implementation of research policy in the Czech Republic*. Foreign good practices is adopted only slowly and it is often resisted by well-established actors. This applies to both the national, system level and the level of individual institutions and teams. In the Czech Republic, project assessment by international panels from abroad and the filling of vacant positions through transparent international selection procedures are still a rare practice. This, too, is a result of the low number of foreign researchers (or researchers with foreign experience) in the Czech Republic.
- In terms of smart specialisation, it is necessary to deal with regulatory barriers that prevent greater openness and internationalisation. At the same time, it is necessary to create horizontal intervention tools that will generally increase the openness and quality of Czech research. In areas where it can be evidenced that research quality is at an international level and is linked to the Czech Republic's application potential, it is advisable to also implement vertical measures (e.g. programmes supporting the entry of foreign scientists, support for strategic partnerships of Czech research facilities with leading foreign partners etc.).

### 3.2.6. Problem area 5: Deficiencies in R&D policy management and governance

#### Manifestations and subproblems

- According to the findings of the International Audit of Research and Development in the Czech Republic, the distrust in the system can be considered the most fundamental problem of the Czech R&D system. *The distrust* is partially associated with political instability since 2006, which resulted in the gradual politicisation of research and development issues that have gradually become the subject of the assertion of particular interests of individual groups of actors<sup>125</sup>.
- One of the manifestations of the distrust is the *absence of consensus as to the further strategic direction of R&D policy in the Czech Republic*, including a more specific focus on addressing social and economic challenges of Czech society. An accompanying phenomenon is the lack of a long-term concept of R&D policy and the uncertainty as to its further direction, including financing uncertainty.
- The absence of a generally accepted strategy is exacerbated by *fundamental deficiencies in accomplishing the specified strategic objectives*. The fundamental inconsistency between the declared objectives and the efficiency of the mechanisms to accomplish them, i.e. the low efficiency of implementation structures, undermines the willingness to address the strategy which is then reduced to merely a formal document.
- In the absence of a clearly defined strategy, it is only logical that there is also *a lack of research orientation in the form of thematic research programmes*, without which there are no conditions for implementing long-term and ambitious problem-oriented research that could achieve a true breakthrough in the given research area.
- *The R&D governance system* shows similar deficiencies, especially the inadequate application of the subsidiarity principle. The key role within the entire system is played by the Research, Development and Innovation Council (RDIC), which is responsible for both long-term strategic issues (strategy and strategic intelligence) and a wide range of "micro-management" issues

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<sup>125</sup> The International R&D Audit in the Czech Republic

(preparation of the national R&D budget, assessment methodology etc.). However, the RDIC is acutely understaffed for such extensive tasks, and no adequate mechanisms to ensure effective cooperation and coordination are in place for the purpose of formulating strategic objectives<sup>126</sup>. The fundamental deficiencies of the R&D governance system include the unclear separation of policy-making and executive bodies, poor capacities for rigorous strategic work, the lacking role of the creator of consensus on strategy and the author of the tasks for the implementation bodies<sup>127</sup>.

- *Within public administration in research there is high turnover.* The accompanying phenomena of personnel instability include *low qualification level*, low strategic intelligence and strategic governance ability and – last but not least – low ability to ensure the accomplishment of specified objectives as mentioned above.
- Another side effects of the inadequate performance of public administration is the *unsuitable methodological setting of research support programmes*, which leads to increased *administrative burden* on researchers. This is connected with the poorly interconnected legislative and methodological rules that complicate the activities of both researchers and auxiliary administrative staff<sup>128</sup>. The manifestations include strict adherence to formalism in fulfilling the research objectives instead of placing emphasis on efficiency and benefits of research activities<sup>129</sup> at all levels (both individual projects and support programmes), tendency towards preference of the least risky projects (i.e. financing that which has already been researched) where it is certain that the planned results will be achieved, at the expense of original but risky research. Frequent changes of the conditions for research programmes that are implemented without consultation with beneficiaries lead to uncertainty among research organisations.
- Another manifestation of the instability and low qualification of state administration in the area of R&D policy is the *insufficiently rigorous preparation of strategies and policies, lack of continuity*, insufficient emphasis on developing evidence-based policy, and the nearly non-existent evaluation of the social and economic benefits and impacts of projects and programmes on a cascading principle<sup>130</sup>. By contrast, there is also a tendency towards simplified solutions that may ultimately prove to be harmful (e.g. a mechanistic quality evaluation model versus a long-term plan to improve the evaluation culture that would gradually improve quality management)<sup>131</sup>.

### Causes and evidence

- The causes of the inefficient management and governance of Czech research lie both in the framework regulatory conditions, and in the conditions existing within the state administration bodies that are responsible for R&D policy.

#### a) Regulatory framework

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<sup>126</sup> For more information see Pazour, M., Kučera, Z. (2012): Suggestions for improving the effectiveness of the research, development and innovation management system in the Czech Republic. Analyses and underlying documentation for implementing and updating the National Research, Development and Innovation Policy.

<sup>127</sup> For more information see the International R&D Audit, annex 2. *R&D Governance in the Czech Republic* and the recommendations of the International Audit.

<sup>128</sup> Especially lack of consistency between Act No 130/2002 Coll., No 218/2000 Coll. and No 341/2005 Coll.

<sup>129</sup> Underlying analytical documents. Annex. Updated National RDI Policy, p. 12.

<sup>130</sup> See the recommendations of the International RDI Audit.

<sup>131</sup> See the International R&D Audit.

- The *absence of a respected arbiter* can be seen as the main reason for distrust in the R&D policy system. The Czech Republic lacks a public administration body that would be perceived by the key players (in both the academic and business sectors) as impartial and that would be able to facilitate consensus on long-term strategy and supervise its fulfilment.

#### b) Stare administration of R&D policy

- The distrust in the R&D policy system also results from negative experience with the real-life implementation of existing strategies, which has been caused by the *inadequate capacity and quality of the public administration officers* responsible for implementing R&D policy. The low attractiveness of the career outlooks of public administration employees in combination with low salaries fail to create sufficiently attractive conditions for hiring qualified experts. For existing public administration employees, there are *no tools to systematically improve qualifications*, the possibility of acquiring foreign experience and good practices (e.g. in the field of project assessment, evaluation of R&D programme contribution, institutional financing, evaluation of measures for increasing cooperation with the application sector, etc.).
- It is only logical that – without consensus on the research strategy – there are *no tools for targeting the research effort at long-term problems of the society and economy* in the Czech Republic, which would concentrate effort and function as leverage for additional investments on the part of the private sector. Although national research priorities<sup>132</sup> have been defined, their accomplishment is still unsatisfactorily implemented via a targeted programme to support research within priority themes<sup>133</sup>. It is obvious that the actual fulfilment of the Smart Specialisation Strategy is only possible if the defined priorities are supported both from sufficient resources intended for regional policy, and from national resources through gradually orienting – at least in part – national resources towards priority areas. Also, it is the factual *absence of thematically focused research programmes* that sets the Czech Republic apart from most comparable countries<sup>134</sup>. This fact reduces the role of research and research policy as a tool to address the problems that are defined by social demand, but it also clearly evidences that lack of interdepartmental coordination in research and development in this area<sup>135</sup>.

#### Consequences

- The missing coordination mechanisms at the national level and the lacking consensus as to the further strategic direction limits the ability *to concentrate and mobilise necessary resources around key problem-oriented long-term research themes*. This results in the fragmentation of public investments in R&D and their low efficiency and poor contribution to addressing social and economic problems. This constitutes a problem that is all the more serious because, at the same time, public investments in R&D are increasing in the Czech Republic.

<sup>132</sup> *National Priorities of Oriented Research, Experimental Development and Innovations.*  
<http://www.priority2030.cz/novinky/priority-orientovaneho-vyzkumu-experimentalniho-id:17/>

<sup>133</sup> There is currently no thematic, oriented research programme in the Czech Republic, the Epsilon programme (TA CR) is still in a preparatory phase. The existing programmes of targeted support are based on the “bottom-up” principle. In addition, there are no specified amounts of resources that should be allocated to individual research areas within each generic programme.

<sup>134</sup> See e.g. the comparison between the Czech Republic and other countries within the Erawatch project:  
<http://erawatch.jrc.ec.europa.eu/>

<sup>135</sup> See measure 7 in the updated National Research, Development and Innovation Policy of the Czech Republic for the period 2009–2015 with an outlook to 2020.

- The consequence for the Smart Specialisation Strategy is the necessity of systemic changes in R&D policy governance, both in terms of modification to the competences of responsible authorities (i.e. clearly defined competence for the coordination of programmes financed from national resources) and in terms of strengthening the professional and administrative capacity of public administration. At the same time, these are the prerequisites for implementation in the form of thematic research programmes (vertical measures). However, their implementation requires reaching the necessary consensus.

### 3.3. Human resources

#### 3.3.1. Introduction

In the current knowledge-oriented economy, the quality of human resources constitutes the key determinant of the international competitiveness of a given country (OECD, 2013) which is based on the ability to develop innovative solutions, and products and services that are difficult to copy. In turn, these allow the achievement of “high road” competition. In this race, it is therefore very important to focus on 3 mutually interlaced stages of the intentional production and development of the research and innovative potential of people.

The first stage can be perceived as a general level of equipment with realistically applicable knowledge and skills. This is the reason why great attention is given to the systems of initial and further education as the differences in their performance ultimately determine the differences in the economic standing of individual countries. E.g. a PIAAC study has shown that the level of reading, numerical and ICT literacy of Japanese high-school students and Italian university students is roughly at the same level (OECD, 2013). This first stage represents both an independent source of innovative ideas and solutions, and human resources with a high-quality foundation for activities in research and development.

The second stage deals with the issue of which people should be prepared for career in research and development and how, as it would be neither reasonable nor effective to prepare the entire population for such a career. One way to do this is to use a system for identifying and developing talent. The essence of that system lies in developing an individual according to their potential and talents, which should ultimately strengthen mainly those abilities and skills in which it is easiest for them to succeed in the labour market to the largest extent, regardless of which occupation they eventually choose.

The last stage in developing research, development and innovative potential lies in working with the researchers themselves. The way in which they are recruited, assessed, developed etc. is very important for correctly utilising their potential and for achieving maximum productivity.

This chapter of the analysis deals with each of these stages separately, brings evidence of the current situation and searches for areas for further improvement. The Czech Republic has been found to have a good starting position in many of the areas considered, and it is important to remove those factors that are slowing down the entire system. However, it has also been found that hesitation in remedying the mistakes in these areas may cause us to lose our current position. The fundamental strategic document for the field of education is the Education Policy Strategy of the Czech Republic up to 2020, not the RIS3 Strategy.

#### 3.3.2. Problem area 1: The outputs of the education system are average quality with no improvement

The purpose of the initial education system is to equip pupils and students with competencies that are important for their personal and professional lives. The professional employability of graduates is then a product of the quantity, quality and relevance of the knowledge and the expert, general and soft skills acquired during the education process. Deficiencies that occurred within initial education

and issues relating to the consequences of the obsolescence of knowledge and skills of an individual are addressed by further education.

The PIAAC international comparison of selected general skills showed that numerical literacy of the Czech population aged 16 to 65 is at an above-average level among 24 OECD countries, whereas reading literacy and the ability to address problems within a technologically demanding environment are at an average level (OECD, 2013). However, if the Czech economy wants to associate its further growth mainly with technology- and knowledge-intensive activities, the situation can only be seen as a good baseline for accelerated improvement in the quality of education in terms of international comparison. The results of the PISA international comparison, which measures reading, maths and natural science literacy of pupils at age 15 in 65 countries, however, do not indicate any improvement in the quality of education. On the contrary, it turns out that in some areas the younger population's skills are worse than those of the population group aged 16–65 years. An analysis of the results from five PISA rounds, which took place between 2002 and 2012, shows that Czech pupils' reading literacy is below average, maths literacy is about average, and natural science literacy is above average, when compared to other countries (these are the prevailing results of the survey), but the long-term trend is not growing in either case. The long-term stagnation or even decline in the results of Czech pupils indicates that, in the area of human resources, the Czech Republic has failed to create conditions for improving its international competitiveness and, by extension, its relative standard of living. It should also be noted that there are significant differences in the results of pupils from different schools, which points to the high selectivity of Czech schools (Palečková, Tomášek et al., 2013). In terms of teaching quality, the Czech education system thus provides a highly inconsistent service.

Other general competencies worth noting include the knowledge of a foreign language and ICT, the importance of which will highly increase in the future (e.g. Balcar, 2011; Burdová, Paterová, 2009; Kalousková, 2007; Kalousková, 2006; Kalousková, Šťastnová, Úlovcová, Vojtěch, 2004). Employers see the quality of foreign language communication as a weakness of university graduates, who are supposed to have the highest potential for research, development and innovation (e.g. Balcar, Filipová, Gottvald, Šimek, Šmajstrlová, 2008), especially in the case of graduates from technical and natural science studies (Kopicová, 2013). By contrast, they evaluate graduates' ICT skills very positively. Overall, it can be concluded that 80% of Czech employers are satisfied with the knowledge and skills required for work, while in the Western countries this percentage ranges between 91% and 99% (Kopicová, 2013).

The importance of an individual's soft skills (communication, cooperation, flexibility etc.) for high-quality work performance is perceived by employers as roughly equal to the importance of expert skills (Burdová, Paterová, 2009; Kalousková, 2007; Kalousková, 2006; Kalousková, Šťastnová, Úlovcová, Vojtěch, 2004). Their development within the system of initial education is seen as insufficient across Europe (Balcar, Homolová, Karásek et al., 2011). A survey among Czech employers in late 2013 revealed that employed university graduates have roughly 69–83% of the level required for 15 soft competencies as defined by the National System of Occupations (these are the preliminary results of the survey provided by authors Balcar and Šimek; Kopicová, 2013, and McKinsey & Company, 2010 indicate virtually the same data).

Further education, which follows initial education, subsequently addresses all education needs of individuals that may result from the insufficient accumulation of knowledge and skills within initial

education or from their obsolescence. It shows that the participation of the Czech population in further education, regardless of its form, achieves average values when compared to other countries. Deeper analyses of the content of further education in each country have shown that this education not always focuses on areas that limit the individual's employability in the labour market (OECD, 2013; Eurostat database).

### **Causes of the problem**

- Applicants applying for pedagogical universities have lower-average scores in SCIO tests of general scholastic aptitude. Only 10% of the applicants applying for these universities rank among the top 20% of persons with the best results. For comparison, this 20% share of the best students include 68% of law students, 23% economics students, and 15% of forestry, agriculture and veterinary students (McKinsey & Company, 2010). In the longer-term, the relatively lower quality of students of pedagogical disciplines translates into the quality of teachers.
- Pedagogical study programmes focus primarily on mastering the curriculum. Only 14-21% of the content of pedagogical programmes focuses on pedagogy and didactics, and only 4% on practical teaching (McKinsey & Company, 2010). The graduates of universities with such focus are familiar with the curriculum that needs to be taught to pupils, but their teaching skills are insufficient.
- Teachers at universities have no obligation to master the skills needed for providing quality education, i.e. skills in the fields of didactics, andragogy etc. (Leisyte, L. et al., 2011). This is left solely up to them. As a result, there are considerable differences in the quality of teaching, depending on each teacher.
- Teachers at all education levels and their pupils and students lack contact with "practice" (NTF, 2011), which translates into teachers' poor awareness of latest trends and market needs and students' inability to apply acquired knowledge in addressing specific problems.
- To date, the curriculum reform has failed to deliver the envisaged results even though the process of necessary change to the education system has been initiated. While the Framework Education Programmes (FEP) define the knowledge and skills to be acquired by each pupil, given the absence of adequate professional guidance and other accompanying steps and tools to support teachers they often only result in formal implementation without required improvement in the quality of teaching (see e.g. the Annual Report of the Czech School Inspectorate 2009/2010). FEP are vague in describing the expected level and quality of the results of education, which is why teachers are often unsure as to the knowledge and skills that need to be taught to their pupils. Without standards and subsequent evaluation and diagnostic tools, teachers' role in the practical implementation of the curriculum reform is very complicate (NERV, 2011).
- The Czech Republic is one of few European countries where systematic and nationwide evaluation of the quality of teaching is not in place. The absence of such objective evaluation makes it impossible to identify schools with above-average and below-average results that need to be understood as the school's contribution to pupils' development and not as mere measurement of pupils' results in absolute terms (to a high degree, these are influenced by their social and economic background). Another factor is also the negative attitude of most schools to

evaluation and self-evaluation (e.g. Straková et al., 2009), as well as the limited possibilities and interest of school oversight authorities to conduct evaluation (for details see McKinsey & Company, 2010).

- Even though the development of pupils' soft skills is included in the Framework Education Programme, no systematic methodological guidance is available to teachers in order to achieve this objective. As a result, none of the levels of the Czech education sector, including tertiary education, systematically supports the development of the soft knowledge that is demanded and highly valued by employers (NTF, 2011; Leisyte et al., 2011). While innovative programs for the systematic development of soft competencies have already been created and successfully tested in the Czech Republic, their general application is hindered by the lacking strategy and experience with the use of best practice examples.
- Despite mandatory classes of foreign languages, which begin already in primary schools, the language competencies of the Czech pupils and students in English and other foreign languages are insufficient, especially in graduates from technical and some natural science programmes (NTF, 2011). The classes usually focus on mastering grammar, whereas conversation in foreign language is insufficient. At the same time, neither pupils nor students feel the need to learn a foreign language at a high level, because even at universities, working with foreign language publications is mostly not required in order to graduate, and there are no obligatory courses in foreign languages (this is mainly due to legislative restrictions on classes in foreign languages, the insufficient number of teachers that are able to provide such classes, and the absence of obligatory English classes, which would worsen the position of students who prefer different languages).
- A serious problem is the pupils' attitude to school, which is one of the worst within the countries being compared, and their low interest in science, research and development (McKinsey & Company, 2010). This fact strongly undermines the potential for the development of the Czech Republic's human resources and, by extension, its research, development and innovation potential.

#### **Consequences of the problem and the risks resulting from failure to address it**

- Should there be continued stagnation or even a decline in the quality of education outputs, it would have a negative impact on the Czech Republic's international competitiveness and, in turn, standard of living compared to other countries whose education systems will improve.
- The current quality of the outputs of the education system does not provide the conditions for achieving above-average results in research, development and innovation. It can be expected that, as before, only few individuals will achieve top-quality science (relatively independent of the education system) and, even though these individuals will significantly affect the development of their disciplines, their effect on the image of Czech science and research will be negligible.
- There is a risk of creating a situation in which individual causes of the current situation will further strengthen: declining results of education – lower prestige of the teaching profession – fewer top-quality applicants interested in studying pedagogical disciplines – declining quality of teaching (and, in turn, deteriorating attitudes of the pupils to schools) – declining results of education...



### 3.3.3. Problem area 2: Dysfunctional system for identifying and working with talent

Identifying areas of activities, in which an individual will be the most productive, and developing them in that direction is the essence of working with talent, which is absent from the Czech education system. As a result, the potential of human resources is used inefficiently. However, it is necessary to point out that talent may take many forms (e.g. artistic talent, scientific aptitude, entrepreneurial talent), but the education system often mistakes talent for good school results. Also, it needs to be noted that each person has a different level of talent, and the following text is not limited to only identifying and developing persons with extraordinary level of talent.

As mentioned above, the Czech education system focuses on identifying persons with good school results and on their further development, especially through a suitable choice of education. The approach of elementary schools to developing these pupils is not uniform. Some schools emphasize the need for accelerated development of talented children, whereas others mainly emphasize the integration and development of disadvantaged children. As a result, one group of pupils is often developed at the expense of the development of others. According to 54% of teachers, addressing the above problem through individual work with pupils depending on their aptitude and needs is impossible (McKinsey & Company, 2010).

The development of children with greater scholastic aptitude is often done through sending them (by their parents and school staff) to grammar schools that prepare them for university studies. Approximately 20% of all pupils attend grammar schools and 9% of pupils attend more selective six-year and eight-year grammar schools (McKinsey & Company, 2010)<sup>136</sup>. However, many talented pupils do not choose this type of education, as 25–30% of students of vocational schools perform better in SCIO tests of general scholastic aptitude than the less successful portion of grammar school students (McKinsey & Company, 2010). The combination of the current per-pupil system of school financing, the significant population decline and only moderate adjustments to the capacities of the different study programmes in schools has resulted in the lack of students of vocational schools and the declining average quality of students (in terms of average scholastic aptitude) at grammar schools and selective vocational schools. The above facts show that grammar schools do not perform the function of schools for extraordinarily talented pupils. This conclusion is entirely consistent with the fact that the Czech system of initial education does not define any type of school that should perform this function.

It may also be mentioned that limited knowledge of own preferences and possibilities, and the nature of the different study programmes often results in the incorrect choice of a study programme. For example, experience from the Gateway to Technical Career project, which was organised at technically-oriented secondary schools in the Moravian-Silesian Region, show that roughly one half of students of these schools consider their choice to be inappropriate and do not plan to work in the area they are studying. This fact, along with the lower popularity of technical and natural science programmes<sup>137</sup> that are often perceived by students as more challenging, results in a significant lack

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<sup>136</sup> The PISA 2012 assessment shows that the Czech education system is highly selective, because it shows rather small differences in the results of students within a single school but substantial differences between the results of different schools. To a large extent, these are influenced by the average social and economic background of the students (Palečková, Tomášek et al., 2013).

<sup>137</sup> According to the classification of core study programmes, natural sciences and studies include e.g. mathematics, geology, geography, chemistry, physics and informatics, i.e. programmes that are often perceived as technical programmes.

of persons wishing to work in technical areas, which can be observed both in tertiary education and in the labour market. The structural disproportion between supply and demand in the labour market, as described above, in many cases highly negatively impacts on the possibilities for the further development of companies or even entire industries. The timely identification of aptitude for studying technical programmes would minimize the occurrence of this phenomena and the inefficiently spent costs for the professional preparation of pupils and students.

However, the decline in the quality of students can also be observed at universities (Leisyte et al., 2011; NTF, 2011), which have expanded their capacities in line with the Bologna Process, despite the above facts. This could be illustrated using the trends in the number of students at universities, which almost doubled over ten years (2001–2011) and reached almost 400 thousand students (the number of employees of universities increased by about a quarter). Within the age group 20–29 years, 12% of people were studying a university in 2001; while in 2011 it was more than 27% (Research, Development and Innovation Council, 2013). It is also notable that, as in the case of secondary schools, universities have not undergone any optimisation in terms of the relative proportions of the different study programmes, so that the proportion of students of technical and some natural science programmes relatively decreased, while the capacities of social-science study programmes increased. In the future, this will lead to significant problems in technical areas, namely when it becomes necessary to replace retiring university-educated employees (Kopicová, 2013; NTF, 2011).

In terms of research, development and innovation, the most interesting group comprises students of doctoral programmes as these represent the most important source of new researchers. However, many universities have significant difficulties in attracting sufficient numbers of qualified candidates and, in response to that, they are recruiting 90–95% of doctoral students from among the graduates of their own master's study programmes. The rate of successful graduation from doctor study programmes ranges between 25% and 45%, and the most frequent causes of non-completion include the low amounts of doctoral scholarships and starting a work career outside the university. On the other hand, 75% of successful graduates prefer staying at their respective institution in a researcher position (Leisyte, L. et al., 2011). Doctoral study programmes as such take place on an individual basis, i.e. the student cooperates with the instructor who plays the role of a mentor in performing the study and research and development tasks of the student.

In 2011, students of doctoral programmes accounted for 6.5% of the total number of students. This value ranks the Czech Republic among top countries within the EU (Research, Development and Innovation Council, 2013). However, if we take into account the low rate of successful completion of this education level, the number of graduates from doctoral programmes is slightly below the OECD average (OECD, 2013b). While the proportion of students of technical and natural science programmes is 26% for bachelor's and master's programmes, in the case of doctoral programmes it is 48%. This means that almost a half of all students of doctoral programmes study technical or natural sciences, which is the highest share of technically oriented doctoral students within the EU (Research, Development and Innovation Council, 2013) and a very high share among OECD countries (OECD, 2013b). On the other hand, the share of students with this orientation in bachelor's and master's programmes is insufficient, which negatively affects the development and innovative potential of technically oriented companies. Given the limited number of available jobs in university and government research, it is also necessary to focus on developing doctoral students' soft skills that are required in the private sector, because the lack of these skills often limits their employability

outside the public sector (Leisyte et al., 2011). The low level of foreign and inter-sector mobility of doctoral students is another factor that significantly limits their employability, regardless of whether they chose to work in the public or private sector after completing their studies.

### **Causes of the problem**

- Support (methodological, knowledge, financial etc.) for identifying each pupil' aptitude for success in different areas of human activity (business, research and development, art etc.) is neither nor is it adequately followed by individual work with the pupil (e.g. in the form of mentoring, individual planning of personal development etc.) in order to prepare them to make maximum use of their natural talents.
- The attempts to make the highest level of education accessible to the largest number of persons possible (without a corresponding increase in resources for teaching) results both in the decline in the average scholastic aptitude of university students (this also applies to pupils of selective facilities within the regional education sector) and in the unification of the approach to these student. Ultimately, this translates into a decline in the average quality of the outputs of education (NTF, 2011). The above factors very negatively influence the possibilities for the intensive and individualised development of talented individuals, which mainly occurs in areas that are perceived as a way to a prestigious profession or, on the contrary, as the least demanding way to obtain formal education.
- The higher number of students in schools and, in turn, the relatively lower number of students with high scholastic aptitude makes it difficult to identify those who might be suited for inclusion in scientific training in the form of doctoral study programmes (Leisyte, L., et. al., 2011). Their success rate is also influenced by the quality of work of their instructor, which differs greatly among individual instructors, and by their willingness to accept low income during the period of their studies.

### **Consequences of the problem and the risks resulting from failure to address it**

- The continuation of current trends, including the unification of teacher's approach to pupils and students, will further limit the effective utilisation of the productive potential of the Czech Republic's human resources, and the guidance of pupils to the most suitable study programmes and areas. This would not only help in achieving high productivity of individuals, but there would also be a positive impact on the currently unbalanced structure of school graduates in terms of their disciplines, which translates into a shortage of graduates from technical and natural science programmes that are employable under real-world conditions. Also, support for entrepreneurial talent would contribute to creating a strong domestic entrepreneurial background. The importance of the above is underlined by the fact that increased efficiency of human resources represents one of the most important sources of economic growth.
- The facts mentioned above will also negatively impact on the quality of human resources in research and development, because individuals with a high aptitude for this work will not have been developed from their early youth in order to reinforce their talents and teach them to apply them in practice (regardless of whether they eventually use them in research or another area).

### 3.3.4. Problem area 3: Shortage of quality human resources for R&D

At the end of 2011, a total of 55 697 full time employees (FTE) worked in the research and development in the Czech Republic, which means 82 283 physical persons. Most of these employees were working in the business sector (53%, mainly in the manufacturing industry and services), university research (27%, with a dominant focus on technical and natural sciences), and government research (20%, with a dominant focus on natural sciences). Correspondingly, out of the total number of 2 720 R&D facilities, 48% employ fewer than 5 employees (FTE) and 17% employs 5–9.9 employees; by contrast, 9% employ more than 50 employees (Research, Development and Innovation Council, 2013). An international comparison shows that the Czech Republic has an average number of R&D employees within OECD countries (OECD, 2013b) – the number is higher than average in the government sector (similarly to other post-communistic countries) and lower than average in the university sector, and equal to average in the industrial sector (Research, Development and Innovation Council, 2013).

Researchers account for 55% of all employees in R&D and the second largest group comprises technical staff who account for 31% of employment in this sector. In three out of four cases, researchers do R&D in the area of technical and natural sciences, which corresponds to the specialisation of doctoral students (see above). Foreigners are rather rare in Czech R&D, as out of the 82.3 thousand individuals employed in this sector, only 3.5 thousand do not have Czech citizenship, of which 1 500 are Slovaks (Research, Development and Innovation Council, 2013).

The Czech Republic has about 10 employees in R&D (FTE) per 1 000 employed persons, which is below the European average of about 11 employees. In some countries (Finland, Denmark) this share is twice as high. The situation is similar in the case of researchers. The Czech Republic has 6 researchers (FTE) per 1 000 employees, whereas the European average is 7 researchers. However, in Norway, Japan, Sweden, Korea, Denmark and Finland this figure is almost three times as high (Research, Development and Innovation Council, 2013).

Given the autonomy of the business sector in issue relating to recruiting, developing and using human resources in R&D, further attention is focused on the university and government sectors. The most important source of new employees in research are own doctoral graduates (their significance as a source of human resources will continue to grow in the future) and other research organisations in the region (Leisyte et al., 2011). This indicates that this labour market segment focuses inwards and has a certain territorial limitation, despite the fact that the selection of new employees is fully in the hands of each research facility. Ultimately, this significantly limits the creation of new stimuli not only for research, but also for the further development of the institutions. The above may also lead to lower quality of recruited human resources: 30–40% of employees in government and university research consider the shortage of qualified academic staff as one of the obstacles to R&D in the Czech Republic, which may be reinforced by the similarly perceived quality of the HR development and management systems of the various institutions (Leisyte et al., 2011).

From this perspective, it is appropriate to ask whether the salary, working, technical and other conditions of academic facilities constitute factors that discourage job applicants from other sources. The study by Leisyte et al. (2011), which presents the general results of an evaluation of work and salary conditions in public research organisation, indicates relatively high general satisfaction of R&D employees, especially in terms of working conditions and opportunities for career growth. The respondents were least satisfied with the salary conditions and the working conditions when

compared to foreign countries. In depth analysis of salaries in this sector revealed that salaries at lower academic positions were only slightly higher than the average salary in the Czech Republic, whereas higher academic positions had salaries comparable with average salaries of managers in the business sector. The international comparison indicates that average salaries of Czech researchers are slightly below the EU-25 average (European Commission, 2007). However, when looking at the structure of the countries in this comparison, it is obvious that attracting researchers from more developed countries is not possible under common salary conditions.

This is also confirmed by the statistics on the nationality composition of the 3.5 thousand foreign researchers working in the Czech Republic as mentioned above. These mainly include Slovaks, Ukrainians and Russians – in addition, the conditions for a carrier in Czech research is also interesting for Indians. By contrast, the main destination of the migration of Czech researchers is the USA, Germany, United Kingdom, France and Switzerland. They are mainly attracted there by gaining new experience (83%), improving their qualifications (57%), better working conditions (43%), a specific research area (38%), and better financial conditions (33%). The income level, career opportunities and social environment for research in the Czech Republic then become the factors that prevent them from returning (Leisyte et al., 2011). Language skills, contacts with foreign research organisations and insufficient funding of foreign trips were not identified as significant factors hindering international mobility. By contrast, these included concerns about losing work after a longer-term interruption of employment and teaching at the home university. For the above reasons, short-term mobility (up to 3 months) tends to be preferred, which – however – is considerably less effective in terms of personal development (Leisyte et al., 2011). Mobility between public institutions in research and the business sector is also low. The cause can be seen mainly in the insufficient competencies of researchers in public institutions for work in the business sector (e.g. deficiencies in problem solving or entrepreneurship) and – to a lesser extent – in the impossibility to interrupt their career for a prolonged period (Leisyte et al., 2011).

In terms of the lack of openness, one specific problem is the low participation of women in research activity<sup>138</sup>. At present, women account for 60% of university graduates and 44% of doctoral students; however there are only 27.4% (headcount) or 24.7% (FTE) of women among researchers, (Tenglerová, 2014). In 2012, this proportion was the lowest since 2001, i.e. since gender statistics have been published. Also, the Czech Republic has the lowest proportion of women in decision-making groups throughout Europe (European Commission, 2013b). Due to inadequate conditions, Czech research is losing a substantial portion of potential talent.

### **Causes of the problem**

- HR management in the various research institutions and universities does not correspond to current needs and trends. In some institutions, the planning and implementation of personal development, evaluation of employees as well as the recruitment of new employees are of insufficient quality.
- New human resources for R&D, including new doctoral students, are recruited within a stable (and rather self-contained) group of people that is defined by its affiliation with a specific region or research sector. As a result, the same persons tend to be “recycled” and no “new blood” is drawn into the system (e.g. the involvement of practitioners is minimal).

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<sup>138</sup> This fact is also pointed out in the conclusions of the International Audit (<http://audit-vav.reformy-msmt.cz/aktuality/zaverecna-zprava-z-audit-u-systemu-vyzkumu-vyvoje-a-inovaci-v-cr>).

- Although increasing the number of doctoral graduates is more than desirable (while maintaining or improving their quality), their employability in the university and government sectors is highly limited. Insufficient development of knowledge and skills that are crucial for the business sector complicates their employability in private research.
- The international and sector mobility of R&D employees is relatively low, especially due to concerns about losing their job during a longer-term stay outside their home organisation. However, there are some other barriers to mobility such as insufficient awareness, financial resources, language skills etc.
- The insufficient involvement of researchers from other countries represents another example of the lacking transfer of stimuli from outside. In this case, mainly short-term stays of teachers in the Czech Republic are used, because the academic environment is unable to offer competitive salaries to experts from developed countries. However, there are some other obstacles such as administrative problems associated with visas, inadequate facilities for families of the foreign researchers etc.
- In the area of *gender discrimination*, there is no programme to promote gender equality in research at the national level, there are no effective tools to facilitate bringing together the private and professional obligations of young researchers (both men and women). Despite repeated references to this problems in strategic documents, no systematic care has been given to this problem either at the level of state institutions or at the level of most research organisations.

#### **Consequences of the problem and the risks resulting from failure to address it**

- The insufficient utilisation of the possibilities of modern HR management in the various research organisations will result in conserving the existing situation in recruiting new employees and developing existing employees. As a result, no adequate stimuli will be generated to change the current situation.
- Recruiting new employees of research organisations mainly from among a relatively closed group of people (most frequently doctoral graduates from the university in question or researchers from other research organisations within the region) often fails to bring sufficient incentives for further development of research and the research organisation. In the long-term, this situation may result in the stagnation of the development of organisation that mainly use this type of recruitment, and in a decline in the quality of human resources in these organisations, i.e. in connection with the perceived decline in the quality of doctoral graduates. The absence of persons from corporate practice may result in the limited ability to commercialise the outcomes of R&D.
- If the problem of gender imbalance continuous to be disregarded, there may be a significant *loss of the human potential of Czech female researchers*. In the future, this deficiency need to be addressed through specific measures to facilitate the inclusion of women in research positions.
- The insufficient development of soft and entrepreneurial skills will continue to hinder both the employability of doctoral graduates in corporate research and cooperation of research organisations and the business sphere. This situation negatively affects the utilisation of the potential of all of the parties mentioned above.

### 3.3.5. Digital agenda in human resources

Development in ICT is related not only to the development of ICT infrastructure but also to the development of the population's digital literacy. If the digital literacy of the Czech Republic's population is not sufficient, investments in ICT infrastructure will only bring marginal results. Therefore, the development of horizontal competencies in IT is crucial at all levels of the education system<sup>139</sup>, including further education and education of the oldest portion of the population. Only a digitally literate society will be able to compete in the coming information and digital economy.

The Czech Republic is one of the countries that advocate Internet freedom – in practical terms, this means minimal regulation of the Internet. This puts increased demands on Internet users because, in addition to basic digital literacy, they must be able to critically evaluate the content and self-control its use. The Czech Republic is one of the average EU countries in terms of the proportion of Internet users with medium to high competencies in its use. A digitally literate and critically thinking society can much more easily protect itself against the threats awaiting less-knowledgeable users in the virtual world.

Compared to other EU countries, the share of Czech households with an Internet connection is slightly below average (63% in the Czech Republic, 67% in the EU27), while Internet coverage in rural areas is at the average level. Likewise, Internet coverage of companies is at the average EU level.

However, the question is not Internet coverage alone, but also the level of its actual usage. In this respect, we can focus on its usage for shopping and communication with authorities. In the Czech Republic, roughly 40% of users shop over the Internet. This value is significantly lower when compared to the EU (57% of users), the USA (66% of users) or South Korea (94% of users). Also, the usage of Internet for communication with the authorities is one of the Czech Republic's weaknesses. The share of the population that uses the Internet for communication with authorities or even for filing forms is one of the lowest within the EU. Less than 20% of the Czech population uses the Internet for communication with the authorities and 4% for filing forms. However, the above situation is also caused by the fact that the online availability of services for the citizens is the seventh worst in the European Union.

## 3.4. Social innovations

### 3.4.1. Introduction

Social innovation is not a new topic, as people have always sought new solutions to pressing social problems. However, there is a growing influence of factors that further increase the importance of social innovation. The most important ones include the increasing global competition, the changing position of Europe in this competition, including the impact of its ageing population, the harsh impacts of the financial crisis on employment, especially among young people, the impacts of climate change etc. As a result, there is a need for new solutions in a wide range of social areas, i.e. not only in the social and health care systems, employment policy and education, but also in the promotion of

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<sup>139</sup> The Ministry of Education, Youth and Sports is preparing a strategic plan entitled Digital Education/Touch Your Future, which aims to include latest digital technology in teaching across the Czech Republic.

entrepreneurship, industrial policy and the development of cities and municipalities in order to ensure the sustainability of the quality of life and employment opportunities for the population. Within this effort, social innovation can help as a social laboratory in which new solutions to these societal challenges are developed and tested in a creative and positive spirit. The European Union and its member states need such an environment very much (European Commission, 2012; Guide to Social Innovation). Social innovation is of strategic importance and it is dependent on a developed culture of partnership and cooperation.

The European Union is characterised by the coexistence and interaction of several levels of government – national (member states), supranational (EU) and sub-national (regional and local authorities), where this coexistence and interaction constitutes the essence of what we call multilevel governance (MLG). But this is not just about a simple transformation of goals adopted at the European or the national levels into activities at the regional or local levels, but also about aligning objectives at the regional and local levels with European strategies. At the same time, MLG strengthens accountability of sub-national authorities in the national context and encourage their participation in the implementation of Community policies (White Paper on Multilevel Governance 2009/C 211/01).

In the state, business and civil sectors of OECD countries, there is increasing cooperation and partnerships are established to encourage economic development, employment and social inclusion. Well-functioning partnerships are an effective tool to effectively address complex social challenges and they often operate with a high innovation potential. Countries often support these partnerships and sometimes help establish them; such established organisations then help ensure that political decisions take greater account of the local needs and have greater impact in real life. Partnership activities have a wide scope: they can promote cooperation between actors of local development, contribute to greater synergy between the various initiatives and suggest ways to improve current practices. They address strategic planning, set out common goals to achieve better results and apply the local development strategy in practice. For local partnerships to fulfil their mission, substantial effort is required in order to generate confidence among all actors and ensure their full involvement.

### **3.4.2. Problem area 1: Insufficient use of partnerships co-operation and creativity of key actors in addressing complex social challenges**

#### **Manifestations and subproblems**

- Underdeveloped culture of multi-sectoral and multi-level governance.
- Insufficient degree and intensity of partnership co-operation between relevant institutions at both the horizontal and vertical levels, where such co-operation is necessary.
- Unclear or sluggish demand of the public sector towards the professional community and the civil society for new solutions to complex social challenges.
- Slow response of the public sector to the opportunity to use new forms of cooperation and creative solutions to social problems on the part of actors within the professional community and the civil society.
- By contrast, social innovation outside the public sector is developing dynamically, often based on inspiration from abroad, as evidenced by the existence of demand and supply that can be built upon.



### **Causes and evidence**

- While the division of the “playing field of social needs” among key actors at central, regional and local levels increases transparency (who is responsible for what), it also reinforces “departmentalism” and limits partnership co-operation in cases where it is needed for integrated solutions to complex social problems.
- In the Czech Republic, there is no infrastructure for the development and dissemination of social innovations; the public sector has never clearly declared its interest in creating and further using new solutions (i.e. innovation demand).
- The level of awareness of social innovations and their benefits is low, and so is the amount of financial resources that are provided for the strategic support of social innovation (MLSA, 2014; Operational Programme Employment).

### **Consequences**

- The limited degree of co-operation among the key actors at the horizontal level, especially at the central level that is the most distant from addressing specific problems in the places where the people live, negatively affects the systemic and strategic framework for co-operation and the search for optimal solutions at regional and local levels.
- Low involvement of well-proven prototype solutions to social and strategic problems in the mainstream or relevant policies at the national level (up-scaling and mainstreaming). Insufficient use the creative potential of the population in order to find smart solutions to complex social problems

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### 3.5. SWOT analysis

Strengths	Weaknesses
<b>Entrepreneurship and Innovation</b>	
<ul style="list-style-type: none"> <li>• Industrial and technical tradition associated with the technical creativity supporting technical incremental innovations</li> <li>• Multi-industry sector of flexible (contract-oriented) suppliers with developed competencies in the area of production and technical development</li> <li>• Position in the geographical centre of Europe – over 200 million customers with a high purchasing power can be served within a one-day truck drive from Prague</li> <li>• The price-quality ratio of technically qualified experts, especially in engineering (including automotive and aerospace industry), electric engineering and IT</li> </ul>	<ul style="list-style-type: none"> <li>• Complex and unstable regulatory framework for enterprise (complexity, frequent and poorly predictable changes, administrative demands, investor protection etc.)</li> <li>• Low innovation demand in the area of higher-order innovations. Minimal number of endogenous companies able to push technological boundaries in their area.</li> <li>• High dependence of economic development on activities of foreign companies (dependence on the business strategies and decisions of foreign companies)</li> <li>• Insufficiently developed entrepreneurial culture and non-technical competencies of companies (strategic management, marketing, innovation management etc.)</li> </ul>
<b>Research and development</b>	
<ul style="list-style-type: none"> <li>• Growing trend in public expenditure on R&amp;D (despite the economic crisis)</li> <li>• Significantly concentrated investments, and improvement in equipment with instruments and in the condition of research infrastructures thanks to support by the EU Structural Funds (R&amp;D centres from OP RDI)</li> <li>• Inclusion of several infrastructure projects from the Czech Republic in projects of the pan-European ESFRI network, including ELI Beamlines (the only ESFRI project based in the Czech Republic).</li> <li>• Existence of the concept of support for large infrastructures and the Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic</li> <li>• Slightly growing demand for research co-operation on the part of the business sector (due to growing business R&amp;D expenditure – interest in graduates and project co-operation)</li> <li>• Existence of research teams of international quality in several areas with immediate application potential (instruments and instrument equipment, nuclear physics and technology, engineering and aerospace, computer sciences, mathematics, selected sub-areas of chemistry, electric engineering</li> </ul>	<ul style="list-style-type: none"> <li>• Inadequate governance of the system of R&amp;D policy management (unclear responsibilities and roles: strategic/advisory vs. executive/implementation)</li> <li>• Administrative burden</li> <li>• Deficiencies in strategic management and absence of a research strategy in RO, deficiencies in managerial and strategies competencies of the management staff of RO</li> <li>• Low inclusion of women in RO management</li> <li>• Deficiencies in public administration performance in the area of research, development and innovation, quality evaluation, and insufficient preference for high-quality research</li> <li>• Too low share of institutional financing, excessive dependence of research on grants – difficult planning of research, financial uncertainty and instability of RO</li> <li>• Low attractiveness of research career to talent from the Czech Republic and abroad</li> <li>• Lack of openness of the environment, in-breeding, conservative culture in RO</li> <li>• Lagging behind (in quality and modernisation) of research infrastructure in Prague, even though Prague concentrates most R&amp;D capacities</li> </ul>

Strengths	Weaknesses
<p>and telecommunications, clinical medicine and biomedical sciences).</p> <ul style="list-style-type: none"> <li>• Existence of extensive diaspora, the alumni network of Czech research organisations</li> <li>• High-quality academic ICT infrastructure combined with high-quality scientific background for its administration and development</li> </ul>	<ul style="list-style-type: none"> <li>• Duality in the financing of R&amp;D (especially of infrastructure) between the regions and Prague, due to the prevailing use of ESIF for this purpose, whose possible use does not correspond to the distribution of R&amp;D capacities in the Czech Republic.</li> <li>• Low interaction between RO and the business sector</li> <li>• Generally inadequate preparedness of RO for cooperation with the practical sector at all levels (institutions, specialised auxiliary facilities/Technology Transfer Office, research teams, individual researchers)</li> <li>• Low demand for results of public research by domestic and foreign companies</li> <li>• Low relevance and focus of research; low practical fulfilment of research priorities, absence of long-term strategic and problem-oriented programmes of R&amp;D</li> <li>• Low publicity and awareness of high-quality results of R&amp;D in the Czech Republic and abroad</li> </ul>
<b>Human resources</b>	
<ul style="list-style-type: none"> <li>• Above-average level of numerical literacy and average level of reading literacy and the ability to address problems in a technologically demanding environment in the adult population (good baseline for further development)</li> <li>• High interest of doctoral students in technical and natural sciences</li> <li>• High interest of doctoral graduates in R&amp;D work</li> <li>• ICT skills of graduates are perceived as sufficient by employers</li> </ul>	<ul style="list-style-type: none"> <li>• Absence of defined results of education</li> <li>• Lacking system for the nationwide evaluation of the quality of teaching</li> <li>• Significant differences in the results of education between schools and regions</li> <li>• Persisting poor level of reading, numerical and natural science literacy among pupils at age 15</li> <li>• Insufficient development of soft competencies in schools</li> <li>• Insufficient level of foreign language skills, especially in graduates from technical and natural science programmes</li> <li>• Negative approach of Czech pupils and students to schools</li> <li>• Low interest of above-average students in studying at pedagogical faculties and in teaching careers</li> <li>• Low focus of pedagogical programmes on practice</li> <li>• University teachers are not obligated to develop their pedagogical skills</li> <li>• Lacking or inadequate contact of teachers and students with practice</li> <li>• Lacking system for identifying and working</li> </ul>

Strengths	Weaknesses
	<p>with talent</p> <ul style="list-style-type: none"> <li>• Insufficient assistance to pupils and students in identifying their professional preferences and subsequently selecting suitable education</li> <li>• Lack of high-quality graduates from technical and some natural science programmes at all levels of the education system</li> <li>• Low rate of successful completion of doctoral studies that, despite the above-average number of doctoral students, results in a below-average number of graduates</li> <li>• Large increase in the number of university students without a corresponding increase in the number of university employees</li> <li>• Compared to developed countries, a below-average number of researchers and employees in R&amp;D</li> <li>• Low proportion of women in research, and inadequate attention paid to this problem at the level of RO and public administration</li> <li>• HR management at the various research institutions and universities does not reflect current needs and trends (frequent recruitment of employees from a sector- and region-limited group of persons, insufficient international and regional mobility, low involvement of foreign researchers)</li> </ul>
<b>Social innovation</b>	
<ul style="list-style-type: none"> <li>• Dynamic development of social innovation outside the public sector</li> </ul>	<ul style="list-style-type: none"> <li>• Absence of a clear public-sector demand for innovative solutions to social problems</li> <li>• Slow response of the public sector to possible solutions to social problems on the part of actors within the professional community and the civil society</li> <li>• Limited room for partnership co-operation between relevant actors, which is needed for integrated solutions to complex social problems</li> <li>• Insufficient amount of financial resources for strategic support for social innovation</li> </ul>
<b>Digital agenda</b>	
<ul style="list-style-type: none"> <li>• Declining price/cost of Internet connection and equipment increases users' demand for the use of digital services</li> <li>• Effort of ISP to quickly develop high-speed next-generation networks (i.e. LTE/4G)</li> <li>• Good quality of research related to the areas of e-infrastructure and ICT, leading to</li> </ul>	<ul style="list-style-type: none"> <li>• Underdeveloped physical infrastructure for expanding broadband Internet connections (especially outside metropolitan areas)</li> <li>• Low usage of digital technologies for communication between business partners</li> <li>• Lack of access to scientific information in digital form, in the form of specialised</li> </ul>

Strengths	Weaknesses
<p>commercially successful results and synergistic links between research facilities and business activities.</p> <ul style="list-style-type: none"> <li>• High usage of eGovernment services by companies.</li> <li>• Introduction of modern digital technologies into teaching in schools.</li> </ul>	<p>databases and electronic scientific journals</p> <ul style="list-style-type: none"> <li>• Low usage of the Internet by the population to communicate with public administration, which is also associated with poor access to these services for citizens in electronic form and their poor user-friendliness.</li> <li>• Inadequate and slow progress in eGovernment and low usage of these services within individual authorities/offices and in internal communication.</li> </ul>

### External analysis – factors that influence the Czech Republic and its NIS

Opportunities	Threats
<b>Politics and legislation</b>	
<ul style="list-style-type: none"> <li>• The adoption of the Act on Public Service, provided that it improves expertise in public administration</li> <li>• The use of new tax advantages for companies in acquiring R&amp;D results from research organisations</li> <li>• New Civil Code</li> <li>• Changes that support a more flexible labour market, higher flexibility of employment, including part-time employment</li> <li>• Changes in the institutional funding of RO that give priority to commercially applicable results and the quality of results over quantity.</li> </ul>	<ul style="list-style-type: none"> <li>• Instability of the political scene that decreases the credibility of the Czech Republic to foreign partners, investors and domestic companies</li> <li>• Corruption and the influence of interest groups on decision-making in public administration</li> <li>• Changes in the tax system that worsen the conditions for the business sector and enterprise in the Czech Republic</li> <li>• Frequency and unpredictability of regulatory changes for entrepreneurs and research organisations</li> <li>• Complexity of the system of Structural Funds administration, high transaction costs</li> <li>• Frequent and unpredictable changes to the administration of the Structural Funds – uncertain environment for beneficiaries</li> <li>• Loss of the population's confidence in political decision-making / democratic principles of government</li> <li>• Ineffective and poor enforceability of law in the Czech Republic, growing distrust in the law enforcement system</li> <li>• Implementation of ill-conceived reforms and changes to key systems – education and universities, pension system, ...</li> <li>• Bureaucratic system strongly undermining the efficiency of institutions at all levels, including companies (this includes both agenda relating to the core activities, and activities associated with the setting-up of</li> </ul>

Opportunities	Threats
companies, etc.)	
<b>Economic and financial</b>	
<ul style="list-style-type: none"> <li>• Accession to the Eurozone – reduction of transaction costs for companies, higher attractiveness of the Czech Republic to investors</li> <li>• Interest among foreign companies in investing in activities that have higher added value in Central European countries</li> <li>• Open innovation: demand of MNC for innovations creates room for high-quality companies with high-quality activities</li> <li>• Reintegration of the value chain: co-location of production plants of suppliers with own production plants</li> <li>• Concentration of R&amp;D activities of MNC: acquisition of additional activities that follow or serve production, including R&amp;D and strategic business services or any part thereof</li> <li>• Re-industrialisation – the return of production activities to traditional regions, including Europe</li> <li>• Shift in global demand, growing demand on the eastern markets where the Czech Republic has good reputation</li> <li>• Growth of business opportunities on new and emerging markets in Asia, South America and Africa.</li> <li>• Distributed knowledge networks – the use of competencies of Czech R&amp;D teams in specific knowledge domains for the needs of the global innovation demand</li> </ul>	<ul style="list-style-type: none"> <li>• High growth rate of the Czech Republic’s debt and failure to address the structural causes of debt<sup>140</sup></li> <li>• Growing demand for raw materials and energy resources – growing prices, dependence of the Czech Republic on imports</li> <li>• Concentration of R&amp;D activities of MNC: <ul style="list-style-type: none"> <li>- R&amp;D activities will concentrate outside the Czech Republic</li> <li>- if plants not requiring knowledge-based production remain in the Czech Republic, there is a risk of their relocation to countries with cheaper inputs or close to the R&amp;D activities of MNC</li> </ul> </li> <li>• Loss of competence in traditional and specialised areas</li> <li>• Growing competition from East Asian countries in industrial areas that are based not only on cheap workforce, but also on knowledge- and technology-intensive activities</li> <li>• Weak innovation demand of the public sector – the state and the public administration do not support innovative solutions in the area of their competence, they do not order them from potential suppliers</li> <li>• Strong economic linkage to the European Monetary Union, negative impacts on the Czech Republic if German export weakens</li> <li>• Increase in non-tariff barriers to international trade</li> <li>• European regulation: <ul style="list-style-type: none"> <li>- excessive transposition – goldplating, impacts on manufacturing companies</li> </ul> </li> <li>• Reduced ability of companies to foresee changes and new trends at the global level</li> </ul>
<b>Social and demographic</b>	
<ul style="list-style-type: none"> <li>• Interest among talented foreigners in work/career in the Czech Republic:</li> </ul>	<ul style="list-style-type: none"> <li>• Population ageing and poor sustainability of the pension<sup>141</sup> and health care systems from</li> </ul>

<sup>140</sup> According to latest data, government debt (% of GDP) increased by 0.2 pp in 2013 In 2014 and 2015, the Ministry of Finance expects it to decrease to 43.9% and 42.2% of GDP respectively

Opportunities	Threats
<ul style="list-style-type: none"> <li>- from countries eastward of the Czech Republic</li> <li>- from countries in Southern Europe</li> <li>- relocation of interest outside Prague as well (to cities, towns for career, if it exists)</li> </ul> <p>Everything depends on the development of knowledge-intensive activities, opportunities for young people</p> <ul style="list-style-type: none"> <li>• Positive impacts of population ageing – new business opportunities (products and services)</li> <li>• Qualitative change of the “typical citizen in retirement age” – active in both social and economic life</li> <li>• Growing number of people seeking self-realisation beyond material security (consequences include the development of entrepreneurship and the social benefits of the activities implemented)</li> </ul>	<p>the state budget perspective</p> <ul style="list-style-type: none"> <li>• Size and age structure of the population – the number of people aged 8–18 is half the number people aged 35–45, which causes: <ul style="list-style-type: none"> <li>- a step change in the lifestyle and values, different attitude to consumption and work</li> <li>- loss of talent, low numbers of university students – also fewer students of technical secondary schools</li> </ul> </li> <li>• Persistently declining quality of graduates and the growing proportion of humanities-oriented graduates, along with the retirement of experienced employees will result in a lack of workforce demanded by the industry (in terms of both areas and depth of knowledge)</li> <li>• The drain of talented and highly-qualified employees from the Czech Republic (brain drain)<sup>142</sup></li> <li>• Reduced need for human labour due to productivity growth</li> <li>• Social instability in society due to increasing gaps (increased perception of gaps) between population groups – perception of social divide, growth of “secondary” and “grey” labour market</li> <li>• Bad image of entrepreneurs in the society</li> <li>• Low attractiveness of the entrepreneurial career, high sensitivity to perception of entrepreneurial risk</li> <li>• Deteriorating conditions for disadvantaged population groups (mothers after maternity leave) – their poor access to qualification-intensive segments of the labour market, loss of potential experts</li> </ul>
<b>Technological</b>	
<ul style="list-style-type: none"> <li>• Continuing digitalisation and automation and development of advanced production technologies, and subsequent change in production chains</li> <li>• Changes to transport processes in the different transport modes (e.g. autonomous means of transport in mass and individual passenger transport) and transport systems (transport in big cities) will change the</li> </ul>	<ul style="list-style-type: none"> <li>• High costs for intellectual property protection in Europe</li> <li>• New technologies for natural gas and crude oil extraction (slate gas and oil) – reduced energy prices, ultimately the shift of production to areas with cheap labour</li> <li>• Growing energy costs due to support for RES – transfer of (energy-intensive) productions to countries with lower costs (i.e. not only</li> </ul>

<sup>141</sup> The sustainability of the pension system will be partially covered by the extension of life expectancy for the next 20–25 years.

<sup>142</sup> Negative overall balance of talent

Opportunities	Threats
<p>demand for solutions in the production of transport means</p> <ul style="list-style-type: none"> <li>• Growing pressure on the use of primary agricultural resources. Ensuring sufficient raw materials for food and fuels in the long-term</li> <li>• Energy production decentralisation. Growing importance of renewable energy sources and their technologies</li> <li>• New IT technologies for a more efficient organisation and operation of the economy and society <ul style="list-style-type: none"> <li>- New technologies for processing, retaining and transmitting large volumes of data</li> <li>- IT system solutions for developing “smart cities” infrastructure</li> </ul> </li> <li>• New approaches in health care and treatment of diseases: <ul style="list-style-type: none"> <li>- drugs adapted to the specific needs of the patient</li> <li>- Earlier and faster diagnosis in health care (reducing costs across the system)</li> </ul> </li> </ul>	<p>lower costs of energy), loss of the potential of innovation demand in some areas.</p> <ul style="list-style-type: none"> <li>• Digitalisation and automation of production – lower use of non-specialised workforce</li> </ul>



## 4. Research and economic specialisation of the Czech Republic

### 4.1. Introduction: the concept of specialisation

In the context of the Czech Republic, smart specialisation needs to be understood as a tool to orient public investment and create suitable framework conditions in the area of creating and using knowledge and innovation, in order to reinforce competitive advantage within the global economy. The objective of smart specialisation is to establish a unique combination of capacities, knowledge and skills based on the existing economic and social potential of the country and the knowledge base, where it is crucial to strengthen the critical mass and diversification within the specialisation, i.e. to use existing assets and knowledge in new areas of application.

Although smart specialisation includes both investment in public research and investment in corporate innovation, its success is dependent on the involvement of actors that are aware of the potential market applicability of new knowledge and innovations and are able to identify new opportunities for innovation activities in both the private and public sectors<sup>143</sup>. If this condition fails to be met, it is impossible to expect that innovations will be implemented in the sense of products and services benefiting the customers and society (in the case of public consumption) nor is it possible to expect any improvement in competitiveness.

The logic underlying the selection of specialisation areas also needs to be viewed in this context, i.e. economic specialisation that reflects the existing (i.e. to date) competitive advantage is crucial. The competitive advantage may be based on the cost efficiency, geographical location (which, in case of the Czech economy, represents the prevailing sources of the competitive advantage to date) or on expertise, knowledge and innovation ability within a segment of economic activity. In terms of smart specialisation, a competitive advantage that is based on expertise and innovation ability play a crucial role.

The existing research specialisation in the public sector needs to be viewed as a source of impulses for applications that may become an important source of competitive advantage. However, this is only possible if knowledge sources are properly linked to economic activities in the private, public and non-profit sectors.

In terms of defining smart specialisation areas, it is necessary to distinguish between two key effects that are decisive for identifying potential new opportunities for application. On the one hand, there are *social challenges*, and on the other hand, there are *knowledge domains* that represent often unintended consequences of the economic and social development to date, with which we have to cope as a society.

In terms of smart specialisation *Social challenges* represent external stimuli that may take form of social and economic needs and threats but, at the same time, that produce opportunities for innovative solutions, including technological and social innovations. Therefore, they can be regarded as demand-based stimuli for which there is no adequate supply of solutions yet. For the purposes of smart specialisation in the Czech Republic, social challenges are defined – with a link to the trends

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<sup>143</sup> See the definition of smart specialisation and the *entrepreneurial process of discovery* in Guide to Research and Innovation Strategies for Smart Specialisations (RIS3) (p. 8) that emphasizes reinforcement of the competitive advantage of a country/region. <http://s3platform.jrc.ec.europa.eu/s3pguide>

and objectives identified in the National Priorities of Oriented Research, Experimental Development and Innovation<sup>144</sup> – as follows:

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

*Knowledge domains* represent a set of findings and technological abilities of generic, cross-cutting nature with a wide spectrum of potential applications in many areas of both private and public consumption. For the purpose of smart specialisation under the conditions existing in the Czech Republic, knowledge domains are defined in accordance with the definition of Key Enabling Technologies<sup>145</sup> as follows:

- **advanced materials,**
- **nanotechnology,**
- **micro- and nanoelectronics,**
- **photonics,**
- **advanced manufacturing technologies,**
- **industrial biotechnology**<sup>146</sup>.

Knowledge in these areas alone does not represent a source of competitiveness unless it is used creatively for specific applications defined by both the private, public or non-profit sectors. However, the ability to acquire and further develop such knowledge also represents a key prerequisite for implementing radically new technological solutions and higher-order innovations, for the ability to improve the position of the companies in global value chains, and for ensuring the long-term efficiency of the public sector. From the perspective of specific innovations and application solutions, expertise in each knowledge domain represents a key input for creating the supply of potentially available solutions.

However, at the same time, further research focusing on the use of knowledge in these knowledge domains needs to be oriented towards topics that have been defined by both the public sector (especially with respect to social challenges) and private business entities. Therefore, these purely technological knowledge domains have been extended to include **the social-science knowledge needed for non-technical innovations** (i.e. knowledge needed for identifying the changing needs of the demand from the public and private sectors, especially social-science knowledge that constitutes a key prerequisite for marketing and organisational innovations and for innovation management in

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<sup>144</sup> See <http://www.priority2030.cz/>.

<sup>145</sup> The European Commission defines Key Enabling Technologies (KETs) as technologies that are knowledge intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment. See Commission Communication COM (2012) 341 final.

<sup>146</sup> Knowledge domains, conceived as *Key Enabling Technologies* (KETs), are – in their nature – close to *general purpose technologies* as defined in the document entitled *National Priorities of Oriented Research, Experimental Development and Innovation* (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=653383>). For the purposes of defining the specialisation areas, the concept of key knowledge domains was brought in line with the concept applied by the European Commission.

general). Non-technical innovations constitute key knowledge that is needed for defining the problems, whose solution may be facilitated by technological knowledge, and – in their nature – form a cross-cutting knowledge domain that is relevant for most application areas (in industry, services, public and private sectors). Furthermore, the **knowledge domain for digital economy and cultural and creative industries**<sup>147</sup> has been added. For the purposes of the smart specialisation strategy, knowledge for cultural industries includes knowledge and skills in applied and industrial design, visual (graphic and fashion design, painting etc.) and performing arts (music, dance etc.) and knowledge and skills in traditional and modern living culture that can be used in the cultural industries. Knowledge for the digital economy includes knowledge for new media, publishing and media, digital content processing, and audio-visual production.

In the case of knowledge domains and social challenges, the public sector and public investment in research and innovation plays a dual irreplaceable role. It fulfils the function of the investor that needs to ensure the existence of the corresponding level of fundamental knowledge and expertise in the knowledge domains that are important in terms of the long-term competitiveness of the economy and effectiveness of public administration, including making sure that corresponding mechanisms are in place to link the supply of knowledge with the demand from users. On the other hand, the public sector should be a partner that defines – in cooperation with the corporate sector – the key social challenges to be preferentially addressed and directs public resources correspondingly. The public sector may facilitate the above through supporting the development of new applications and solutions to problems in cooperation with the corporate sector or through an effort to directly provide new applications and solutions in areas where the public sector plays the role of an important client (e.g. in the area of public and semi-public goods such as health care, environmental protection, education, food sufficiency). In addressing social challenges, it can be assumed that there is a need for combining technological expertise from different knowledge domains with in-depth knowledge of an area, including knowledge for non-technical innovations.

By contrast, the private sector has an irreplaceable role in *identifying the application themes* (through the *entrepreneurial process of discovery*) aimed at innovations, new products and services that can succeed within specific market niches<sup>148</sup>. This may include both the use of new findings within each knowledge domain, and solutions that are based on already available technologies but provided in a new way, or on solutions of non-technical innovation nature that, however, may substantially contribute to the competitiveness of the economy, especially in services.

On the one hand, smart specialisation must provide sufficient investment in knowledge domains that are necessary for maintaining and reinforcing the existing competitive advantage, but it must also

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<sup>147</sup> This area has been defined in line with the Programme Declaration of the Government from February 2014, where this area is referred to as a specific strategic priority of the Czech Republic's R&D policy (see <http://www.vlada.cz/cz/media-centrum/dulezite-dokumenty/programove-prohlaseni-vlady-cr-115911/>). In line with UNESCO's definition, creative industries are defined as "sectors of organised activity whose principal purpose is the production or reproduction, promotion, distribution and/or commercialisation of goods, services and activities of a cultural, artistic, or heritage-related nature." (see <http://www.unesco.org/new/en/santiago/culture/creative-industries/>).

<sup>148</sup> While in the case of knowledge domains, the further development of knowledge usually takes place in areas with low technological maturity, at the level clarifying and verifying basic principles in the sense of *technology readiness levels* 1 to 4, in the case of most innovation activities of companies this involves research that is closer to market application (technology readiness levels 5 to 9). For details, see e.g. EC (2013): *Innovation – How to Convert Research Into Commercial Success*, <http://s3platform.jrc.ec.europa.eu/guides>.

create conditions for developing new application areas and opportunities, including those that will respond to the social challenges identified. Last but not least, smart specialisation needs to define (within the priority areas of economic specialisation) tools to ensure closer links between companies and research organisations as the bearers of expertise in the various knowledge domains.

The following text analyses the economic specialisation of the Czech Republic, including an analysis of the knowledge intensity of each economic sector, which provides elementary guidance for identifying strong companies whose future technological and innovative needs are determinative for selecting the specialisation areas. Also, the text describes the existing areas of research specialisation, which provide an insight into the knowledge domains that can be used as a potential source of the Czech Republic's competitive advantage.

In addition to the analyses that have been carried out for the purposes of this strategy, and in addition to the documents mentioned above, some **documents that had been prepared specifically for that purpose** were used in proposing the specialisation domains of the Czech economy: (i) The working draft of the main conclusions of the analytical foundation for establishing the research specialisation of the Czech Republic, prepared by the Technology Centre of the AS CR for MEYS Group III, and (ii) MIT priorities for the area of industrial R&D and innovation – working version, prepared by MIT from June to September 2014.

## 4.2. Specialisation of the Czech Republic

### 4.2.1. Economic specialisation

The Czech Republic is a small, open economy. Despite short-term fluctuations that are related to the economic cycle, the share of exports in GDP has been growing in the long-term. In 2013, exports totalled CZK 3 174 billion, which accounts for 77.7% of the GDP<sup>149</sup>. Therefore, an export analysis is the initial step for identifying smart specialisation domains. Through the export analysis, we identify the main areas in which the Czech Republic's economy is competitive at international level. Within these areas, we further identify main product groups in which the Czech economy has an important international position.

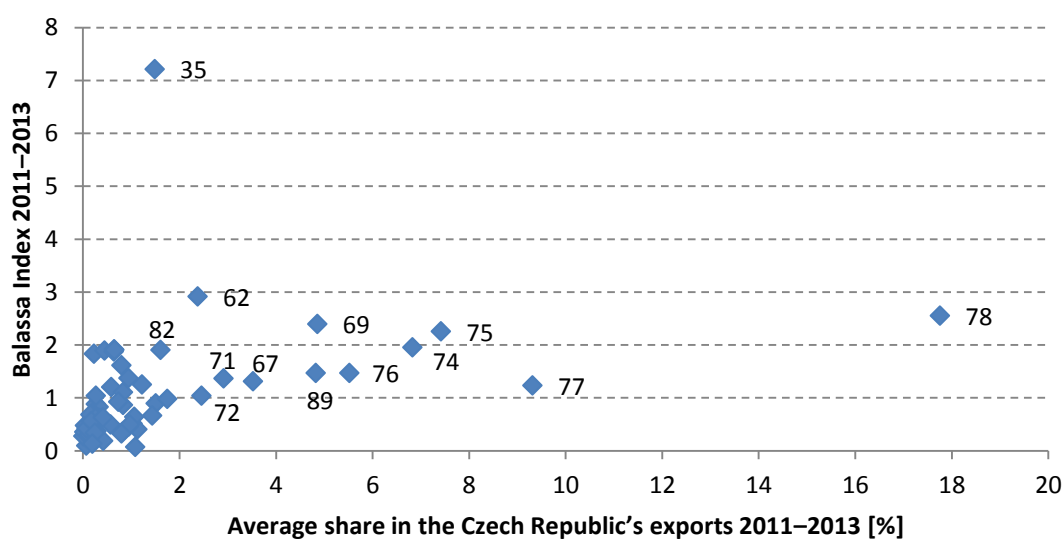
The first step in the export analysis is the identification of the SITC 2<sup>150</sup> product classes with the highest share in the Czech Republic's exports. In order to eliminate the effect of year-to-year fluctuations, share in exports is calculated as the average share in 2011–2013. Share in exports is an indicator of the significance of individual product classes for the Czech economy. The second step is the calculation of the revealed comparative advantage for the SITC 2 product classes. As before, the year-to-year fluctuations are eliminated through using the average for 2011–2013. The comparative advantage is measured using the Balassa Index (hereinafter the BI) where the numerator contains the share of the SITC 2 class in the Czech Republic's exports and the denominator represents the share of the same SITC 2 class in total world exports. The result of the first two steps is shown in Chart 4 below.

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<sup>149</sup> The value is based on foreign trade statistics (cross-border concept). In 2012, exports amounted to 75.9% of GDP, in 2000 only to 47,3% of GDP (CZK 1 121 billion).

<sup>150</sup> SITC 2 – Standard International Trade Classification SITC 2 denotes the level of detail of classification, i.e. two digits.

**Chart 4: Export specialisation of the Czech Republic at the level of SITC 2 classes**



Source: Own calculations based on data from UNCTAD and CSO (database of foreign trade). Note: For better understanding, SITC 2 class codes are only used for export items that clearly exceed the values achieved by most export items.

Chart 4 demonstrates that the main drivers of Czech exports are (i) automotive industry – SITC 78, (ii) electrical engineering and electronics industry – SITC 75, 76 and 77, and (iii) mechanical engineering industry – SITC 71, 72 and 74. Items within the metal-working industry (SITC 69) and metallurgical industry (SITC 67) also have a significant share in exports. The extent and export power of the last two industrial areas shows a strong background for the mechanical engineering, automotive and electrical engineering<sup>151</sup> industries. Field surveys of the corporate sector showed that especially the automotive industry – as a sophisticated customer – increases<sup>152</sup> the transnational competitiveness of these traditional industrial areas, which have a large share in employment. As a result, the dominant automotive, electrical engineering and mechanical engineering industries represent – to a large extent – the drivers of the internal restructuring of other traditional industrial areas. At the same time, they support export from related areas. This applies for example to SITC 62 “Rubber manufactures, n.e.s.”, which is largely due to the concentration of tyre manufacturers (not only for vehicles). A specific example is SITC 89 “Miscellaneous manufactured articles, n.e.s.”. However, this is a highly varied structure of difficult-to-classify products<sup>153</sup> that cannot be regarded as a specific area. The high share of this item in exports and the BI (a value slightly above 1) corresponds to the Czech Republic’s very broad manufacturing base that is oriented towards

<sup>151</sup> The metallurgical and metal-working industries are sources of important modules and components e.g. for products in heavy-current electrical engineering (e.g. generators, electric motors etc.), automotive frames, machines etc.

<sup>152</sup> Companies in the automotive industry push very strongly on reducing unit costs and, in turn, improving production efficiency and absorption of modern technologies in their suppliers (see Berman Group, 2010: An analysis of the material priorities and the needs of the different areas within the responsibility of the MIT for the purposes of targeting support from the EU Structural Funds in the next programming period 2014+). These companies, often in the metal-working, metallurgical and plastics industries, have gradually achieved a high production efficiency, which has allowed them to successfully penetrate into other markets outside the automotive industry.

<sup>153</sup> From medical products to pens and pencils, from costume jewellery to ornamental products for tourists. However, the area of medical products and aids shows particularly interesting dynamism.

European markets<sup>154</sup>. Another specific item is electricity (SITC 35). The Czech Republic ranks among top world exporters of electricity, and it significantly strengthened this position over the monitored period (see Table 1 below).

**Table 1: SITC 2 classes with the highest share in Czech exports**

Export item – SITC 2		Share in Czech export (%)		Balassa index (BI) in CR	
Code	Title	2002–2004	2011–2013	2002–2004	2011–2013
<b>78</b>	<b>Road vehicles</b>	<b>15.53</b>	<b>17.75</b>	<b>1.68</b>	<b>2.56</b>
<b>77</b>	<b>Electrical machinery, apparatus &amp; appliances n.e.s.</b>	<b>10.20</b>	<b>9.31</b>	<b>1.17</b>	<b>1.23</b>
<b>75</b>	<b>Office machines &amp; automatic data processing equip.</b>	<b>5.79</b>	<b>7.42</b>	<b>1.15</b>	<b>2.26</b>
<b>74</b>	<b>General industrial machinery &amp; equipment, and parts</b>	<b>6.61</b>	<b>6.82</b>	<b>1.78</b>	<b>1.95</b>
<b>76</b>	<b>Telecommunications &amp; sound recording apparatus</b>	<b>3.65</b>	<b>5.52</b>	<b>0.81</b>	<b>1.47</b>
89	Manufactures of metal, n.e.s.	5.58	4.85	2.67	2.39
<b>69</b>	<b>Miscellaneous manufactured articles, n.e.s.</b>	<b>4.20</b>	<b>4.82</b>	<b>1.15</b>	<b>1.47</b>
67	Iron and steel	4.34	3.52	1.67	1.31
<b>71</b>	<b>Power generating machinery and equipment</b>	<b>3.03</b>	<b>2.92</b>	<b>1.20</b>	<b>1.37</b>
62	Rubber manufactures, n.e.s.	3.16	2.46	1.21	1.04
72	Machinery specialized for particular industries	2.29	2.37	3.15	2.92
82	Furniture and parts thereof	2.51	1.61	2.51	1.91
<b>35</b>	<b>Electric current</b>	<b>0.66</b>	<b>1.48</b>	<b>3.23</b>	<b>7.22</b>
x	Share of items 1 – 5 in Czech exports	41.77	46.82	-	-
x	Share of items 6 – 10 in Czech exports	20.31	18.57	-	-
x	Share of top 10 items in Czech exports	62.08	65.39	-	-

Source: Own calculations based on data from UNCTAD and CSO (database of foreign trade). Note: SITC 2 classes in which the BI increased over the period under review are indicated in bold

Table 1 shows that the aggregate share of the five most important SITC 2 classes has increased by 5 pp over the past ten years. By contrast, the aggregate share of the sixth to tenth most important items slightly decreased. Together with the trends in the BI values, the data document an increase in the level of specialisation of the Czech economy in the period under review.

In the global economy, dynamic development also takes place in the export of services. However, the Czech Republic is lagging behind in this area. While the Czech Republic's share in world exports of goods is close to 1%, for services this is only 0.5%<sup>155</sup>. This difference documents the relative underdevelopment of the sector of the services in the Czech Republic as compared to top OECD countries and it is in line with the conclusion that the main driver of the Czech economy is the manufacturing industry<sup>156</sup>, namely the industrial areas mentioned above. The volume of the export of services is an order of magnitude lower than the export of goods. The Czech Republic has a comparative advantage in services that are associated with transport and travel (see Table 2 below), which corresponds to the Czech Republic's geographical position in the centre of Europe. From the RIS3 perspective, one important and growing part within this item is logistics<sup>157</sup>. This is an area whose development is largely driven by the development of industrial areas. On the other hand, the

<sup>154</sup> Berman Group (2010): An analysis of the material priorities and the needs of the different areas within the responsibility of the MIT for the purposes of targeting support from the EU Structural Funds in the next programming period 2014+

<sup>155</sup> Calculated based on UNCTAD data (<http://unctadstat.unctad.org>).

<sup>156</sup> International Competitiveness Strategy of the Czech Republic for 2012–2020

<sup>157</sup> A one-day trip of a truck dispatched from Prague may service a market of about 200 million people whose purchasing power is very high in global comparison.

conditions for the development of logistics and related services represent a significant part of the overall conditions for the development of the manufacturing industry and services relating to customer care<sup>158</sup>. Transport and especially logistics can thus be perceived as a specific part of the Czech Republic's specialisation that is mainly based on the above industries.

**Table 2: Balassa index of types of export services, Czech Republic vs. world; three-year averages**

	Category	Average 02–04		Average 09–11		BI	
		CZ	World	CZ	World	Average 02–04	Average 09–11
	Services total	100	100	100	100	1	1
<b>1</b>	<b>Transport</b>	<b>27.07</b>	<b>21.58</b>	<b>24.03</b>	<b>20.22</b>	<b>1.25</b>	<b>1.19</b>
<b>2</b>	<b>Travel</b>	<b>43.80</b>	<b>28.78</b>	<b>34.30</b>	<b>24.55</b>	<b>1.52</b>	<b>1.40</b>
3	Other services	29.13	49.62	41.67	55.03	0.59	0.76
3.I	Telecommunication services	2.03	2.34	2.52	2.51	0.87	1.01
3.II	<b>The building industry</b>	<b>1.44</b>	<b>2.07</b>	<b>3.66</b>	<b>2.72</b>	<b>0.69</b>	<b>1.35</b>
3.III	The insurance sector	0.07	2.66	1.27	2.48	0.03	0.51
3.IV	Financial services	3.18	6.41	0.35	7.34	0.50	0.05
<b>3.V</b>	<b>IT and information services</b>	<b>1.47</b>	<b>3.94</b>	<b>6.89</b>	<b>5.61</b>	<b>0.37</b>	<b>1.23</b>
3.VI	Intellectual property rights and licence fees	0.55	6.11	0.49	6.63	0.09	0.07
3.VII	Other corporate services	17.91	22.82	25.38	25.15	0.78	1.01
<b>3.VIII</b>	<b>Personal, cultural and recreational services</b>	<b>1.95</b>	<b>0.98</b>	<b>0.92</b>	<b>0.81</b>	<b>1.98</b>	<b>1.14</b>
3.IX	Public services n.e.c.	0.53	2.28	0.18	1.77	0.23	0.10
5	Market services total	99.47	97.72	99.82	98.23	1.02	1.02

Source: Own calculations based on data from UNCTAD

Transport and travel account for over 58% of total exports of the services. Their share in Czech exports of services is declining, especially in the case of travel. For both, the BI value slightly decreased over the period under review, but it still remains greater than 1. Tourism, which is partly included in item 2 Travel, is specific in terms of the RIS3. Given that, except for Prague, the Czech Republic does not have any significant attractions of international significance that would also generate important export income of national importance, tourism will be a specialisation at regional rather than national level.

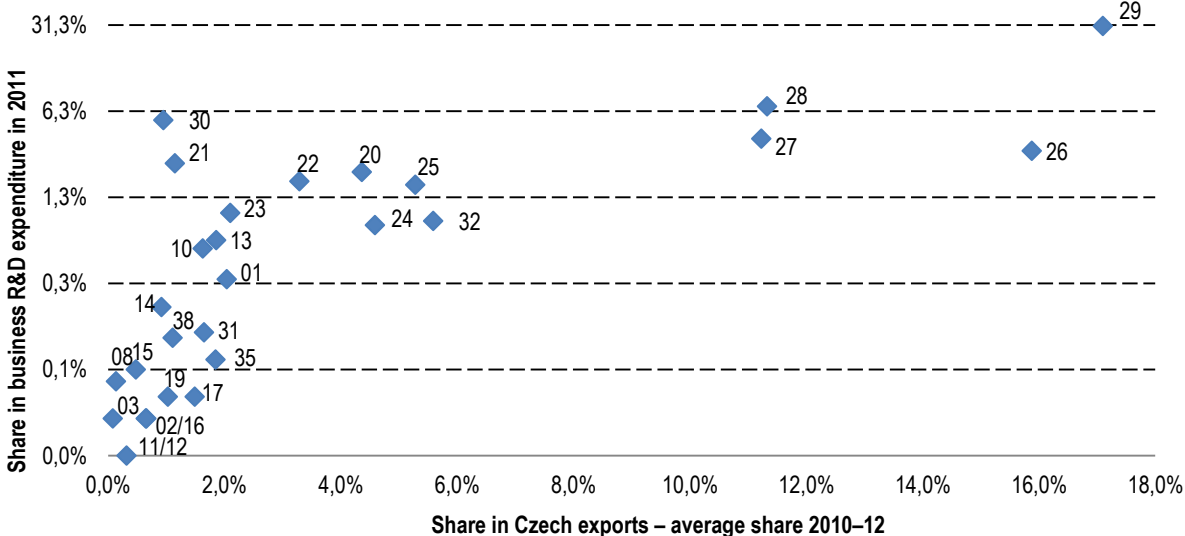
By contrast, IT services have experienced a significant increase in BI. Moreover, IT reports the highest rate of the long-term growth of the export of services. Over the past decade, the share of this category of services in total exports of services increased from 1.5% to almost 7% (see Table 2 above). This trend is attributable both to the development of activities of global centres of customer services, and the dynamic development of enterprise in SW development and related services. Given the nature of IT services, which also include a wide range of supporting services necessary for implementing the export of industrial goods, the area of IT services and digital economy services (including software development) may be regarded as one of the key branches of the Czech economy. Further growth of knowledge-intensive services, including IT services, can be considered a necessary prerequisite for further increasing the value of Czech exports and improving the position of

<sup>158</sup> Over the past decade, services related to the trend of growing individualisation of consumption and customer care have been developing. One example may be the provision of customised surgery sets to hospitals where the surgery sets include instruments and devices (manufactured in different countries) custom-made for surgeons that do surgeries in the given hospital. In this way, hospitals in surrounding countries (e.g. in Germany) are also served from the Czech Republic.

Czech companies in global value chains. Besides IT services, cultural and creative industries<sup>159</sup> also needs to be included among important areas of services with a high export orientation.

In addition to export importance, the next step assesses the importance of areas in terms of their share in corporate expenditure on research and development (R&D). To this end, export data according to SITC 2 items have been recalculated according to the NACE classification, which is used to structure data for most indicators, including indicators of corporate R&D capacities. A comparison of the importance of NACE sections according to their share in exports and business R&D expenditure is shown in Chart 5 below.

**Chart 5: NACE sections by their share in Czech exports and business R&D expenditure, 2010–2012**



Source: Own calculation based on CSO (Research and development) and UN COMTRADE data  
 Note: Titles of sections and data are listed in the annex. Through expert matching, export data in SITC 2-digit classification were converted to the NACE 2-digit structure of economic activities. For maximum accuracy, export data in a SITC 4-digit classification were also used for some NACE items. Business R&D expenditure: Only non-capital expenditure is included in order to avoid distortion due to extraordinary large capital expenditure.

Chart 5 confirms the dominant export importance of the automotive (NACE 29), electronics (NACE 26), mechanical engineering (NACE 28), and electrical engineering (NACE 27) industries. With respect to share in business R&D expenditure, the automotive industry dominates the domestic economy, accounting for about one third (30.6%) of R&D expenditure in the corporate sector. On the other hand, this position is largely attributable to Škoda Auto a.s., the biggest Czech exporter that significantly contributes to this item. It is followed by mechanical engineering with a 7% share in business R&D expenditure, and manufacture of other transport equipment (5.3%). The combined share of the electrical engineering and electronics industries in business R&D expenditure amounts to 6.7%. Other industries with relatively significant shares in business R&D expenditure include the pharmaceutical industry (NACE 21), chemical industry (NACE 20), metal-working industry (NACE 25), and rubber production (NACE 22). In terms of knowledge intensity, the manufacture of medical

<sup>159</sup> See for example the Good Country Index, which identifies the Czech Republic as one of the top countries globally with respect to the relative intensity of the export of cultural goods relative to the size of the national economy (for details, see UNCTAD (2010): Creative Economy: A Feasible Development Option. Report 2010, www.goodcountry.org).



products (NACE 325) is also an important sector. Its share ranges from 1.5% to 2.3% of business R&D expenditure. This specialisation is also reflected in the participation and success in projects of the Seventh Frame Programme, where the Czech Republic has mainly been historically successful in thematic priorities ICT, Nanosciences, nanotechnologies, materials and new production technologies (NMP), and Transport (including aerospace<sup>160</sup>) – within these priorities, the Czech Republic also reports significant involvement of companies. (Hebáková, Granger, 2013).

The comparison of industries according to knowledge intensity is affected by significant differences between individual industries with respect to the innovation regime and the need for inputs to the innovation process in the form of the results of research and experimental development. These differences are reflected in the very varied levels of business R&D expenditure relative to generated GVA, by industry. Therefore, the significantly higher R&D expenditure relative to GVA in the chemical and pharmaceutical industries as compared to the food and metal-working industries does not necessarily mean that the former two are more innovative or ambitious in terms of technological innovation. Table 3 below compares the knowledge intensity of selected industries in the Czech Republic with the knowledge intensity of the same industries in OECD countries. The values show that NACE 30 – Manufacture of other transport equipment is the only industry with above-average knowledge intensity. The automotive industry (NACE 29) is slightly below average. The pharmaceutical industry (NACE 21) is lagging behind more significantly, but it still reaches about 80% of the average intensity in OECD countries (see Table 3 below).

**Table 3: Knowledge intensity in selected industries – Czech Republic vs. OECD average**

NACE	NACE – Description	BERD share in GVA (average for 2006–2009)		
		Czech Rep.	OECD countries	OECD=100
21	Manufacture of pharmaceutical products and preparations	25.34	30.20	83.9
30	Manufacture of other transport equipment	12.19	8.92	136.7
29	Manufacture of motor vehicles	7.71	8.54	90.3
26/27	Manufacture of computer, electronic and optical products / Manufacture of electrical equipment	4.25	14.52	29.3
28	Manufacture of machinery and equipment	3.04	6.24	48.7
20	Manufacture of chemicals and chemical products	2.37	8.69	27.3
22	Manufacture of rubber and plastic products	1.26	3.27	38.4
24	Manufacture of basic metals; metallurgy; casting	0.83	2.27	36.4
25	Manufacture of fabricated metal products	0.53	1.15	46.0
13/14/15	Manufacture of textiles, wearing apparel, leather and related products	1.11	1.96	56.7
10/11	Manufacture of food products, beverages	0.33	1.04	31.1
17	Manufacture of paper and paper products	0.02	1.37	1.4
23	Manufacture of other non-metallic mineral products	0.85	1.51	56.4
	HI-TECH manufacturing industry – combined	12.06	25.02	48.2

Source: STI Database OECD. Note: 1: BERD = Business Expenditure on R&D, GVA = Gross Value Added.

Note: According to the definition used by OECD ISIC Rev. 3, the aggregate hi-tech manufacturing industry includes the following industries: aircraft and spacecraft; pharmaceuticals; office, accounting, and computing machinery; radio, television, and communications equipment; medical, precision, and optical instruments. The knowledge intensity of the business sector has increased in the Czech Republic since the period under review, which is why the values in Table 3 should not be overestimated.

<sup>160</sup> The term refers to an industry dealing with technologies for air transport and the aerospace industry.

Note: The knowledge intensity of the business sector has increased in the Czech Republic since the period under review, which is why the values in Table 3 should not be overestimated. No newer data is available

In other industries, the knowledge intensity of the business sector is far below the OECD average in the Czech Republic. This is particularly important in the case of the main export industries, namely in the mechanical engineering (NACE 28), electrical engineering/electronics (NACE 26 + 27), metalworking (NACE 25) and metallurgical (NACE 24) industries. In these industries, the share of business R&D expenditure in generated GVA is less than a half of the level common in OECD economies. This fact is documented by the overall position of the Czech economy in the area of innovations, which is characterised by:

- the dominance of innovations in the form of absorption of foreign technology over innovations based on own technologies / technical knowledge;
- low number of companies operating at the technological boundary of their industry that are able to generate higher-order technological innovations that are new to the market;
- dependence on large foreign companies, the vast majority of which have most of their R&D capacities outside the Czech Republic.

The above characteristics of the business sector result in low innovation demand in the area of higher-order innovations, which limits the potential for research co-operation and technological transfer between companies and research organisations.

Given that transport means<sup>161</sup> are basically machines that are fitted with latest electronics and use many electrical-engineering components, the above presentation of data on exports and business R&D expenditure can be summarised as follows: *the economic performance of the Czech Republic is based on industrial production, with the decisive position of industries relying on knowledge and technologies in the field of mechanical engineering, electrical engineering, and electronics. An important part of these application industries are information technologies and related services<sup>162</sup>, which are an integral part of modern technologies in mechanical engineering, electrical engineering and transport systems.* In addition to the automotive industry, which is the dominant driver for a major part of companies in the mechanical engineering, electrical engineering and other supply industries, other drivers include industries such as power engineering and investment units for the petrochemical, metallurgical, mining and mechanical engineering industries. A large portion of the overall production in mechanical engineering and electrical engineering “ends up” in these industries. The importance of power engineering and investment units lies, among other thing, in the good image of “Made in Czech” in the emerging markets of post-Soviet countries and some countries in Asia. In addition to these traditional industries, the manufacture of drugs and medical products, i.e. an industry with a relatively high knowledge intensity and growing economic dynamism, is becoming important in terms of specialisation at the national level.

The automotive, mechanical engineering, electrical engineering and related IT industries, as well as the manufacture of drugs and medical products are the main industries in many other countries. It is therefore important to identify specific branches within these industries that represent the main competitive power of the economy. These branches, i.e. the companies within these branches, are important for identifying the knowledge domains whose development will be the focus of smart specialisation.

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<sup>161</sup> Be it cars, aeroplanes or buses.

<sup>162</sup> The share of relevant NACE 62 and NACE 63 in business R&D expenditure exceeds 10%.

Overall, based on the above combination of available empirical data on the one hand (data on export intensity, intensity of R&D expenditure, trends in turnover in time), and based on the on-going process of entrepreneurial discovery that was launched in 2013 at the regional level on the other hand, it is possible to identify the areas of the economic specialisation in which the Czech Republic shows above-average growth potential. These include **manufacture of transport means, mechanical engineering, electronics and electrical engineering, IT services and software, electricity production and distribution, drugs and medical products**<sup>163</sup>.

It needs to be emphasized that virtually all identified application areas (except for IT services and, in part, health services and care) are manufacturing industries. This reflects the current economic specialisation of the Czech Republic and, in the future, it is desirable to orient the research specialisation correspondingly. However, this must not lead to the wrong conclusion that only industrial production should be supported. On the contrary, given the increasing global commodification of manufacturing activities, it is desirable to **increase the share of related qualified services** (for example construction, testing, design, customised development, consulting services, or marketing services) in the Czech Republic's economic performance.

Within these application areas, there are Czech business entities that show high knowledge intensity, positive economic dynamism, and promising potential for the future. These areas represent the concentration of key knowledge-intensive and innovation activities of businesses, which have been identified – using the entrepreneurial discovery process – from the regional level and verified through data analyses at the national level. These are the application areas<sup>164</sup> in which specific knowledge and technological competences are applied on a large scale and which should be developed and strengthened in the future within the Smart Specialisation Strategy.

#### **Manufacture of transport means and equipment**

Passenger cars and their components (lights, combustion engines, transmissions, brakes etc.), development, design, construction and testing

Aircraft, particularly ultra-light aircraft, their components, development, design, construction and testing

Space technologies<sup>165</sup>, including their use outside space applications

Electric vehicles and electric drive units

Rail vehicles and their components, development, design, construction and testing

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<sup>163</sup> This conclusion is also consistent with the conclusions of the analytical findings of the Ministry of Industry and Trade (2014) – the document entitled Priorities of the Ministry of Industry and Trade for the area of industrial research, development and innovation from September 2014 that identifies the following priorities: 1. transport means and their components; 2. advanced manufacturing and mechanical-engineering technologies; 3. electronics, electrical engineering, optics, photonics, ICT and related IT services; 4. special machines and equipment and precision devices; 5. advanced materials, technologies for their processing; 6. new chemical technologies, procedures and products, biotechnology and drugs; 7. technologies for the aviation and aerospace industries. Unlike the RIS3, the approach of the of the Ministry of Industry and Trade's document, does not distinguish between application areas and knowledge domains in which there is potential for applying knowledge in generic, enabling technologies across a larger number of application areas.

<sup>164</sup> However, this is not an exhaustive list but rather an overview of the application areas identified so far, which should not be overlooked. On-going additions and refinement should be a permanent part of the entrepreneurial discovery process, which will be coordinated from the national level throughout the implementation of RIS3 by the national RIS3 manager.

<sup>165</sup> Space technologies are formally included as a part of the manufacture of transport means, but – in fact – their use is reflected in many other industries and sectors and, conversely, space technologies use the results of and inputs from many other industries and knowledge domains.

Materials with low energy and material demands

Communication and security systems, electronic control and information systems, development, design, construction, testing

### **Mechanical engineering**

Power engineering (turbines, boilers, combustion and gasification equipment etc.)

Engineering and design for investment units

Manufacturing equipment in mechanical engineering, mechatronic systems, machining and forming machines and tools

Precision mechanics and metering technology

Pumping equipment

Textile machines

Progressive materials and technologies for their processing, surface finishing

Design activities, modelling, simulation

Optimisation of manufacturing processes

### **Electronics and electrical engineering**

Industrial automation, communication, identification, control equipment

Robotics, artificial intelligence

Switching technology, circuit breakers, switches, distributors

Microelectronics

Analytical, metering and scientific devices

Electric motors and electric rotary machines and devices

Optics, optoelectronics, lasers and their applications

### **IT services and software**

Network technologies and network security

Antivirus SW

Database, information and expert systems, enterprise SW

Creative IT services, digital media (engineering and architectural services, computer games, audio-visual and promotional services)

Internet services and mobile applications

Computer modelling, virtual prototyping

Applications based on the products of space systems

### **Electricity production and distribution**

Production and conversion of energy, devices for energy production and distribution

Transmission and management of production and transmission of electricity, smart energy networks

Performance electronics, heavy-current electrical engineering

Nuclear power engineering

Mining and use of coal

Renewable energy sources, use of waste for energy recovery

Energy materials

Low-carbon technologies and energy savings

Energy optimisation of activities for transport and transport security

## Drugs and medical products and methods

Medical equipment and aids

Implants and medical replacements, biologically active materials

Diagnostic devices

Drugs, pharmacology

Health services and care (spa and balneology, clinical studies, bio-statistics etc.)

In addition to six application themes derived from the economic and innovation dynamism of relevant application areas, an additional seventh theme was added to reflect the need for innovations in the area of natural resources, agriculture and food<sup>166</sup>. This is an area in which the Czech Republic currently has no immediate comparative advantage on an international scale, but it is reasonable to assume that the area is critical with respect to maintaining long-term competitiveness and preventing risks (sustainability of development, resource security and sufficiency) that may jeopardise prosperity of the economy and society in the long-term. Within this theme, too, narrower application areas have been identified that show significant dynamism in terms of the new findings produced and the applications achieved.

## Natural resources, agriculture and food

Separation and remediation technologies for the environment and the food industry

Technologies for water and soil processing, purification and treatment and for waste processing

The food industry and food security

Agricultural and food technology (biotechnology, microbiological procedures etc.)

Production of alcoholic beverages (incl. brewing) and related supply chains

Freshwater aquaculture and fish processing

In addition to specifying in detail the application areas within the national economic specialisation, region-specific specialisations were also identified from the regional level that should also be considered in setting up future interventions as part of implementing the Smart Specialisation Strategy. The following table summarizes the territorial aspect of the areas of national economic specialisation and an overview of region-specific specialisations that – even though they go beyond the national specialisation – represent significant application areas on a regional scale. For a more detailed description of the region-specific areas of economic specialisation, see the different regional annexes to the National RIS3 Strategy.

**Table 4: Presence of key areas of knowledge application (economic specialisation) in the Czech Republic's regions**

	Self-governing regions													
	PRG	CB	SB	PL	KV	UL	LB	HK	PA	VYS	SM	OL	ZL	MS

<sup>166</sup> Empirically, the identification of this application theme relies on the conclusions of the Working draft of the main conclusions of the analytical foundation for establishing the research specialisation of the Czech Republic (TC AS 2014), and on priority 3 as defined in the document entitled National Priorities of Oriented Research, Experimental Development and Innovation.

Areas of national specialisation	Manufacture of transport equipment	X	X	X	X	X		X	X	X	X	X	X	X	X
	Mechanical engineering	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Electronics and electrical engineering	X	X	X	X	X		X	X	X	X	X	X	X	X
	IT services and software	X			X				X	X		X		X	X
	Electricity production and distribution	X	X	X	X	X	X		X		X	X			X
	Drugs and medical products	X	X		X				X	X		X	X		X
	Natural resources, agriculture and food		X	X	X	X		X	X				X		
Areas of region-specific specialisation															
	Chemistry and chemical industry		X			X	X			X			X		
	Glass, ceramics					X	X	X							
	Rubber and plastic industry					X			X					X	
	Media	X													
	Textile							X	X	X					

#### 4.2.2. Research specialisation

Research activities in the Czech Republic cover a wide spectrum of directions and, to a certain degree, they cover all key knowledge domains (or KET) – material research, nanotechnology, micro- and nanoelectronics, photonics, advanced manufacturing technologies, and industrial biotechnology. In most knowledge domains, the Czech Republic has a research base of sufficient quality that is able to produce internationally competitive results and that can be a high-quality partner to the application sector in identifying new application directions and technological solutions. However, in an international comparison, the publication and patent outputs indicate three knowledge domains with above-average parameters. These include **photonics, advanced materials and, to a lesser extent, nanotechnology** (Kučera and Vondrák, 2014), where the former two areas achieve higher values in both publication and patent parameters, while nanotechnology has low values.

However, this finding alone is not sufficient for assessing whether above-average publication outcomes have a potential for use in innovations. Nevertheless, they indicate that there are Czech research facilities in these areas that produce new findings that are well received internationally. These facilities should not be overlooked as key partners in identifying new opportunities within innovation platforms and the entrepreneurial discovery process.

When examined in a more-detailed classification of areas, the Czech Republic shows mostly below-average values compared to the world average. Above-average levels with respect to measurable

parameters (i.e. primarily bibliometric characteristics)<sup>167</sup> are only achieved by Czech research activities in two scientific areas (instruments and instrumentation, and energy science and technology), and in about forty narrowly defined sub-areas<sup>168</sup>. The areas, in which the Czech Republic consistently achieves above-average values in the form of quotation response<sup>169</sup> and, at the same time, the total scientific production achieves minimum number of publications<sup>170</sup>, include both areas that have immediate links to the areas of the Czech Republic's current economic specialisation, and areas where, conversely, there is only weak linkage to economic areas with a potential for using research results in applications<sup>171</sup> (see Table 5 below that shows areas with an above-average RCIO, i.e. greater than 1).

The first category includes, above all, the following research areas: instrumentation (instruments and instrumentation and microscopy), physics and material sciences and power engineering (especially nuclear physics, nuclear sciences and technology), some sub-areas of chemistry and chemical engineering (spectroscopy, electrochemistry, textile materials, applied chemistry), computer sciences (computer sciences and software engineering), areas of electrical engineering and telecommunications (automation and control systems, telecommunications), areas of mechanical engineering (mechanical and aerospace engineering, general engineering), and biomedical areas (medicinal chemistry, toxicology, medical laboratory technologies). In these areas, there are – in the Czech Republic – both strong research teams and potentially complementary companies in economic sectors that show positive dynamism in the form of exports and investments in R&D and can be expected to be interested in applying the results of research organisations. Direct links between knowledge domains of the above research areas and sub-areas can be expected in the following sectors: manufacture of transport equipment, mechanical engineering, electrical engineering and electronics, and manufacture of drugs, but also in some other narrower market niches such as manufacture of scientific and analytic instruments, special textiles, chemical engineering etc.

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<sup>167</sup> While we need to be aware of the numerous methodological limitations (e.g. different weight of co-authorship of articles depending on the publication practice in each area, different presence of Czech journals among the periodicals registered under WOS in different areas), bibliometric indicators in exact sciences are a rather reliable, internationally comparable indicator of the quality of the research activity. By contrast, specialisation with respect to patent activity has not been considered for this purpose due to the minimal number of international patents applied by Czech entities (40 to 50 each year in the case of the European Patent Office, and even fewer in the case of the US Patent and Trademark Office).

<sup>168</sup> This is a classification of areas used by WOS Thomson Reuters. The data is taken from the bibliometric analysis of publications with Czech authors (or co-authors) for 2003–2009: Vaněček, J. (2011): *A map of the research and application potential of the Czech Republic: Field and institutional analysis of R&D results in the Czech Republic*. (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=15138>).

<sup>169</sup> The analysis relies on assessment based on the RCIO relative citation index that shows the average citation rate of publications of authors and co-authors from a given country relative to world average for the given field. These are the results of bibliometric analyses for 2003–2009.

<sup>170</sup> Generally, it needs to be taken into account that research in the Czech Republic in the vast majority of areas lacks critical mass, in most of the branches, the Czech Republic's share in global publication production exceeds 1% only in three sub-areas (nuclear, molecular, and chemical physics; nuclear sciences and technology; ecology).

<sup>171</sup> See Žižalová, P. (2011): *A map of the research and application potential of the Czech Republic: Assessment of application potential*. (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=15138>).

**Table 5: Above-average cited sub-areas in the Czech Republic.**

Zastřešující obor	podobor	RCIO oboru v ČR	Počet publikací ČR	Podíl na svět. publikacích v oboru (%)	Podíl na počtu publikací ČR (%)
AGRICULTURE AND FOOD SCIENCE	SOIL SCIENCE	1.208	157	0.696	0.207
BASIC MEDICAL SCIENCES	CHEMISTRY, MEDICINAL	1.008	355	0.595	0.468
BIOLOGICAL SCIENCES	ORNITHOLOGY	1.193	76	1.071	0.100
BIOLOGICAL SCIENCES	MARINE & FRESHWATER BIOLOGY	1.088	367	0.638	0.483
BIOLOGICAL SCIENCES	FISHERIES	1.065	222	0.809	0.292
BIOMEDICAL SCIENCES	MEDICAL LABORATORY TECHNOLOGY	1.353	132	0.729	0.174
BIOMEDICAL SCIENCES	ANATOMY & MORPHOLOGY	1.168	91	0.902	0.120
BIOMEDICAL SCIENCES	TOXICOLOGY	1.049	513	0.946	0.676
CLINICAL MEDICINE	MEDICINE, GENERAL & INTERNAL	2.522	240	0.235	0.316
CLINICAL MEDICINE	RHEUMATOLOGY	1.959	110	0.462	0.145
CLINICAL MEDICINE	TROPICAL MEDICINE	1.365	16	0.126	0.021
CLINICAL MEDICINE	ALLERGY	1.054	36	0.252	0.047
CLINICAL MEDICINE	CRITICAL CARE MEDICINE	1.033	74	0.314	0.097
CLINICAL MEDICINE	OBSTETRICS & GYNECOLOGY	1.029	192	0.326	0.253
COMPUTER SCIENCES	COMPUTER SCIENCE, SOFTWARE ENGINEERING	1.155	217	0.583	0.286
EDUCATIONAL SCIENCES	PSYCHOLOGY, EDUCATIONAL	1.151	3	0.033	0.004
ELECTRICAL ENGINEERING AND TELECOMMUNICATION	TELECOMMUNICATIONS	1.116	44	0.088	0.058
ELECTRICAL ENGINEERING AND TELECOMMUNICATION	AUTOMATION & CONTROL SYSTEMS	1.089	132	0.405	0.174
ENERGY SCIENCE AND TECHNOLOGY	NUCLEAR SCIENCE & TECHNOLOGY	1.270	822	1.437	1.083
ENVIRONMENTAL SCIENCES AND TECHNOLOGY	URBAN STUDIES	1.964	11	0.138	0.014
ENVIRONMENTAL SCIENCES AND TECHNOLOGY	BIODIVERSITY CONSERVATION	1.757	99	0.595	0.130
ENVIRONMENTAL SCIENCES AND TECHNOLOGY	FORESTRY	1.400	175	0.805	0.231
ENVIRONMENTAL SCIENCES AND TECHNOLOGY	ECOLOGY	1.030	772	0.896	1.017
GENERAL AND INDUSTRIAL ENGINEERING	ENGINEERING, MULTIDISCIPLINARY	1.068	149	0.334	0.196
HEALTH SCIENCES	HEALTH POLICY & SERVICES	2.201	2	0.011	0.003
HEALTH SCIENCES	NURSING	1.330	10	0.047	0.013
CHEMISTRY AND CHEMICAL ENGINEERING	SPECTROSCOPY	1.338	638	1.347	0.840
CHEMISTRY AND CHEMICAL ENGINEERING	ELECTROCHEMISTRY	1.217	473	1.013	0.623
CHEMISTRY AND CHEMICAL ENGINEERING	MATERIALS SCIENCE, TEXTILES	1.152	82	0.916	0.108
CHEMISTRY AND CHEMICAL ENGINEERING	CHEMISTRY, APPLIED	1.050	448	0.651	0.590
INFORMATION AND COMMUNICATION SCIENCES	COMMUNICATION	1.018	14	0.137	0.018
INSTRUMENTS AND INSTRUMENTATION	INSTRUMENTS & INSTRUMENTATION	1.518	663	0.950	0.873
INSTRUMENTS AND INSTRUMENTATION	MICROSCOPY	1.035	81	1.294	0.107
LAW AND CRIMINOLOGY	MEDICINE, LEGAL	1.329	25	0.339	0.033
MATHEMATICS	MATHEMATICS, INTERDISCIPLINARY APPLICATIONS	1.061	169	0.426	0.223
MECHANICAL ENGINEERING AND AEROSPACE	ENGINEERING, AEROSPACE	1.285	102	0.587	0.134
MECHANICAL ENGINEERING AND AEROSPACE	ENGINEERING, MECHANICAL	1.104	212	0.288	0.279
MULTIDISCIPLINARY JOURNALS	MULTIDISCIPLINARY SCIENCES	1.170	257	0.343	0.339
PHYSICS AND MATERIALS SCIENCE	PHYSICS, NUCLEAR	1.679	536	1.269	0.706
PHYSICS AND MATERIALS SCIENCE	PHYSICS, ATOMIC, MOLECULAR & CHEMICAL	1.003	1084	1.080	1.428
PSYCHOLOGY	PSYCHOLOGY, SOCIAL	1.639	15	0.089	0.020
PSYCHOLOGY	PSYCHOLOGY, APPLIED	1.336	5	0.035	0.007
SOCIAL AND BEHAVIORAL SCIENCES, INTERDISCIPLINARY	SOCIAL SCIENCES, BIOMEDICAL	1.462	4	0.033	0.005
SOCIOLOGY AND ANTHROPOLOGY	FAMILY STUDIES	2.931	2	0.023	0.003

Source: Vaněček, J. (2011): A map of the research and application potential of the Czech Republic: Area and institutional analysis of R&D results in the Czech Republic



The second category, i.e. the category of areas where the Czech Republic shows significant research specialisation, critical mass of results, and quality of research, but in which there is a relatively weaker business sector (and thus demand) with the potential for using unique knowledge, mainly includes some sub-areas of biological and environmental sciences and, to a lesser extent, medical sub-areas. In specific terms, these include sub-areas of clinical medicine (general and internal medicine, rheumatology, obstetrics and gynaecology), biological sciences (fisheries and sea and freshwater biology) and some sub-areas of environmental sciences (biodiversity protection, forestry, ecology). For these scientific disciplines, there are generally no strong and knowledge-intensive corporate partners with export potential – this is either due to historical specialisation or because the main users of the results of these research areas are partners in the public sector. However, these are areas that significantly contribute (or may contribute) to addressing social challenges and/or to innovations in areas where the public sector is the dominant user of the results (typically in health care and environmental protection). In some of the above areas there may be specific market niches in which the results of research can be commercially utilised, even though these are not key economic sectors in terms of the national economy, but they may have a specific position within some regions and their specialisations (typically freshwater aquaculture in the South Bohemian Region).

The existing research specialisation has recently been influenced by rather massive investments in public research thanks to the use of the Structural Funds, especially from the Operational Programme Research and Development for Innovation (OP RDI). In the future, these R&D centres should become the key building blocks of the Czech Republic's research specialisation (except for Prague, no building of significant additional capacities is envisaged) and it will be necessary to make maximum use of their knowledge potential to address both social challenges and research problems that have been defined in co-operation with the application sector. Thanks to these investments, a total of 8 centres of excellence and 40 regional R&D centres were created in the Czech Republic, which have significantly strengthened the critical mass in the selected areas. Also, a significant portion of the capital expenditure of Czech involvement in 11 projects of pan-European research infrastructures is linked to R&D centres. By far the largest project is ELI Beamlines, the only ESFRI Roadmap project whose basic part of the research infrastructure is located in the Czech Republic. In addition to this project, there are a number of R&D centres that, thanks to extensive investment in research infrastructures, represent national partner infrastructures for ESFRI infrastructures (Ministry of Education, Youth and Sports, 2011).

The impact of the R&D centres on research specialisation is delayed has not yet fully translated into scientific production, but the structure in terms of areas is obvious from the orientation of their research. Out of the eight centres of excellence, two focus on information technologies (IT4Innovations and NTIS), two on biotechnologies and biomedicine (Biocev and Ceitec), two on materials research (Ceitec and CET Telč), one on laser physics and optics (ELI Beamlines), one on clinical medicine and biomedicine (ICRC), and one on research of global changes of climate and ecosystems (CzechGlobe).

The regional R&D centres financed by the Operational Programme Research and Development for Innovation focus mainly on energy research (7), materials sciences (6), biomedicine and biotechnologies (5), mechanical engineering (4), electrical engineering, electronics and instrumentation (3). Overall, it can be concluded that the creation of R&D centres has significantly strengthened the Czech Republic's research capacities in all five basic knowledge domains, while

reinforcing (at least in financial terms with respect to invested resources) the importance of research in the field of biotechnologies and natural sciences, partly in information technologies, and somewhat less in materials research. In terms of application areas, the most important ones include power engineering and mechanical engineering research (including various aspects of materials research), as well as biomedical and biotechnological research. While the first two application areas can be expected to have a direct link to existing areas of economic specialisation (mechanical engineering, manufacture of transport equipment, including manufacturers of components, power engineering), investment support for biomedical and biotechnological research means strengthening a research area in which there has historically been low demand by the private sector in the Czech Republic (manufacture of drugs and medical products). This means that, in the future, greater emphasis will need to be placed on strengthening the mechanisms for transferring knowledge from centres with such orientation into practical applications, and especially on searching for applications in specific niches that may use biotechnology and biomedicine knowledge in sectors of existing economic specialisation (e.g. scientific and analytical instruments, medical equipment, application of biotechnologies in the energy sector etc.).

From a regional perspective, the distribution of research capacities in areas of Key Enabling Technologies shows significant imbalance in the Czech Republic. The table below presents the distribution of research capacities in terms of the volume of scientific production in relation to KETs (prepared based on a study by Kučera and Vondrák, 2014). In addition to existing research capacities, whose activities already translate into research outputs, the table also includes – in parenthesis – the newly built capacities that are financed by the Operational Programme Research and Development for Innovation (indicated as (X)).

**Table 6: Presence of generic knowledge domains (KETs) in public research (research specialisation) in Czech regions<sup>172</sup>**

	Self-governing regions <sup>173</sup>													
	PRG	CB	SB	PL	KV	UL	LB	HK	PA	VYS	SM	OL	ZL	MS
Advanced materials	XX	X		X		(X)	X		X	(X)	XX	X	X	X
Nanotechnology	XX						(X)		X		XX	X	X	X
Micro- and nanoelectronics	XX			X					X		XX	X	X	X
Advanced manufacturing technologies	XX	(X)	X	X			X				XX	X	X	X
Photonics	XX	(X)	X				(X)		X		XX	X		X

<sup>172</sup> In the case of separate facilities of a single research organisation, it was not possible to differentiate bibliometric outcomes that are attributable to a separate facility in regions other than the one in which the parent institution is based.

<sup>173</sup> The table shows self-governing regions in which there are research organisations that rank among the top 15 research organisations in the Czech Republic within the given KET area in terms of bibliometric performance (according to Kučera and Vondrák, 2014) (indicated as “X” and “XX” if there are multiple institutions in the region), or in which significant research capacities with relevance to the given knowledge domain are being built with OP RDI support (indicated as “X”). In the case of two non-technological knowledge domains the table is based on the regional priorities as declared in the different regional annexes to the National RIS3 Strategy.

Industrial biotechnologies	XX	X	X	(X)			(X)	(X)			XX	X		
Knowledge for digital economy, cultural and creative industries	X										X			
Social-science knowledge for non-technical innovations	X													

Overall, it can be concluded that in the Czech Republic there are research capacities in all five generic knowledge domains (materials research, nanotechnology, micro- and nanoelectronics, photonics, advanced manufacturing technologies, industrial biotechnologies) that, with few notable exceptions, do not achieve exceptional quality but are sufficient for absorbing knowledge and keeping up with global trends. In several specific niches there are high-quality research teams in the Czech Republic whose results are at an international level with respect to the production of scientific results. In the case of some of them it can be assumed – depending on the area of their general focus – that they may be an appropriate partner and a source of innovation impulses for key economic sectors as defined in the chapter on economic specialisation. These mainly include technical areas that have their counterparts in traditional economic sectors. In the future, it will be essential to provide further investment support to excellent research facilities, i.e. both those that received OP RDI support in the 2007–2013 programming period, and other facilities in Prague whose quality is above average (see the analytical part for a description of the specific problems in education and research in the capital city of Prague). At the same, it will be necessary to increasingly target the orientation of support according to problems, i.e. at themes that have been defined in greater cooperation with the users of results from both the private and public sectors.

In addition to traditionally strong economic sectors, public administration and other organisations administering public goods represent an important group of users of research results, especially where there is a monopolistic or oligopolistic market situation (“public infrastructures”). These sectors include, above all, the health care sector and power engineering and energy management (electricity production and distribution), water and wastewater management, environmental monitoring and measures to mitigate negative impacts on humans and the environment (including the effects of climate change) and safety (including the administration of critical infrastructures and crisis management). At the national level, priority themes<sup>174</sup> have been defined whose research will receive preferential public resources from the public sector in the future. **Basically, these are the social challenges** to which the Czech society will have to respond and for which it is necessary to maintain and further develop adequate knowledge background. Moreover, social challenges often require innovative solutions that are based on a combination of knowledge and expertise from various knowledge domains and, at the same time, addressing these challenges may in many cases not only bring solutions to social problems but it may also open new market opportunities for private entities.

The table below presents an overview of social challenges that will need to be addressed in defining vertically oriented interventions in research during the implementation of the Smart Specialisation Strategy.

<sup>174</sup> National Priorities of Oriented Research, Experimental Development and Innovation (2012).

**Table 7: Social challenges of the Czech Republic<sup>175</sup>**

<b>Social challenges</b>	Competitive knowledge-based economy	Using new knowledge in the area of General Purpose Technologies Strengthening the sustainability of production and other economic activities Strengthening safety and reliability Mapping and analysing competitive advantages
	Sustainability of the energy sector and material resources	Sustainable energy sector Reducing the energy-intensity of the economy Material base
	Environment for quality life	Natural resources Global changes Sustainable landscape development Environmental technologies and eco-innovations Environmentally friendly society
	Social and cultural challenges	Demographic and social changes Government and administration Culture, values, identity and tradition Development and application of human potential People, science and new technologies
	Healthy population	Emergence and development of diseases New diagnostic and therapeutic methods Epidemiology and prevention of the most serious diseases
	Safe society	Safety of the citizens Security of critical infrastructures and resources Crisis management and security policy Defence, defensive capacity and deployment of armed forces

#### 4.2.3. Identification of knowledge domains and application themes of the smart specialisation

The identification of the **knowledge domains** and **application themes** of smart specialisation in the Czech Republic was carried out based on three kinds of inputs: an analysis of economic specialisation, an analysis of research specialisation, and the National Priorities of Oriented Research, Experimental Development and Innovation up to 2030 that had already been defined and approved by the Czech government and that include social changes that need to be addressed by Czech oriented research in the long-term.

The analysis of economic specialisation is a means of identifying the actors who may play an important role in identifying future technological needs and new knowledge that is required in order to define **application themes** that may lead to marketable innovations. Based on the main social challenges as defined in the National Priorities of Oriented Research, Experimental Development and Innovation, a general outline of the aspects of relevant social challenges has been added to the promising economic application themes<sup>176</sup> identified. This projection is done in the form of modifiers characterising the most significant effects of social challenges within the given application theme, for which it can be assumed with a high degree of certainty that they will be determinative of future trends in the application areas.

<sup>175</sup> Defined based on the National Priorities of Oriented Research Experimental Development and Innovation (2012).

<sup>176</sup> The areas of economic specialisation have been identified using data on exports (according to SITC, 4 digits), business R&D expenditure and their trends in time.

In addition to the analysis of economic specialisation, the proposed smart specialisation is also based on analyses of the Czech Republic's research specialisation<sup>177</sup>. It is used (i) as a means of identifying **the knowledge domains** in which the research organisations in the Czech Republic excel and can thus be expected to become a source of quality inspiration and expertise for addressing applied problems; (ii) as a means of identifying research directions that have a historically strong position in Czech research and require preferential long-term cultivation of quality. The analyses done so far rely on statistical data that indicate above-average results in the knowledge domains of photonics, advanced materials and, to a lesser extent, nanotechnology. The subsequent entrepreneurial discovery process, which will be aimed at identifying more-specific knowledge domains that are required for addressing the application themes defined, will show whether the above-average results of research in these domains can become a source of innovations within the application themes.

The results of the analyses can be summarized in the following *knowledge matrix*. It provides a schematic overview of key application themes by area of the Czech Republic's economic specialisation (i.e. the areas in which knowledge can be marketed, where Czech entities show an above-average growth potential), including the perspective of social challenges and knowledge domains that may become a source of the supply of new knowledge for addressing application problems and/or show above-average research results in international comparison. In addition to the themes that have been identified as specialisation areas at the national level, there are also application areas that have been identified from the regional level as significant for smart specialisation, even though their significance is lower from the national perspective. These areas, too, will require attention.

The proposed areas of smart specialisation are based on the current situation (September 2014) of the institutional preparedness of the RIS3 implementation structures. The matrix therefore defines the themes relatively broadly, its fields are empty at this preparation phase, and it needs to be viewed as the framework for identifying vertical interventions, measures and projects at the national level (or at the regional level with subsequent implementation from the national level<sup>178</sup>). A more detailed identification of the contents of the actual vertical interventions will be addressed by field-oriented innovation platforms for priority knowledge application areas at the national level, as well as on-going inputs from regional innovation platforms. Individual innovation platforms are gradually being established since October 2014, and one of their key activities will be to gradually define the contents of the fields of the knowledge matrix. The actual process of refining meaning of specialisation, i.e. "filling in the fields" of the matrix, is subject to the entrepreneurial discovery process, i.e. the process of discovering new opportunities that will take place in an interaction between partners in the different innovation platforms in which the representatives of both the business sector and research organisations and the public sector are involved. In this way, it will be possible to refine and prioritise the application themes of smart specialisation that are defined as the intersection of social challenges, basic knowledge domains, and application opportunities. During the

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<sup>177</sup> In the case of the research specialisation, the analysis is mainly based on bibliometric data (classified at the KET level, and also at the more detailed level of sub-area classification according to WOS Thomson Reuters). For the purposes of the Smart Specialisation Strategy, more detailed analyses of the research specialisation were performed by the TC AS in September 2014 as part of a separate study entitled the Working draft of the main conclusions of the analytical foundation for establishing the research specialisation of the Czech Republic.

<sup>178</sup> The implementation of vertical interventions from the regional level, i.e. the level of self-governing regions, is not considered within the RIS3. However, mechanisms are envisaged to transfer the needs defined from the regional level into proposals for interventions at the national level (see the chapter on implementation).

2014–2020 programming period, preferential support will be gradually aimed at these vertical themes in the form of specific activities or projects (e.g. thematic calls for projects of applied R&D addressing specified themes, new university curricula to ensure sufficient numbers of high-quality graduates that are able to develop a given priority application direction of research, etc.). The concept of smart specialisation and the entrepreneurial discovery process will thus be further developed throughout the implementation of the National RIS3 Strategy.

In cooperation with key partners, model operations (indicated in *italics* in the text) have also been identified in the proposal part of the Smart Specialisation Strategy for which it is proposed that the vertical dimension of interventions should be considered in the implementation phase. The specific form and degree of the “verticalisation”<sup>179</sup> of model operations will be discussed in innovation platforms and the RIS3 Management Committee at the national level. The model operations will include both model operations that are implemented as purely vertical (i.e. only projects that fulfil a vertical priority as defined in the corresponding national or regional innovation platform will be supported), and model operations with a specified degree of verticality where the share of resources or projects, whose support will be conditional upon clear links to fulfilling the vertical priorities of the Czech Republic or any region, will be defined. In addition to the “verticalisation” of some proposed interventions, it will be necessary to initiate steps at the national level in order to take account of the areas of the Czech Republic’s smart specialisation within long-term financial planning, so that a part of the state budget resources for research, development and innovation is gradually oriented towards the priority areas of research and innovation. Without this step, there is a risk that vertically oriented RIS3 interventions, which will be mainly financed from ESIF resources, will not be sufficiently linked to the main flow of national resources.

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<sup>179</sup> “Verticalisation” means gradual prioritisation, i.e. the narrowing of interventions to themes that are defined within each smart specialisation priority – as opposed to horizontal interventions, which will support the given activity without thematic restrictions.

**Table 8: The matrix of innovation and research needs of smart specialisation – knowledge domains vs. application sectors**

		Key application sectors and application themes – national						Key sectors of knowledge application – regional <sup>180</sup>					
		Manufacture of transportation equipment, sustainability and safety of transport	Advanced and cost-effective mechanical engineering and automation	Cost-effective solutions in electronics and electrical engineering	IT services, software and IT security	Sustainable and safe production and distribution of electricity	Drugs and medical products and methods for healthy ageing	Natural resources, sustainable agriculture and food safety and sufficiency	Chemistry and chemical industry	Glass, ceramics	Rubber and plastic industry	Media	Textile
<b>Generic knowledge domains (KETs + non-technological domains)</b>	Advanced materials												
	Nanotechnology												
	Micro- and nanoelectronics												
	Advanced manufacturing technologies												
	Photonics												
	Industrial biotechnologies												
	Knowledge for digital economy <sup>181</sup> , cultural and creative industries <sup>182</sup>												
	Social-science knowledge for non-technical innovations												

<sup>180</sup> These are application areas that differ from the priorities defined from the national level and, at the same time, have been identified by at least one region as an area of its smart specialisation (see section 4.2.1).

<sup>181</sup> This includes knowledge in the area of IT for new media, publishing and media, digital content processing, and audio-visual production.

<sup>182</sup> This includes knowledge in applied and industrial design, visual and performing arts, and knowledge and skills in traditional and modern living culture that can be used in the cultural industries.

## 5. Proposal section

The proposal section is structured according to the problem areas that are based on the analytical section of the RIS3. It starts with the draft proposal of the long-term strategic vision whose contents are based on the visions of existing documents and that has been discussed in the partner structures. Then there are five thematic fields – business and innovation, research and development, human resources, information and communication technologies and digital agenda, social innovations – in which the Czech Republic must achieve changes in order to be able to seriously strive to achieve the vision in the long-term horizon and to approach the vision in a real and measurable manner by 2022.

Each thematic field consists of one or more key areas of change for which strategic and specific objectives are proposed. For each specific objective, model projects, programmes or activities are proposed – model operations – through which the specific objective is to be achieved. The list of model operations is not exhaustive and it is expected to be further expanded and modified depending e.g. on how the RIS3 will be implemented through specific projects from operational programmes. With respect to the various model operations, the operations for which it is proposed that the vertical dimension of interventions should be taken into account in the implementation phase are indicated in *italics*. This means that for these interventions:

- a) the share (or volume) of the financial allocation of the model operation (e.g. a new subsidy programme or a call within an operational programme) will be specified that will be oriented towards support for the activities defined as an area of vertical specialisation; or
- b) support within the model operation will be restricted exclusively to supporting operations that contribute to fulfilling the vertical priorities of the Smart Specialisation Strategy where projects are obligated to clearly document compliance with the vertical priorities at the national or regional level.

The specific form and degree of the “verticalisation” of the model operations will be discussed in innovation platforms and subsequently approved by the RIS3 Management Committee at the national level.

### 5.1. Long-term strategic vision

The long-term strategic vision formulates the basic direction of the Czech Republic’s development with an emphasis on the knowledge economy and with an emphasis on the transformation of the economy in order to improve competitiveness based on innovations and reduce the Czech Republic’s dependence on competitiveness that is based on low costs. The long-term strategic vision focuses on a longer period than up to 2020 (or 2022). Even though the National RIS3 is being prepared for the above period, the long-term strategic vision has a longer validity.

Key aspects of the changes that are described in a separate chapter, are an integral part of the design and represent interventions that are below the long-term strategic vision to help achieve. In this sense, the key areas of change and the interventions described within these areas are the “operationalisation” of the vision, i.e. they describe the methods and ways to fulfil the vision.



The long-term strategic vision is not going to fulfil itself. The vision may only be fulfilled through joint effort of the key actors in the innovation system at both the national and regional levels. The vision is a flag that brings together actors with a different level of influence on the future of the innovation system, who are aware that success will not come without their personal and joint effort.

The long-term strategic vision for the development of the Czech Republic towards the knowledge economy is:

## **CZECH REPUBLIC – ENTERPRISING, CREATIVE AND ATTRACTIVE TO TALENT AND MONEY**

The contents and the component parts of the vision are explained and described below, including the way in which the progress of its implementation will be monitored and measured.

**Czech Republic – Enterprising** – the basis of prosperity in the 21st century is an enterprising person that has an active approach to life, desires to put their ideas to the test in a competitive environment and is willing to take the risks involved. Enterprising people think on an international scale, the companies they manage want to be successful not only at home but also in the European or global market.

### **How do we verify the fulfilment of this part of the vision?**

- The Czech Republic will be a country with an increasing intensity of business activities per 1 000 inhabitants
- The Czech Republic will be a country with an increasing share of young people up to 35 years of age doing business for a living
- The Czech Republic will be a country with an increasing share of newly established and surviving companies

**Czech Republic – Creative** – in order to do things differently, we also need to see them differently; the best way to great ideas is to have a lot of ideas; being original requires creative thinking in a cultural, economic and technological context, and the basic element of creativity is not being afraid of making mistakes – these are only a few of attitudes that are characteristic of creativity. The Czech society will learn to better stimulate creativity and appreciate and reward successful innovations.

### **How do we verify the fulfilment of this part of the vision?**

- The number of companies doing business in cultural, creative and similar sectors (incl. industrial design) will increase in the Czech Republic
- The Czech Republic will have the highest share of R&D activities located there by multinational companies among all CEE countries
- The Czech Republic will be a country with an increasing trend in the technological balance of payments – foreign trade in advanced technological services

**Czech Republic – Attractive to talent** – a talented person is creative and enterprising and likes the environment where they can use their ideas and activity. An enterprising and creative Czech Republic will provide such environment – it will prepare the conditions for their development in a “creative ecosystem”.

### **How do we verify the fulfilment of this part of the vision?**

- The Czech Republic will create and develop functional systems to timely identify the natural talents of people and use them for career consultancy, thereby improving young people’s choice of occupation and the efficiency of expenditure on education
- The Czech Republic will create and develop functional programs to develop extraordinary talents and creativity of people with aptitude and enthusiasm for enterprise, technical areas, science and research, thereby increasing their number and improving their competencies upon their entry to the innovation system;
- The Czech Republic will create and offer a friendly working environment, i.e. a creative ecosystem for enterprise (at all levels)
- The Czech Republic will have a positive “talent balance” – BRAIN GAIN

**Czech Republic – Attractive to money** – an environment that encourages creativity (coming up with new things), values innovation (doing new things, doing things in a new way) and supports the entrepreneurial spirit and enterprise (taking risks that are part of market competition) is also attractive to both domestic and foreign investors.

**How do we verify the fulfilment of this part of the vision?**

- The Czech Republic will be among top 10 EU countries with the highest inflow of foreign direct investments relative to GDP
- The Czech Republic will be among top 10 EU countries with the highest volume of private expenditure on science and research relative to GDP
- The Czech Republic will be among EU countries with an increasing volume of allocated private venture capital in companies set up in its territory

**Verification and measurement of the vision**

In a structured form, the following table shows the baseline values of the indicators that will be used for measuring whether the Czech Republic is successful in fulfilling the vision and in progressing in the direction of the vision. To evaluate whether the vision is or is not being successfully fulfilled, it is also important to examine trends and not only the values that are measured at a single point in the given year. To allow for further comparison and evaluation of trends, the annex to the RIS3 lists time series and more detailed (structural) data for the indicators used below.

**Indicators for measuring the vision and its sub-aspects – baseline values**

<b>Characteristic of the verification of the vision</b>	
<i>Indicator used for verification*</i>	<i>Year</i>
	<i>value</i>
<b>The Czech Republic will be a country with an increasing intensity of business activities per 1 000 inhabitants</b>	
Number of newly established companies per 1 000 inhabitants	2013
	9.45
<b>The Czech Republic will be a country with an increasing share of young people up to 35 years of age doing business for a living</b>	
Share of people up to 35 years of age doing business	2013
	10.26%
<b>The Czech Republic will be a country with an increasing share of newly established and surviving companies</b>	

New companies as % of all active economic entities	2013
	6.75%
<b>The number of companies doing business in cultural, creative and similar sectors (incl. industrial design) will increase in the Czech Republic</b>	
Number of legal and natural persons	2010
	63,260
<b>The Czech Republic will be a country with an increasing positive trend in the technological balance of payments – foreign trade in advanced technological services</b>	
	2012
Technological balance of payments, services (CZK million)	-2,882
Technological balance of payments, % of total income from export of services	-0.70%
<b>The Czech Republic will create and offer a friendly working environment, i.e. a creative ecosystem for enterprise (at all levels)</b>	
Total index – ease of doing business**	CR's rank 2014
	75
<b>The Czech Republic will have a positive “talent balance” – BRAIN GAIN</b>	
	CR's rank 2014–15
Capacity of the country to keep talent***	80
Capacity of the country to attract talent***	93
<b>The Czech Republic will be among top 10 EU countries with the highest inflow of foreign direct investments relative to GDP</b>	
FDI-GDP ratio****	Average 2011–2013
	11th place
<b>The Czech Republic will be among top 10 EU countries with the highest volume of private expenditure on science and research relative to GDP</b>	
BERD-GDP ratio****	Average 2010–2012
	14th place

\* Data sources are listed in the trend tables in the annex to the RIS3

\*\* Rank according to the Doing Business rankings published by the World Bank

\*\*\* Rank according to the Global Competitiveness Index

\*\*\*\* Averages for multiple years are indicated in order to reduce the impact of random fluctuations (e.g. major one-off investments)

## 5.2. Structure of the proposal section – key areas of change.

The proposal section consists of six key areas in which the Czech Republic must achieve significant changes in order to strengthen the knowledge-intensity of the economy and to facilitate the development of the selected specialisation domains and their gradual refinement. The key changes are as follows:

- Higher innovation performance of companies
- Improved quality of public research
- Improved economic benefits of public research
- Better supply of HR, in terms of both quality and quantity, for innovative enterprise, research and development
- Development of eGovernment and eBusiness to improve competitiveness

- Improvement and better utilisation of social capital and creativity in addressing complex social challenges

These key areas of change are further structured into **strategic and specific objectives** whose achievement will contribute to achieving changes at the level of the key areas. For each specific objective, **model projects or activities** are proposed, but these are not a final or exhaustive list of activities or model projects. The model projects/activities include interventions that are currently being prepared or considered in the Czech Republic. At the level of the model projects/activities, many of them need to be verified in partnerships (e.g. in innovation platforms).

Given that the long-term process of co-operation and partnership with entrepreneurs and researchers as well as other actors from the quadruple helix is an integral and necessary part of the preparation and implementation of RIS (entrepreneurial discovery process), a given the variability of the environment and the components of the Czech innovation system, which cannot be avoided during the programming period, it is not possible – with sufficient certainty – to describe and plan each activity and model projects for the entire period of RIS3 implementation. On the contrary, proposing the final structure of the model projects and activities would go against the purpose of the process of searching for opportunities to develop the specialisation with the participation of entrepreneurs and researchers, which is inherent to the RIS3.

The key areas of changes are not self-contained and isolated, but their interventions rely on and complement each other. Of course, the level of linkage between individual model projects/activities is different.

### 5.3. Combination of interventions in the National RIS3.

The Czech Republic is one of the countries that tend to be included in the category of moderate innovators according to IUS or, in some cases, even among innovation-based economies (for the purposes of the GCI rankings). However, both the analytical section of the RIS3 and analyses that have been performed for other purposes show that, in terms of knowledge-intensity and competitiveness based on innovation, the Czech Republic does not rank among the most developed countries, even though it is one of the top innovators among the less developed countries in Europe. It is therefore important for the Czech Republic to implement the interventions resulting not only in strengthening and developing specialisations, as is the case in the most developed countries and regions of Europe, but also to concentrate on interventions that develop the innovative system as a whole, improve its conditions and operation and complete it. Therefore, the RIS3 focuses on and contains two types of interventions:

- Interventions that are not oriented specifically towards selected sectors and that focus on completing the innovation system in order to improve conditions for effective investment in smart specialisation (horizontal interventions).
- Interventions that are aimed at selected domains and that lead to strengthening smart specialisation through searching for and utilising opportunities for innovation that result in the growth of companies and their increased success in global markets.

In the initial years, the first type of interventions will prevail within the National RIS3 as they are a pre-condition for improving the effectiveness of interventions resulting in the development of

specialisation. During the implementation of the National RIS3 and with the involvement of entrepreneurs and researchers (entrepreneurial discovery process), new, emerging and promising opportunities for improving the specialisation will gradually be proposed within the domains of the specialisation, and this component of the RIS3 will be strengthened. During the implementation, the proposed domains of specialisation (at the national and regional levels) will be gradually refined in cooperation with entrepreneurs and researchers and will be supported and developed through investments. At the end of the programming period, interventions that develop the domains of specialisation will be more important than those aimed at completing and developing the innovation system as a whole.

Interventions to strengthen the domains of specialisation (vertical interventions) are proposed as part of the key areas of change described below. Vertical interventions are indicated in italics and are designed so that, in combination with horizontal interventions, they jointly contribute to achieving the objective for which they have been designed. Therefore, horizontal and vertical interventions are not designed separately, but rather so that their interaction contributes to achieving common objectives, whether strategic or specific. In this respect, the National RIS3 is an integral strategy aimed at transforming the Czech economy in the context of the growing importance of the knowledge economy. Further specifications of interventions within the domains of specialisation will be proposed at meetings of national innovation platforms, along with the concept of the selection conditions and the targeting of operations. The actual rules of the call will be defined by the relevant managing authority.

## 6. Key areas of change

### 6.1. Entrepreneurship and innovation

#### **Key area of change A: Higher innovation performance of companies**

The model of the Czech Republic's economic growth to date, which is based on the inflow of foreign direct investments and motivated by a cost- and location-related advantage, is gradually being depleted. Labour cost and the cost of other production inputs (especially energies) are rising in the Czech Republic. At the same time, other countries are emerging that offer attractive cost-effective opportunities for the territorial optimisation of the operations of multinational companies. In addition, there are growing signals pointing to the upcoming re-industrialisation of developed economies due to new technological and other trends<sup>183</sup>. The highly exhausted potential of this model of economic growth – together with an unstable business environment and negative economic mood – can be considered one of the main causes underlying the interruption of convergence of the Czech Republic's economic performance towards the level of developed economies after 2008.

The fundamental prerequisite for restoring long-term growth and, in turn, further convergence of the level of the Czech Republic's prosperity with developed countries (Germany, Austria etc.) is a substantial increase in the development dynamism and innovation performance in the endogenous<sup>184</sup> corporate sector. This portion of the economy, which includes the largest number of entities but lags behind in terms of performance, should become the second main pillar of the Czech Republic's economic growth. In case of the sector of foreign companies, it is necessary to concentrate on their maximum interconnection with the local economy, which is the basic prerequisite for further related investments. To this end, it is necessary to consistently cultivate the entrepreneurial environment both in terms of predictable and lean regulation, and in terms of the conditions for developing knowledge-intensive activities. Another important opportunity is the development of R&D and other activities of foreign companies with links to successful local production capacities.

Developing the endogenous corporate sector and establishing the conditions for related investments of foreign companies with significant operations in the Czech Republic are the main directions within support for the Czech Republic's economic growth. For that purpose, the Smart Specialisation Strategy of the Czech Republic in the field of enterprise and innovation focuses on the following three strategic objectives:

1. Increasing the innovation demand in the business and public sectors. Lacking and, above all, low ambitions of the innovation demand in the application sector have many causes (see the analytical section of this strategy) that jointly contribute to the fragmentation of the national

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<sup>183</sup> For example, additive manufacturing, the energy revolution based on shale oil and gas, the need for more intense linkage between production and technical development etc.

<sup>184</sup> An endogenous company is a business entity established, owned and controlled by Czech citizens.

innovation system and the low innovation performance. The increase in the innovation demand of the application sector will be achieved through (i) strengthening the research and development capacities of businesses, with an emphasis on the implementation of the industrial research and development, (ii) improving the non-technical competencies of companies – strategic management, innovation management, marketing etc., and (iii) strengthening multi-faceted co-operation in line with the open-innovation trend that is being increasingly promoted within corporate innovation processes. Attention will also be given to initiating innovation demand in the public sector. Under this strategic objective, emphasis will be placed on interlinking the technical and non-technical competencies of companies. At the same time, attention will be focused on stimulating growth and innovation aspirations of entrepreneurs and executive managers of companies, especially SMEs. Special emphasis will be placed on innovations that are new to the market and not only to the company.

2. Increasing the level of enterprise in the society, with an emphasis on establishing knowledge-intensive companies in fast growing areas (not only IT). Developing the venture capital market and providing high-quality consulting and conditions for start-up technological companies are the main roads to achieving this objective. However, the start-up of first business will be supported in the largest part of the population possible. Successful, fast growing companies are most often established by mature people with previous entrepreneurial experience. The overall increase in the level of enterprise and entrepreneurship is in full synergy with the first strategic objective, because new technological companies are an important source of growth of innovation demand.
3. Increased internationalisation of SMEs. The domestic market is small and the vast majority of growth opportunities lie abroad, especially in the fast growing markets of emerging countries, to which the mass of global demand is gradually shifting. In the longer-term, higher internationalisation of SMEs is a necessary prerequisite for maximum economic benefit from the fulfilment of the above two strategic objectives.

Key area of changes A: Higher innovation performance of companies	
<b>Strategic objectives in key area of change A:</b> <b>A.1: Increasing the innovation demand in companies (and in the public sector)</b> <b>A.2: Increasing the level of enterprise in the society, with emphasis on the establishment of new, fast growing companies</b> <b>A.3: Increasing the internationalisation of SMEs</b>	<b>Indicators of strategic objectives/key area of change:</b> A.1: Number of companies with non-investment R&D expenditures of CZK 10+ million, number of new patent applications (international applications only – PCT, EPO, USPTO) A.2: (i) Number of incubated companies (in the national network of technological incubators) that are still active three years after establishment, (ii) number of fast growing companies (gazelles <sup>185</sup> ) out of the total number of companies incubated in the national network of technological incubators A.3: (i) Number of supported companies (SMEs) that increased or started their export within 3 years; (ii) number of SMEs that increased the number of target countries within 3 years of granting support (of which countries outside EU) or started their export

<sup>185</sup> A “gazelle” is a company whose turnover increases by at least 20% for 4 years.

**Strategic objective A.1: Increasing the innovation demand in companies (and in the public sector)**

The innovation performance of the corporate sector as a whole is strongly dependent on companies' internal demand for innovations. In this area, the Czech Republic is facing several problems (see the description of the area of change above) that jointly limit the innovation demand and, in turn, the shift of the entire economy towards competitiveness that is to a larger degree based on creating and using new knowledge. The focus of the objective, however, reflects the structure of the local economy. Increasing the demand for innovations means both (i) increasing companies' effort to achieve higher-order innovations that are usually based on the intensive research and development, and (ii) shifting the strategic focus of companies away from the competitive advantage based on low costs towards an advantage that is based on quality and innovations, even if these are lower-order innovations requiring no extensive in-house R&D. At the level of companies, accomplishing this objective will translate into an increase in the volume of inputs (expenditure on innovations, including R&D expenditure) into the innovation process. At the level of the entire economy, the growth of innovation demand will translate into an increase in companies' total own expenditure on R&D<sup>186</sup>. Accomplishing this objective will translate into an increase in the number of companies that carry out their own R&D, i.e. that systematically spend some minimum amount of resources on this area. An increase in innovation demand will be achieved through three specific objectives:

1. Improving research and development capacities of companies: The purpose of this objective is to improve the ability of companies to implement technical innovations. Special emphasis will be placed on innovations that are new to the market in which the company operates, and not only to the company. Technical innovations usually require considerable investments in own R&D. R&D capacities mean both the resources<sup>187</sup> for financing research and development, and the infrastructure that is required for that.
2. Improving strategic management in SMEs: The commercial success of innovations, regardless of how good they are in technical terms, depends primarily on the correct identification of customers' needs and the ability to quickly launch the innovation on the market. A corporate strategy and the setting of key business processes are thus a necessary prerequisite for the efficiency of activities focusing on the ability to implement technological innovations (objective A.1.1). Therefore, the purpose of this specific objective is to help develop the non-technical competences<sup>188</sup> of SMEs, whose quality in the Czech Republic is not at a level comparable with most developed economies (see the description of the area of change above).
3. Strengthening the co-operation of companies in R&D and innovation: The global trend of the opening of companies' innovation processes (including global leaders) leads to the increasing importance of external cooperation in R&D and innovation. In the Czech Republic, this cooperation is not developed and the companies that need it often face significant obstacles. For SMEs, external cooperation is often the only way to obtain principal inputs for the internal innovation process. The purpose of this objective is to reduce (or eliminate, if possible) the barriers to establishing and developing bilateral as well as multilateral co-operation both among companies and with research organisations. In addition to increasing connectivity within the Czech Republic's innovation system, the purpose of the objective is also to increase its links to sources of new knowledge and business inspiration abroad.

<i>Specific objectives</i>	<i>Indicators of the specific objective</i>	<i>Model activities/projects/operations</i>
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<sup>186</sup> The most suitable measure of the intensity of inputs into the innovation process is own non-investment business R&D expenditure (including own expenditure on external cooperation in this area). This applies despite the fact, that the importance of R&D for innovations differs greatly depending on the type and the order of the innovation, as well as the relevant economic sector.

<sup>187</sup> Higher-order technical innovations usually require extensive and long-term experiments and, in turn, large investments in R&D that may even bankrupt the company if they fail. The high risk that is associated with this type of innovation is considered an obstacle to purely private investment in this type of innovation.

<sup>188</sup> Strategic management, marketing, innovation management and other key processes. Here, the competences relate to the entire company and not to individuals within the company.



<p><b>A.1.1: Strengthening the research and development capacities of companies</b> Capacities mean both people in business R&amp;D and related processes (manufacture of prototypes, product design, construction etc.) and infrastructure for implementing business R&amp;D.</p>	<ul style="list-style-type: none"> <li>• Number of new patent applications by supported companies (international applications only – PCT, EPO, USPTO) – binding</li> <li>• Number of supported companies whose own non-investment R&amp;D expenditure has increased by X% within 3 years of project completion (X will be defined depending on company size) – monitoring</li> </ul>	<p><i>Direct support for implementing business R&amp;D, including support for implementing joint projects of RO and companies, including the sharing of capacities of companies and RO</i></p> <p>Direct support for protecting intellectual property of SMEs</p> <p>Support for the availability of talent for business development and innovations in SMEs (e.g. the Innovation Assistant programme)</p> <p>Support for innovations through facilitating the absorption of new technologies (e.g. SW for digital design) – room for the use of financial engineering tools</p> <p><i>Public pre-commercial procurement</i></p> <p>Support for business R&amp;D infrastructure (in addition to subsidies, room for the use of financial engineering tools)</p>
<p><b>A.1.2: Improving strategic management in SMEs</b> For many SMEs, even the mere involvement of managers in things other than daily operations and their increased attention to strategic issues concerning the development of the companies they manage will be a significant improvement. Given the variability of the problems and management approaches of SMEs, the improvement of strategic management will take many different forms.</p>	<ul style="list-style-type: none"> <li>• Number of supported companies whose sales increased by X% within 3 years of project completion (X will be defined depending on company size) – monitoring</li> </ul>	<p>The network of internationally certified providers of consulting services<sup>189</sup> based on a two-tier procedure focusing on (i) identifying the new growth opportunities/development needs for SMEs, (ii) finding a way (solution) to utilise/fulfil them, and (iii) coaching/mentoring on the implementation of identified solutions in the company</p> <p>Interim management – a temporary manager responsible for re-designing the processes that need to be improved by the company</p> <p>Assistance service to improve awareness among companies about the importance and method of IPR protection, and the actual provision of international IPR protection</p> <p>Provision of high-quality management education in strategic management and innovation management (aimed mainly at employees with the potential to become future managers)</p>

<sup>189</sup> The providers are internationally certified (EBN) entities such as development agencies. The phase of identifying new growth opportunities or growth barriers of the company is implemented by the providers themselves. Subsequently, they assist the supported companies in implementing the next phase, during which a consultant with proven international expertise provides custom-tailored consulting services. The provider of support helps the company to find this expert. An inspirational example may be the Manufacturing Extension Partnership programme that is financed by the US Federal Government (many OECD countries and even regions within some countries have similar programmes).

<b>A.1.3: Strengthening technological co-operation of companies</b>	<ul style="list-style-type: none"> <li>• Number of supported companies that have their own expenditure on R&amp;D cooperation one year after project completion <ul style="list-style-type: none"> <li>○ of which cooperation with research organisations</li> </ul> </li> <li>• Number of supported companies that purchased a licence to use external intellectual property after project completion – monitoring</li> <li>• Volume of the drawing of H2020 resources by companies – monitoring</li> </ul>	<i>Shared capacities for industrial research, development, innovation and professional education – Science and Technology Parks, Centres of Competence<sup>190</sup>, clusters, innovation centres etc.</i>
		Support for process and product upgrading of SMEs through production and development co-operation with foreign companies
		<i>Technological platforms</i>
		Activities focusing on initiating the establishment of new co-operation networks and open-innovation platforms (e.g. innovation vouchers, targeted networking etc.)
<b>The strategies and national documents to which the strategic and specific objectives are related:</b>		
<ul style="list-style-type: none"> <li>- A.1.1 + A.1.3 is in the National Innovation Strategy and the International Competitiveness Strategy of the Czech Republic for 2012–2020; A.1.2 is not there but a change in this sense is implicitly expected</li> </ul>		
<b>Strategic objective A.2: Increasing the level of enterprise in the society, with emphasis on the establishment of new, fast growing companies</b>		
<p>Enterprise or entrepreneurship represents a key driving force of innovation. In an international comparisons, the Czech Republic belongs to countries with an average entrepreneurship level (see above). However, with the exception of IT, few new companies are being established in technological areas that are characterised by intensive creation and use of new knowledge. Another fundamental prerequisite for innovations is entrepreneurship within established companies. The entrepreneurial ambitions of the owners and managers of many mature companies, especially within the endogenous segment, are very limited and are often aimed at maintaining the positions instead of looking for new sources of growth. A common consequence is the limited innovation potential and, by extension, growth potential of the local economy, i.e. its endogenous segment – unless its dynamism increases, the economic performance of the country will remain strongly dependent on foreign companies<sup>191</sup>. The purpose of this strategic objective is the multi-faceted development of entrepreneurship and the entrepreneurial culture in the Czech society. The result will be an increased level of new business activity and a higher number of new companies in technological areas. In the longer-term, the activities of this objective will translate into increased entrepreneurial ambitions of the owners and managers of small companies. This change is an important prerequisite for the future existence of a higher number of large Czech companies that will drive the growth of the local economy. The increase in the level of enterprise in the society, with emphasis on the establishment of new, fast growing companies, will be achieved through three objectives:</p>		
<ol style="list-style-type: none"> <li>1. Increasing the number of new companies striving for innovations, especially higher-order innovations: The purpose of this objective is to provide adequate conditions for the establishment and development of new technological companies in areas with high growth potential. Starting a business in these areas is often more demanding and risky in terms of investment. While the founders of successful businesses of this type often have previous entrepreneurial experience, they need</li> </ol>		

<sup>190</sup> i.e. long-term joint programmes of applied research that are associated with PhD education, including the setting up of new legal persons.

<sup>191</sup> Due to this dependence, economic development in the Czech Republic largely relies on business decisions taken outside the Czech Republic. Given the change in the relative prices and conditions between the Czech Republic (or Central Europe) and other regions, this creates a risk of long-term economic stagnation or decline.

various specific services and conditions in order to implement their business plans. Almost all developed countries in the world are trying, in different ways, to create such services and conditions.

2. Improving the availability of external financing for start-up entrepreneurs and companies with a short history: The purpose of this objective is to provide resources that are necessary for start-up entrepreneurs and dynamic companies with a short history, for whom obtaining external financing in the loan market is problematic. Another purpose is to connect these entrepreneurs and companies with investors who can bring not only capital, but also commercial experience or technological expertise into the company.
3. Increasing interest in enterprise within the society: This objective is aimed at increasing the overall level of entrepreneurship in the society. New companies in technological areas or fast-growing companies (gazelles) are usually established by people with prior entrepreneurial experience. Therefore, supporting the overall level of entrepreneurship increases the likelihood that companies of this type will also be established. In addition, own entrepreneurial experience contributes significantly to spreading the entrepreneurial culture within the society. The Czech Republic faces the poor image of entrepreneurship and entrepreneurs (see above), and increasing the share of entrepreneurs in the society is a way to gradually eliminate this barrier to innovation.

<i>Specific objectives</i>	<i>Indicators of the specific objective</i>	<i>Model activities/projects/operations</i>
<b>A.2.1: Increasing the number of new companies striving for innovations, especially higher-order innovations</b>	<ul style="list-style-type: none"> <li>• Number of incubated companies (in the national network of technological incubators) that are still active three years after establishment</li> <li>• Number of fast growing<sup>192</sup> companies incubated in the programme of technological incubators</li> <li>• Number of internationally certified providers of incubation programmes</li> </ul>	A network of technological incubators consisting of 4 to 8 internationally accredited providers of incubation services.
		Support for Proof-of-concept activities (national and regional schemes, provided they are not identical). <i>Cooperation of operators of business incubators, innovation centres and accelerators with top technological companies in providing special services for start-up entrepreneurs.</i>
<b>A.2.2: Improving the availability of external financing for start-up entrepreneurs and companies with a short history</b>	<ul style="list-style-type: none"> <li>• Volume of seed and venture investments in companies in the programme of technological incubators</li> <li>• Volume of inactivated bank guarantees and unclassified loans for companies with a history of up to 3 years</li> </ul>	A national seed fund or a limited number of the regional seed funds
		Guarantees and preferential loans
<b>A.2.3: Increasing interest in enterprise within the society</b>	<ul style="list-style-type: none"> <li>• Share of university graduates that do/start a business in the total number of graduates (to be calculated 2 years after graduation)</li> <li>• Number of entrepreneurs supported</li> </ul>	Voucher for start-up entrepreneurs to bridge financial difficulties in the transition from employment to enterprise (for graduates and possibly other specific groups)
		Shared infrastructure for prototype manufacture and development (e.g. FabLab, TechShop etc.)

<sup>192</sup> According to the definition of “gazelle” companies, fast-growing companies are those whose turnover increases by at least 20% in 4 consecutive years.

	through a voucher, who run a business and have at least one employee 3 years after receiving support	Marketing / awareness rising focusing on the social role of entrepreneurs Basic network of support for start-up enterprise (entrepreneurship consulting centres)
<b>The strategies and national documents to which the strategic and specific objectives are related:</b>		
- A.2.2 is in the International Competitiveness Strategy of the Czech Republic for 2012 to 2020 and the National Innovation Strategy of the Czech Republic; A.2.1 + A.2.3 are not explicitly mentioned in any strategy, but changes in these directions are implicitly expected		
<b>Strategic objective A.3: Increasing the internationalisation of SMEs</b>		
<p>The economic performance of the Czech Republic is strongly dependent on exports that, in turn, are largely driven by foreign companies. Even though the ability of endogenous companies to succeed in foreign markets is improving consistently, it remains strongly limited to the neighbouring countries and markets in Europe. Especially SMEs have to cope with insufficiently developed competencies and capacities for foreign trade and they also have to face many barriers to the internationalisation of their activities, especially as the geographical and cultural distance of the target markets from the Czech Republic increases. The purpose of this strategic objective is to stimulate the international expansion of local companies through both export and foreign direct investments that are an inevitable response to new growth opportunities in the rapidly changing world economy. Specific attention will be given to target markets with a high growth potential (see the Export strategy of the Czech Republic for 2012 to 2020). Through expansion in foreign markets, it is possible to substantially increase the overall benefit of the highly-developed technical competencies of local companies for the Czech Republic's economic growth. In this sense, this strategic objective has significant synergistic links to the first objective, which focuses on developing the technical competences of companies. Another important synergy lies in the fact that foreign expansion of local companies is strongly dependent on the ambitions of entrepreneurs and executive managers of local companies and it is also linked to the aspirations (demand) in the area of innovations. From the perspective of the various development phases of companies, the purpose of this objective is both to support the (global) expansion of well-established exporters, and to support small companies in their initial entry into foreign markets. Increased internationalisation of SMEs will translate into increased sales abroad, with an overall increase in turnover, and it will be achieved through the following objectives:</p> <ol style="list-style-type: none"> <li>1. Improving the availability of strategic information about the target markets of local SMEs: The knowledge of trends and preferences in foreign markets, and of the regulatory specifics, is a key input for the management of the international expansion of companies. Usually, SMEs have limited capacities to obtain this knowledge internally. They also have to deal with the lack of experience with cultural differences in business customs. The purpose of this specific objective is to eliminate these barriers to the international expansion of SMEs.</li> <li>2. Improving the key competences of the companies in marketing and foreign trade: The purpose of the activities within this specific objective is to help companies and their employees in becoming familiar with efficient methods to manage expansion in foreign markets, including business experience required for specific target markets. The activities of this objective will also focus on educating potential future traders and foreign trade managers.</li> <li>3. Reducing the costs and risks of SMEs associated with their entry into foreign markets: The purpose of this specific objective is to reduce the risks and costs associated with export and investment abroad, especially in markets with substantially different regulatory rules and business customs. For SMEs, these risks often have such relevant weight (relative to turnover or financial reserves) that they prevent the implementation of foreign business or investment opportunities.</li> </ol>		
<b>Specific objectives</b>	<b>Indicators of the specific objective</b>	<b>Model activities/projects/operations</b>
<b>A.3.1: Improving the availability of strategic information about the target markets of local</b>	<ul style="list-style-type: none"> <li>• Number of supported companies that</li> </ul>	Specialised consulting aimed at facilitating the entry into a specific target market of SMEs

<b>SMEs:</b>	<p>increased their exports (while increasing or maintaining their sales) by X% or started to export within 3 years</p> <ul style="list-style-type: none"> <li>• Number of SMEs that increased the number of target countries (of which countries outside the EU) or started to export within 3 years of being granted support</li> </ul>	<p>Provision of strategic information to SMEs about development trends and their implications for specific markets</p> <p>Trade missions / temporary business representations</p>
<b>A.3.2: Improving the capacities and competencies of companies in marketing and foreign trade</b>	<ul style="list-style-type: none"> <li>• Number of supported companies that increased their exports (while increasing or maintaining their sales) by X% or started to export within 3 years <ul style="list-style-type: none"> <li>○ Number of SMEs that increased the number of target countries (of which countries outside the EU) or started to export within 3 years of being granted support</li> </ul> </li> </ul>	<p>Direct support for service centres and customer care services in the target markets of SMEs</p> <p>Specialised management education (export academy)</p> <p>Support for SMEs in obtaining certifications and other documents needed for entry into foreign markets</p>
<b>A.3.3: Reducing the costs and risks of SMEs associated with their entry into foreign markets</b>	<ul style="list-style-type: none"> <li>• Number of supported companies that increased their exports (while increasing or maintaining their sales) by X% or started to export within 3 years</li> <li>• Number of SMEs that increased the number of target countries (of which countries outside the EU) or started to export within 3 years of being granted support</li> </ul>	<p>Export alliance and mutual assistance in covering demand</p> <p>Shared business representations, shared distribution channels</p> <p>Export guarantees (EGAP)</p>
<b>The strategies and national documents to which the strategic and specific objectives are related:</b> <ul style="list-style-type: none"> <li>- Export strategy of the Czech Republic for 2012 to 2020</li> <li>- International Competitiveness Strategy of the Czech Republic for 2012–2020</li> </ul>		
<b>The conditions for and barriers to implementing interventions in this key area of change:</b> <ul style="list-style-type: none"> <li>• In order to increase the entrepreneurship and innovation performance of companies, the stability of the tax and regulatory environment needs to be improved significantly. Frequent changes that occur in the Czech Republic create uncertainty that complicates planning in companies. Uncertainty and poor predictability of changes always reduces entrepreneurship and innovation activity. The seriousness of the problem is documented by recent problems with the VAT rate, where the</li> </ul>		

rate for 2013 was still uncertain in early December 2012.

- The Czech Republic's business environment is characterised by a high administrative burden on both new and well-established companies (75th place in the Doing Business rankings, 2013<sup>193</sup>). The Czech Republic ranks the worst in terms of: setting up businesses and connecting businesses to electricity (both 146th), tax payment (122nd) and investor protection (98th). In recent years, competing countries (see e.g. Poland, Romania, Estonia etc.) have been improving much faster than the Czech Republic where the changes are being postponed or only slowly implemented due to political instability. This negatively affects the perception of the country by foreign investors, which is significant risk for the economy, as its growth is mainly driven by foreign companies.
- The development of the entrepreneurial culture and innovation atmosphere is being prevented by a high level of perceived corruption (see World Competitiveness Report, WEF, 2013). The level of perceived corruption affects the size of the portion of the society that – rather than personal effort in transparent competition – considers building and misusing personal connections and influence groups as the most effective method of economic self-realisation. At the same time, the high level of perceived corruption motivates entrepreneurs to focus on protecting what they have already achieved rather than of further growth, which is greatly exacerbated by the instability of the regulatory framework in the Czech Republic.

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<sup>193</sup> The World Bank compiles the Ease of Doing Business rankings for 189 countries in the world. In October 2014, the twelfth edition of this international comparison was published.

## 6.2. Research and development

### Key area of changes B: Improving the quality<sup>194</sup> of public research

The overall quality of research in the Czech Republic falls behind that of most developed countries in the OECD, despite the fact that this country has research teams that are at an international level. While there are positive trends in improving the quantity and quality of the results of research as measured through bibliometric parameters, the Czech Republic still fails to achieve satisfactory values. However, the implementation of high-quality research and further improvement in its quality by international comparison is a prerequisite for: (i) training highly-qualified human resources for research and innovation that are essential both for pushing the boundaries of knowledge and transferring existing knowledge from abroad into the Czech Republic, and for ensuring sufficient numbers of qualified experts for the needs of the application sector; (ii) the ability to come up with new technological solutions to existing and future problems of the economy and society, including problems identified by application partners in the fields of the Czech Republic's economic specialisation.

Within the context of the Czech Republic, it is essential to simultaneously strive to generally increase the quality of research, which is closely associated with the setting of suitable general conditions, and to increase the quality and problem-orientation of research in those knowledge domains<sup>195</sup> where the Czech Republic has already attained an international level. The target is both a general improvement in the quality and problem-orientation of Czech research and the creation of a limited number of internationally competitive research organisations that will become principle partners for the further development of the key knowledge domains within the Czech Republic's smart specialisation (see the chapter on specialisation).

The general improvement in quality and the problem-orientation requires both measures in the regulatory area at the national level, and measures at the level of individual research organisations. At the national level, this mainly involves changes in the *governance* of R&D policy; changes in the evaluation of quality and institutional financing with an emphasis on *peer review* elements and good international practices and the associated differentiation of quality and the reinforcement of the critical mass in the areas of good-quality research, improving the quality of the performance of public administration in R&D, increasing the qualifications of the responsible civil servants and improving the methodological level of the support programmes with the aim of improving the ability to implement the approved strategy, improve the evaluation of projects and support programmes, and reduce the administrative burden on researchers. At the level of research organisations, the prerequisites for a general increase in quality also include a general improvement in the strategic management of research activities, including the professionalisation of the support processes for research management and implementation.

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<sup>194</sup> The quality of the research is fundamentally dependent on the quality of human resources for research careers. For more on this topic, see the key change area *Better supply of HR, in terms of both quality and quantity, for innovative enterprise, research and development*.

<sup>195</sup> For more information see the chapter on specialisation. The knowledge domains are understood to mean the following areas of research: materials research, information and communication technology, electronics and photonics, advanced manufacturing technology, biotechnology and biomedicine.

Improvement in the quality and problem-orientation of research in the fields where the Czech Republic has achieved an international level of quality presupposes the concentration of resources into a limited number of priority areas of oriented research with links to identified key knowledge domains and application directions defined in co-operation with the application sector. There, it will be essential to ensure prioritised, stable financing that enables planned development (through implementing long-term, problem-oriented research agendas, including economic research in the area of non-technical innovations and the digital and creative industries, and through supporting partnerships with high-quality international partners, upgrades of research infrastructures, especially large infrastructures, including their operation), and through strengthening their international openness and co-operation, and also through increasing their attractiveness to talent from the Czech Republic and abroad.

<b>Key area of changes B: Improving the quality of research</b>		
<b>Strategic objectives in key area of change B:</b> <b>B.1: Improving the quality and problem-orientation of research in knowledge domains that are relevant for intelligent specialisation</b>		<b>Indicators of strategic objectives/key area of change:</b> <ul style="list-style-type: none"> <li>• The share of specialist publications co-authored by domestic and foreign researchers</li> <li>• Number of participations of supported research teams implemented within the Horizon 2020 programme</li> <li>• Number of international patent applications (PCT) with an originator/co-originator from research organisations</li> </ul>
<b>Strategic objective B.1: Improving the quality and problem-orientation of research in knowledge domains that are relevant for intelligent specialisation</b> <sup>196</sup>		
<p>Improving the quality of research in the knowledge domains that are critical for strengthening smart specialisation is an essential prerequisite for the Czech Republic's long-term competitiveness. This requires (apart from identifying the actual knowledge domains) providing favourable and stable conditions for their further development in the form of the long-term financing of excellent teams (including teams deployed in Prague) with an emphasis on the-problem orientation of research, and providing high-quality research infrastructures. In order to improve quality, it is also necessary to strengthen the openness of the research environment in the Czech Republic (active measures against in-breeding) through linkage to the international research community by means of international partnerships, support for international co-operation in R&amp;D and support for bidirectional international mobility.</p> <p>Improved conditions for the development of high-quality research facilities in the fields that are relevant for smart specialisation will translate into more-intensive involvement in international research cooperation (in the form of greater success in acquiring international grants, involvement in international projects of research infrastructures, and international patent activity) and eventually into the increased number and share of international researchers and researchers who graduated abroad but are active in the Czech Republic.</p>		
<b>Specific objectives</b>	<b>Indicators of the specific objective</b>	<b>Model activities/projects/operations</b>

<sup>196</sup> For more information see the chapter on specialisation in the Czech Republic.



<b>B.1.1: Providing stable conditions for the long-term development of high quality research facilities</b>	<ul style="list-style-type: none"> <li>The number of infrastructures in the Czech Republic that are involved in projects of the pan-European ESFRI infrastructures and included in the national roadmap of large infrastructures</li> </ul>	<i>Upgrading strategically significant research infrastructures and infrastructures constructed using the EU Structural Funds (especially from the OP RDI and infrastructures included in the Roadmap for large research experimental development and innovation infrastructures in the Czech Republic<sup>197</sup>), including securing long-term stable financing and support services (technical personnel) for the needs of open access. In the case of the ELI Beamlines project, the additional construction of infrastructure (within the phasing of the project).</i>
		<i>Improving the quality of the infrastructure conditions of universities and AS CR institutes that co-operate on research-oriented programmes with relevance for the RIS3.</i>
		<i>Specifically supporting the modernisation and additional construction of research infrastructures at universities and AS CR institutes in Prague in research organisations that are critical for the implementation of RIS3.</i>
		Support for access to sources of R&D information, specialist publications and data sources (magazines, e-books, bibliographic and scientometric databases etc.), including free access to the results (data and information repositories).
		Support for acquiring and retaining critical research staff in excellent research teams
<b>B.1.2: Increasing the international openness of public research in the Czech Republic</b>	<ul style="list-style-type: none"> <li>Number of new international co-operation projects within established international strategic partnerships<sup>198</sup></li> <li>Headcount of foreign researchers employed in research organisations in the Czech Republic</li> </ul>	<i>Strategic research partnerships with leading foreign facilities both within and outside the EU (the implementation of a joint research agenda, bidirectional mobility)</i>
		Support for the international mobility of research, technical and administrative R&D staff and students
		Projects for the establishment or development of selected research groups, including groups connected with the arrival of foreign

<sup>197</sup> Within the meaning of Act No 130/2002 Coll.

<sup>198</sup> The precondition is an international research partnership with international partners that have attained a demonstrably higher level of quality than the Czech partner entity.

		<p>researchers and reintegrating Czech scientists including the obligation of open competition for both domestic and foreign scientists</p> <p>Support for soft services for the arrival of foreign researchers and students (Euraxess etc.)</p> <p><i>Projects of international graduate schools, especially at doctoral level</i></p> <p><i>Specific support for strategic international R&amp;D projects (Teaming, Twinning, EIT KICs)</i></p> <p>Activities aimed at improving grant support, especially in the case of international grants (support for the activities of grant offices at RO)</p> <p>Implementing support activities to strengthen international research co-operation, including the involvement of research organisations in Joint Technology Initiatives and Joint Programming, ERA Nets, including the personnel reinforcement of capacities for strategic, information and administrative support and improved coordination at national level.</p> <p>Preparing and subsequently implementing the marketing strategy of the Czech Republic for research and innovation in order to enhance the image of the Czech Republic as a technologically advanced country (incl. the promotion of R&amp;D achievements in the Czech Republic and abroad).</p>
<p><b>The strategies and national documents to which the strategic and specific objectives are related:</b></p> <ul style="list-style-type: none"> <li>- National Research, Development and Innovation Policy of the Czech Republic for 2009–2015</li> <li>- National Innovation Strategy of the Czech Republic</li> <li>- Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic – updated in May 2011 (MEYS)</li> <li>- The International R&amp;D Audit in the Czech Republic</li> <li>- National Reform Programme of the Czech Republic 2014</li> <li>- National Priorities of Oriented Research, Experimental Development and Innovations</li> </ul>		
<p><b>The conditions for and barriers to implementing interventions in this key area of change<sup>199</sup>:</b>  The implementation of <i>regulatory measures</i> aimed at increasing the effectiveness of the management of research policy, especially in the following areas:</p>		

<sup>199</sup> This includes measures of the updated National RDI Policy for 2009 to 2015 with a view to 2020, namely measures 1, 2, 5, 14, 15, 16, 17 and 18. Other intervention-type measures are included among the proposed model activities.

- Changes in the governance of R&D policy (including the necessary amendment to Act 130/2002) in order to strengthen the creation of a consensus on the strategy and achieve real prioritisation and subsequent strengthening of the critical mass in areas of high-quality R&D
- As of 2016, introducing a new methodology for evaluating research quality (based on good international practices, including the element of peer review, the combination of evaluation of the past and plans for the future, consideration of interdisciplinary differences, strengthening the element of application relevance in evaluation, and closer linkage between financing and the originator of the results) and the associated institutional financing with a substantial preference for (differentiation of) quality over mediocrity
- Strengthening the component of institutional financing over targeted financing with the aim of increasing the financial stability and predictability

The above changes will need to be translated into corresponding *legislation*, especially into Act No 130/2001 Coll., on support for research and development from public resources.

Systemic measures to improve the *quality of the performance of public administration* in the area of R&D, especially:

- ***Clearly defined competence for the coordination of programmes that are financed and co-financed from national resources) so that it is possible to thoroughly interconnect the financing of the defined priorities of smart specialisation from resources intended for regional policy (ESIF) and national resources***
- Stabilising civil servants in responsible institutions and improving their qualifications with the aim of improving the ability to implement the agreed research, development and innovation strategies
- Improving the methodological quality of support programmes with the aim of systematically reducing the administrative burden on researchers, systematically reducing the administrative burden and coordinating this effort across the providers of targeted support
- Improving the evaluation of R&D projects and the support programmes (ex-ante and ex-post), including greater involvement of foreign evaluators
- Developing the strategic management of research, development and innovation policy (foresighting, trend mapping) for the purposes of focussing the programmes of targeted support for R&D
- Building the institutional capacity and strategic intelligence of public administration in the area of research, development and innovation and the implementation of RIS3 at national and regional levels
- Increasing public expenditure on R&D with the aim of achieving a 1% share in GDP by 2020
- Preparing a long-term financial outlook for the R&D budget for 7 years, including the fixation of the amount for implementing the National Priorities 2030
- Updating the National roadmap of large Infrastructures up to 2020, including linking its financial requirements to the long-term financial outlook
- Introducing a new methodology for evaluating programmes of targeted support

### Key area of change C: Increasing the economic benefits of public research

In terms of the interaction of public research with partners from the application sector, Czech research organisations show significant deficiencies, which are even more apparent in international comparison. In the vast majority of areas, Czech research organisations show only a minimal level of commercial utilisation of their research results and knowledge, whether in the form of the direct commercialisation of results (the sale of licences to intellectual property or the establishment of technology companies using the intellectual property of the research organisations) or in the form of co-operation with the application sector (contract research, joint projects and joint publication activity). As a result, the growing public investment in research has translated very little into higher economic and social return, higher added value and improved competitiveness of the Czech Republic.

The causes of this unsatisfactory situation must be addressed simultaneously at three levels: (i) through changes in the regulatory conditions, which must be set in a way that stimulates greater interest in the commercial use of the results on the part of research organisations, especially while taking into account the aspect of co-operation with the application sector in evaluating the quality of research and institutional financing; (ii) through improving the preparedness of research organisations to cooperate with the application sector through changes and improvements to internal procedures and mechanisms; (iii) through implementing support tools and interventions that will ensure the highest possible level of interaction between research organisations and the application sector, including joint training of doctoral students.<sup>200</sup>

The changes in the regulatory conditions and improvements in the preparedness of research organisations to cooperate with the application sector have the nature of horizontal measures that should affect the widest group of research organisations possible, regardless of their area of interest. The implementation of support tools should mainly take the form of vertical measures, i.e. interventions aimed primarily at research teams and research and application themes that are relevant to smart specialisation.<sup>201</sup>

The target situation is the improved preparedness of research organisations for co-operation and, at the same time, the creation of stimulating conditions for cooperation between public research and the application sector. Another target is the creation of mechanisms for intensive long-term interaction between research organisations and companies, especially through supporting their co-operation on joint research in directions that are significant for strengthening the competitive advantage of companies in the Czech Republic (see the chapter on specialisations).

Key area of change C: Increasing the economic benefits of public research	
<b>Strategic objectives in key area of change C:</b> <b>C.1: Increasing the relevance of research to the needs of the application sector</b>	<b>Indicators of strategic objectives/key area of change:</b> <ul style="list-style-type: none"><li>• Number of licences to research results granted to companies by research organisations</li><li>• Number of acquired grant (i.e. co-financed by companies) research projects of research organisations and companies</li></ul>

<sup>200</sup> Another cause of the unsatisfactory situation is the low sophistication of innovation demand on the part of Czech companies. This area is addressed in key area of change *Higher innovation performance of companies*.

<sup>201</sup> For more information see the chapter on specialisation in the Czech Republic.

**Strategic objective C.1: Increasing the relevance of research**

The relevance of research activities is directly dependent on the intensity of the interaction and co-operation with the users of the results and with the application sector, which is a necessary partner for correctly defining the research problem. In order to increase the relevance of research financed from public resources, it is therefore necessary to support co-operation and mobility and to strengthen the partnership relations between research organisations and the application sector. In order to increase the economic benefits of research that is implemented by research organisations, it is essential to improve the support processes for the commercial use of R&D results.

Increasing the intensity of the interaction between research organisations and companies will translate into increased intensity of jointly prepared and implemented projects, and the volume of contract research. Improving the processes to support commercialisation will translate into an increase in the number of licences granted by research organisations for the results of their research activities, and in the number of technological companies that use the intellectual property of research organisations.

<i>Specific objectives</i>	<i>Indicators of the specific objective</i>	<i>Model activities/projects/operations</i>
<b>C.1.1: Strengthening the co-operation and interaction between research organisations and the application sector<sup>202</sup></b>	<ul style="list-style-type: none"> <li>The volume of financial resources for R&amp;D acquired by research organisations from corporate sources (contract R&amp;D + donations from donors)</li> <li>The share of specialist publications co-authored by research organisations and companies</li> </ul>	<i>Support for the preparation and implementation of joint projects of research organisations and application partners in R&amp;D and education, with an emphasis on interdisciplinary approaches and on defining the focus of the activities in co-operation with the application sector (projects such as competence centres)</i>
		<i>Long-term problem-oriented research programmes<sup>203</sup> that respond to the medium-term needs of the application sector; emphasis on the networking of leading Czech facilities and entities from the application sector (especially technologically advanced companies) in key economic sectors, and on interdisciplinary topics with the potential for the wide application of the results in practice</i>
		<i>Summer schools implemented in co-operation between research organisations and the application sector</i>
		Student mobility, joint training of PhD students under the supervision of universities and companies (Knowledge Transfer Partnerships)
		Industrial professorships (professorial positions for experienced specialists from practice)
		Innovation vouchers
		<i>The establishment of innovation platforms for the priority areas of RIS3 (the areas of vertical specialisation) at the national level, while identifying promising long-term R&amp;D themes that respond to the needs of the application sector and to identified social challenges</i>
		Providing access to the instruments of research organisations for the needs of external users – creating a central nationwide database of the instruments available at research organisations, negotiating the terms and setting the rules for access to the instruments.
Activities aimed at strengthening contacts and building up trust between research organisations and the		

<sup>202</sup> Only in the implementation of application research topics that develop smart specialisation.

<sup>203</sup> This is an analogy to the Future and Emerging Technologies (FET) programme that is implemented within the 7th EU Framework Programme.

		commercial sector (the establishment of information and cooperation platforms, networking events etc.)
<b>C.1.2: Increasing the commercial use of the R&amp;D results and knowledge of research organisations</b>	<ul style="list-style-type: none"> <li>• The volume of resources obtained by research organisations from newly granted licences to research results (from 2014)</li> <li>• The number of start-up companies using intellectual property from research organisations</li> </ul>	Activities aimed at strengthening the entrepreneurship of university students and researchers (student competitions, education in the basics of entrepreneurship...)
		The implementation of international incentive tools (within research organisations) to support co-operation with the application sector
		Support for the creation of academic start-ups (i.e. companies based on research results), including temporary management services to manage the establishment and development of companies
		Educating students and researchers in the area of intellectual property
		Securing internal and expert capacities for the transfer of technology (licensing, contract research) from research organisations to companies, improving the effectiveness of and professionalising the processes during commercialisation, including providing a mechanisms for financing the patent protection of research organisations' results
		The presentation of results in the media as part of the commercialisation of research
<b>The strategies and national documents to which the strategic and specific objectives are related:</b> <ul style="list-style-type: none"> <li>- National Research, Development and Innovation Policy of the Czech Republic for 2009–2015</li> <li>- National Innovation Strategy of the Czech Republic</li> <li>- International Competitiveness Strategy of the Czech Republic for 2012–2020</li> <li>- The International R&amp;D Audit in the Czech Republic</li> <li>- National Reform Programme of the Czech Republic 2014</li> </ul>		
<b>The conditions for and barriers to implementing interventions in this key area of change:</b> <p>The implementation of regulatory measures aimed at strengthening the aspect of co-operation with the application sector in the overall evaluation of research quality:</p> <ul style="list-style-type: none"> <li>- Earmarking a portion of institutional resources for research organisations, which will be allocated in the form of an additional financial bonus based on an evaluation of co-operation with the application sector (an analogy to the system introduced for English universities).</li> <li>- Revising the existing system for allocating institutional resources so that the application relevance and quality of the applied results is also taken into account (a new evaluation methodology from 2016)</li> <li>- Removing systemic barriers to co-operation of research organisations and the practice, especially in the area of contract research and the commercialisation of R&amp;D results (the binding interpretation of the public support rules that will not excessively limit contract research, the use of subsidised equipment and intellectual property for commercial purposes etc.)</li> </ul>		

### 6.3. Human resources

#### **Key area of change D: Improved availability of HR, in terms of both quality and quantity, for innovative enterprise, research and development**

Human resources represent the key determinant of the competitiveness of a country, especially in terms of competitiveness in knowledge-intensive markets. From this perspective, there are three very important interconnected levels of creating and developing people's research and innovation potential.

The first level can be viewed as the general level of realistically applicable knowledge and skills that, in practice, translate mainly into the ability to create commercially usable innovations. From this perspective, it is possible to identify some skills that are above average in comparison with other OECD countries, both in the adult population and in the population of pupils aged 15. However, the application of the current, mostly average skills of the Czech population continue to be limited by the insufficient level of soft skills, such as entrepreneurship, co-operation, flexibility or customer orientation, which are essential for success in knowledge-intensive markets. Insufficient language skills also hinder the potential of the economy to benefit from market globalisation and for example quickly and knowledgeably introduce new practices or benefit from innovations emerging abroad. Unless a larger portion of the population can offer a combination of expertise, soft skills and language skills, the Czech Republic will provide poor environment for innovative companies, both domestic and foreign.

The development of the mix of competencies that support the creation of innovations and increase the potential for knowledge-intensive activities, including research and development, represents merely an initial prerequisite for success. The "building block" of the second level is to use those characteristics of individual people that can generate the greatest value. This essentially involves identifying and developing natural talents, where the entrepreneurial talent, technical talent and the talent for research and development work are the most important for the topic being discussed. Unfortunately, the Czech education system lacks the identification of personal aptitude for a career in which the individual will be the most productive, and it does not support the individual's development in this direction. In turn, this negatively affects the degree to which the potential of human resources is utilised, reduces the effectiveness of investment in education in a large part of the population (including the lack of graduates from technical disciplines) and limits the inclusive function of education. The introduction of the above system of working with talent would make it possible to identify the best talent and work with them intensively from a very young age. The acquisition of talent includes both making better use of the country's own resources and effectively attracting talent from abroad, because – regardless of the origin of these individuals – it is their presence and contribution in the Czech Republic that count.

The highest level includes working with people whose profession is research and development, because they have the best prerequisites for generating knowledge that may contribute significantly to the competitiveness of the country. It turns out that already in the initial phase of university education, knowledge from research and development is inadequately used in students' practical training and in the knowledge of students, which translates into insufficient transfer of new knowledge into practice. At the same time, however, it also turns out that researchers themselves do not have suitable conditions for their development, especially in the public sector. The competitive environment in the public sector is insufficiently open, weak (and in some cases even unhealthy) and it does not provide enough room or motivation for the development of a large portion of the employees in this sector. It is therefore necessary to specify the correct direction for the development of individual research organisations and universities and to adjust work with

human resources correspondingly. The parallel implementation of measures at all three levels will ensure a systemic change in the use of human resources for work in research, development and innovative enterprise.

The RIS3 Strategy specifies the following strategic objectives for this key area of change; for the area of regional education, these are indicative proposals for activities and indicators.

<b>Key area of change D: Improved availability of HR, in terms of both quality and quantity, for innovative enterprise, research and development</b>	
<p><b>Strategic objectives in key area of change D:</b></p> <p><b>D.1: Improving the quality of school graduates</b></p> <p><b>D.2: Identifying and making use of talent</b></p> <p><b>D.3: Improving the quality of research and development staff</b></p>	<p><b>Indicators of strategic objectives/key area of change:</b></p> <ul style="list-style-type: none"> <li>• The numbers of primary and secondary schools and universities equipped with tools for the diagnostics and development of soft skills</li> <li>• The proportion of secondary school graduates with a knowledge of English at a corresponding level according to the Common European Framework of Reference (secondary school completed without the maturita school-leaving examination – B1, secondary school completed with the maturita school-leaving examination – B2)</li> <li>• The proportion of university students who have studied at least one semester abroad</li> <li>• The number of primary and secondary schools with a borrowed (standardised) system for identifying the natural talents of pupils</li> <li>• The number of primary and secondary schools with an implemented programme for developing natural talent</li> <li>• The number of persons participating in individualised programmes for the development of individuals with exceptional talent</li> <li>• The number of foreign students at universities</li> <li>• The number of research organisations with a modernised system of strategic management</li> <li>• The proportion of doctoral students who successfully completed their studies</li> <li>• The proportion of doctoral students who have studied at least one semester abroad</li> </ul>
<p><b>Strategic goal D.1: Improving the quality of school graduates</b></p> <p>The quality of human resources in the current knowledge-oriented economy represents the key determinant of international competitiveness. Therefore, all countries</p>	



focus on the different levels of their initial education systems with the aim of improving their effectiveness. It is no coincidence that the countries with the best functioning school systems are the leaders in the area of research and innovation and that they achieve above-average rates of growth (for example, Munich and Protivínský<sup>204</sup> have documented a strong relationship between the education of the population and economic growth). From this perspective, it is absolutely essential for the Czech Republic to focus its attention on improving as quickly as possible the quality of the outputs of each level of the education system. At present, the Czech Republic admittedly achieves above-average results in the natural-science literacy of pupils, the numerical literacy of the adult population and the high level of interest in studying technical and natural science fields among doctoral students, but the long-term declining trend in the quality of the outputs of education, the inadequate development of soft skills and language skills, the high ratio of unsuccessful doctoral students and the unbalanced structure of the fields of study in relation to the needs of the labour market not only make it impossible to use the above advantages, but they also represent a threat for Czech competitiveness in the future.

<i>Specific objectives</i>	<i>Indicators of the specific objective</i>	<i>Model activities/projects/operations</i>
<b>D.1.1: Creating a functioning relationship between schools and employers</b>	<ul style="list-style-type: none"> <li>▪ The satisfaction of employers with the quality the expertise and skills of graduates from various fields of study (it is necessary to carry out a representative survey among employers<sup>205</sup>)</li> </ul>	<ul style="list-style-type: none"> <li>▪ The definition of the expected education outputs (these can be called graduate competence models) that will not only indicate the required competencies, but also their contents and target level for each level of the system of initial education; these expected outputs will be processed for the different groups of professions and as such will represent recommendations for modifying the curricula of individual schools (the objective of this measure is the specific description of the objectives of education based on the needs of employers). The processing of the competence models can make use of, for example, the relevant outputs from the National System of Qualifications and the National System of Professions.</li> <li>▪ The introduction of a system of (preferably long-term) placements for teachers active in initial education at employers and linking the system to teachers' career paths</li> <li>▪ The implementation of activities leading to the practical orientation of teaching at universities and secondary schools, for example in the form of internships, shadowing or the setting of work topics by employers</li> </ul>
<b>D.1.2: Increasing the level of entrepreneurship and other soft competencies</b>	<ul style="list-style-type: none"> <li>▪ The satisfaction of employers with the quality of soft competencies in the graduates from various fields of study (it is necessary to carry out a representative survey among employers<sup>206</sup>)</li> <li>▪ The numbers of primary and secondary schools</li> </ul>	<ul style="list-style-type: none"> <li>▪ The general introduction of tools for the diagnostics and development of entrepreneurship and the soft skills defined by the National System of Professions at all levels of the education system, including training teachers on working with these tools</li> <li>▪ The implementation of activities leading to the practical orientation of</li> </ul>

<sup>204</sup> Munich and Protivínský (2013): The impact of education on economic growth in the light of the new PISA 2012 results

<sup>205</sup> The alternative is the introduction of a nationwide system for the evaluation of the quality of the teaching.

<sup>206</sup> The alternative is the introduction of a nationwide system for the evaluation of the quality of teaching.

	and universities equipped with tools for the diagnostics and development of soft skills	teaching (see the activity under objective D.1.1)
<b>D.1.3: Improving the active knowledge of English and another foreign language</b>	<ul style="list-style-type: none"> <li>▪ The satisfaction of employers with the level of knowledge of English and possibly another foreign language among the graduates from various fields of study (it is necessary to carry out a representative survey among employers<sup>207</sup>)</li> <li>▪ The proportion of secondary school graduates with internationally acknowledged certificates attesting to their knowledge of English at a corresponding level according to the Common European Framework of Reference (secondary school completed without the maturita school-leaving examination – B1, secondary school completed with the maturita school-leaving examination – B2)</li> <li>▪ The proportion of university students who have studied at least one semester abroad</li> <li>▪ The proportion of university students who have studied at least one subject in English during their studies</li> </ul>	<ul style="list-style-type: none"> <li>▪ The introduction of compulsory English lessons at primary and secondary school completed with an examination with requirements corresponding to the levels according the Common European Framework of Reference (primary school – A2, secondary school completed without the maturita school-leaving examinations – B1, secondary school completed with the maturita school-leaving examination – B2); other languages should be taught as a second foreign language</li> <li>▪ The development of a specialist foreign language at specialist secondary schools and universities</li> <li>▪ The involvement of native speakers in teaching English in the system of initial education</li> <li>▪ The involvement of foreign specialists in teaching at universities</li> <li>▪ The introduction of a system of foreign language courses for teachers and its links to teachers’ career paths</li> <li>▪ The introduction of the obligation to actively use a foreign language during studies at all universities and secondary schools, for example in the form of the study of some subjects in English, or the implementation of a study stay abroad (except for Slovakia)</li> </ul>
<p><b>Strategic objective D.2: Identifying and making use of talent</b></p> <p>Identifying areas of activities, in which an individual will be the most productive (because they have e.g. an artistic or sports talent, an aptitude for craft, entrepreneurial skills etc.), and developing them in that direction is the essence of working with talent. Unfortunately, this is lacking in the Czech education system. Every pupil or student has a natural talent for something (this is not taken to only mean exceptional talent) and he and she should choose the type of education accordingly. However, people often discover their talents towards the end of their educational path, after its completion or not at all. These cases mean that resources are spent inefficiently on incorrectly oriented education and that the individual’s productive potential will be used only partly or not at all. This also means that the individual’s chances of succeeding in their personal and professional life are reduced. Therefore, the timely identification of the natural talents of each individual, their correct guidance and targeted development could help significantly reduce the inefficiency in education and improve competitiveness. According to the targeting of these tools, the Czech Republic could deliberately support the development of entrepreneurial talent, reduce the problem of insufficient workforce with a technical education and cultivate top-quality talent for research teams from their childhood. Also, this measure has an inclusive nature, because it assists in the use of individuals who show poor school results and who do not receive adequate attention in the current education system. The insufficient amount of “domestic talent” in individual areas can also be addressed through supporting the arrival of such talent from other countries.</p> <p>Binding indicators for objective D.2:</p>		

<sup>207</sup> The alternative is the introduction of a nationwide system for the evaluation of the quality of teaching.

<ul style="list-style-type: none"> <li>• The proportion of primary and secondary schools with an implemented system for identifying the natural talents of pupils</li> <li>• The proportion of primary and secondary schools with an implemented programme for developing natural talent</li> <li>• The number of persons participating in highly individualised programmes for the development of individuals with exceptional talent</li> <li>• The number of foreign students at universities</li> </ul>		
<b>Specific objectives</b>	<b>Indicators of the specific objective</b>	<b>Model activities/projects/operations</b>
<b>D.2.1: Creating a system for identifying and developing natural talent</b>	<ul style="list-style-type: none"> <li>▪ The proportion of primary and secondary schools with an implemented system for identifying the natural talents of pupils</li> <li>▪ The proportion of primary and secondary schools with an implemented programme for developing natural talent</li> </ul>	<ul style="list-style-type: none"> <li>▪ The creation and introduction of tools for identifying pupils' natural talent for entrepreneurship, technical professions and research and development</li> <li>▪ The creation and application of development programmes for the above types of natural talent, including the preparation of consultants for working with such them</li> </ul>
<b>D.2.2: Preparing the next generation of innovators</b>	<ul style="list-style-type: none"> <li>▪ The number of persons participating in individualised programmes for the development of individuals with exceptional talent</li> </ul>	<ul style="list-style-type: none"> <li>▪ The implementation of highly individualised programmes for the development of individuals with an exceptional entrepreneurial talent, a technical talent or a talent for research and development work</li> </ul>
<b>D.2.3: Creating a system for attracting and adapting highly qualified people to the Czech Republic</b>	<ul style="list-style-type: none"> <li>▪ The number of foreign students at universities</li> <li>▪ The number of highly qualified foreigners with long-term residency in the Czech Republic or with granted Czech citizenship</li> </ul>	<ul style="list-style-type: none"> <li>▪ Encouraging foreign students to study at Czech universities (for example the promotion of Czech universities abroad, the introduction of English as a second official language at universities, the introduction of compulsory subjects in English, the purchase of foreign literature for libraries etc.)</li> <li>▪ Encouraging highly qualified foreigners (especially in technical professions) to work in the Czech Republic</li> </ul>
<p><b>Strategic objective D.3: Improving the quality of research and development staff</b></p> <p>The quality of research and development mainly depends on the quality of the available human resources and the effectiveness of their use. In the private sector, the presence of competitive pressures and the need to survive creates a suitable environment that gives rise to the need to intensively address both of the above factors. However, the environment in public research differs significantly from that in the private sector, especially in the intensity of the pressure on the results and effectiveness of research and development (furthermore, there are also significant differences between individual research organisations). As a result, the public research environment in the Czech Republic can be perceived as being generally less competitive and showing less pressure on performance than in the case of the private sector or in research in developed countries. The above is often reflected in the unclear development strategy of individual research organisations (including the implementation framework), the insufficient functioning of personnel processes, and also the insufficient effectiveness or the absence of tools that might help eliminate the above deficiencies of the current system. Public research organisations are therefore faced with the very demanding task of changing the culture of this sector, defining the direction of development (including identifying priority research areas), building support structures and commencing targeted work associated with the development of human resources, and improving the effectiveness of their use.</p> <p>Binding indicators for objective D.3:</p> <ul style="list-style-type: none"> <li>• The number of research organisations with a modernised system of strategic management</li> <li>• The proportion of doctoral students who successfully completed their studies</li> <li>• The proportion of doctoral students who have studied at least one semester abroad</li> </ul>		
<b>Specific objectives</b>	<b>Indicators of the specific objective</b>	<b>Model activities/projects/operations</b>

<p><b>D.3.1: Improving the level of strategic and operational management and creating the conditions for improving the competitiveness of research organisations</b></p>	<ul style="list-style-type: none"> <li>▪ The number of research organisations with a modernised system of strategic management</li> <li>▪ The number of universities with implemented transparent systems for evaluating quality</li> </ul>	<ul style="list-style-type: none"> <li>▪ Management education for executives at research institutes, universities and their faculties, especially in the area of strategic management, leadership and change management</li> <li>▪ Updating and implementing strategic development plans of faculties, universities and research institutes, which are aimed at achieving European quality in research and teaching (the aforementioned assumes a change in the culture of these organisations towards a “challenge culture”)</li> <li>▪ Optimising the internal processes of the research organisations, reducing the administrative burden, and defining the measures of quality</li> <li>▪ The introduction of English as a second language in the operations of research organisations</li> </ul>
<p><b>D.3.2: Introducing an effective system of human resource management at research institutes, universities and their faculties</b></p>	<ul style="list-style-type: none"> <li>▪ The evaluation of the satisfaction and work participation of employees</li> <li>▪ The proportion of research institutes and universities certified in human resource management</li> </ul>	<ul style="list-style-type: none"> <li>▪ A change in the existing system of human resource management according to modern trends and the specific needs of each organisation (analysis, proposal, introduction, evaluation and improvement)</li> <li>▪ Educating managers and relevant employees of research organisations on human resource management</li> </ul>
<p><b>D.3.3: Increasing the attractiveness of the research career and improving the quality of the preparation of future researchers</b></p>	<ul style="list-style-type: none"> <li>▪ The proportion of doctoral students who successfully completed their studies</li> <li>▪ The proportion of doctoral students who have studied at least one semester abroad</li> <li>▪ <i>The number of foreign internships longer than 5 months</i></li> </ul>	<ul style="list-style-type: none"> <li>▪ Activities to popularise research with the aim of increasing the interest of the young generation in research activities, including improving the infrastructure for popularisation</li> <li>▪ Programmes for talented students (master’s and doctoral level) with special preference for the priority fields of smart specialisation</li> <li>▪ Improving the quality of scientific preparation through support for the completion of a part of doctoral studies abroad, for example in the form of long-term internships at a foreign organisation engaged in research and development, or the obligation to complete an internship or shadowing of a corresponding profession in practice</li> <li>▪ Strengthening international mobility in the European Research Area (ERA)</li> <li>▪ Improving the quality of scientific preparation through support for the active participation of doctoral students in reputable international conferences</li> <li>▪ The development of relevant language skills in doctoral students at least to the C1 level</li> <li>▪ The development of the relevant soft skills in doctoral students to an above-average level, i.e. level 4 and 5 according to the classification of soft skills in the National System of Professions</li> </ul>

- Specific measures to strengthen the proportion of women in research, including measures aimed at reconciling maternity and parental leave with a career in research and development

**The strategies and national documents to which the strategic and specific objectives are related:**

- Education Policy Strategy of the Czech Republic up to 2020
- International Competitiveness Strategy of the Czech Republic for 2012–2020
- Human Resources Development Strategy for the Czech Republic
- Economic Growth Strategy of the Czech Republic
- National Innovation Strategy of the Czech Republic
- The Updated National Policy for Research, Development and Innovation of the Czech Republic for 2009 to 2015 with a view to 2020
- National Reform Programme of the Czech Republic 2014

**The conditions for and barriers to implementing interventions in this key area of change:**

- Increasing the level of entrepreneurship and other soft skills (objective D.1.2) must be supported through the introduction of a uniform methodological approach and the provision of suitable tools throughout the entire system of initial education. The current practice, where individual schools have approached the achievement of this objective in different ways based on their own solutions, shows that this approach does not guarantee the necessary results.
- The introduction of the obligation to actively use a foreign language during studies at secondary schools and universities (objective D.1.3) is conditional upon the implementation of the other proposed measures in this objective. Above all, it is crucial to increase the number of foreign specialists teaching at universities and to include native speakers in teaching at secondary schools. The limited number of Czech teachers with a corresponding knowledge of a foreign language does not need to be of fundamental importance in that it is sufficient to include 1 subject in English for each year of study, i.e. only a very limited number of teachers are needed to provide these classes. This step is also conditional upon a change in the relevant laws, which will allow the inclusion of compulsory lessons in a foreign language in Czech study programmes.
- The general introduction of a system for identifying and developing talent (objective D.2.1) at all primary and secondary schools will ensure that all pupils (given that school attendance is compulsory, this means the entire population aged 6–15) will be monitored in terms of their aptitude for entrepreneurship, technical career or career in research and development. Pupils, in whom the potential for any of those areas is identified, will be worked with in order to develop this aptitude. Given that this involves long-term work with the entire population of pupils in the area of their development, it is logical that this activity will be implemented by individual schools. To this end, it is necessary to create functioning diagnostic and development tools that will be provided to all primary and secondary schools. The uniform systems of identifying and developing talent will ensure equal approach to all pupils across the Czech Republic.
- The successful implementation of the objectives in this key area is conditional upon improving the quality of teachers at all levels of the system of initial education (for example through implementing the Education Policy Strategy of the Czech Republic up to 2020).
- Developing the quality of teaching at primary schools and technically oriented secondary schools supports the achievement of the objectives of this key area of change. It is therefore necessary to ensure co-operation between primary schools and the business sector, which would assist in the better orientation of pupils in the labour market and lead them to a more responsible choice of secondary school (these activities support the effectiveness of the implementation of objective D.2.1), as well as improve the quality of the outputs of education (this can be roughly measured using the results of the PISA survey). At the same time, it is necessary to develop awareness of the technical fields available (including selected fields in the area of the natural sciences) and to increase their attractiveness, especially through

developing their quality. This can be achieved e.g. through changing the way in which some subjects are taught (for example mathematics), introducing elements of dual education, creating a system enabling schools to flexibly respond to the requirements of the labour market (see objective D.1.1) and so on.

- The identification and development of a natural talent for technology and science (see objective D.2.1) also requires motivating pupils and their parents to seek a career in these fields. In the 2007–2013 programming period, a basic infrastructure for the popularisation of science at the national level (science learning centres) was created using resources from the EU funds. It is advisable to ensure the further development and use of these centres.

## 6.4. Information and communication technology – digital agenda

### Key area of change E. The development of eGovernment and eBusiness for increased competitiveness

The electronisation of communication and the distribution of information represents a new phenomenon that, if used correctly, can substantially increase the effectiveness of communication both at the level of public administration, and between public administration and citizens or business entities. Thanks to that, support for the development and use of ICT constitutes a fundamental precondition for improving the competitiveness of the entire economy.

While companies continue to introduce and utilise ICT at their own initiative (due to market pressure and the need to constantly improve the effectiveness of their business activities), the use of ICT at the level of public administration is still inadequate<sup>208</sup>, which ultimately reduces the effectiveness of public administration, increases the cost of public administration, and reduces the competitiveness of the economy as a whole.

As part of the activities to date, the Czech Republic has created the foundations in the form registers that represent a very significant initial step for the development of eGovernment services. However, their use by the different services is currently at a minimal level and they need to be developed.

In order to achieve a greater degree of use of eGovernment services and to gain the trust of the clients (citizens and companies), not only the electronisation of the offered services is important, but also the electronisation of the public administration itself, both within each department and in the communication between the different departments. Only a fully and functionally equipped administration can operate effectively and be a reliable and credible partner for its clients.

Just as ICT can contribute to the effectiveness of the public administration, it also represents significant potential for the development of enterprise, i.e. both thanks to the increased use of ICT in business across all fields and due to the new possibilities in the new fields that emerge along with the rapid development of ICT. Taking advantage of this opportunity requires targeted and highly effective support for the use of ICT in enterprise, support for new companies taking the form of start-ups and spin-offs, and support for research and development in the area of ICT and for the use of ICT which can contribute to the establishment of such companies.

An essential prerequisite for the development of eGovernment and eBusiness is the existence of a sufficient-capacity, high-quality, secure and accessible infrastructure that will provide equal basic entrance conditions for all citizens and entrepreneurs, a high-quality interconnection of all institutions involved, i.e. at a level that not only corresponds to latest requirements, but that also corresponds to the expected trends in the demand and use of ICT at least up to 2020 or 2025.

The development of the necessary infrastructure must provide support for building new networks and modernising existing ones, but also for improving the accessibility of high-capacity connection in peripheral areas where insufficient bandwidth is a critical factor limiting the development of any use of ICT<sup>209</sup>.

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<sup>208</sup> 90% of companies use eGovernment services. On the other hand, the proportion of the population who have used eGovernment services in the past 12 months is less than a third. (EU, Digital Agenda for Europe: <http://ec.europa.eu/digital-agenda/en>)

Key area of changes E: Development of eGovernment and eBusiness to improve competitiveness (development of ICT and digital agenda)		
<b>Strategic objectives in key area of change E:</b> <b>E.1: The development of eGovernment</b> <b>E.2: The development of eBusiness and ICT in enterprise</b> <b>E.3: The development of infrastructure in ICT</b>		<b>Indicators of strategic objectives/key area of change:</b> <ul style="list-style-type: none"> <li>• 100% of public administration offices of municipalities with extended competence or higher (regions, ministries, financial offices, land registry offices etc.) will be offering their 20 most frequently used services for citizens and the 20 most frequently used services for companies in fully electronic form by 2020.</li> <li>• More than 70% of the population will have intermediate computer skills by 2020</li> <li>• More than 70% of households in remote areas will be serviced by a high quality Internet connection</li> <li>• - More than 70% of the population will use eGovernment services to communicate with the public administration at least once a year</li> </ul>
<b>Strategic objective E.1: The development of eGovernment</b> A fully electronic and effectively functioning public administration that corresponds to the trends in the current development of ICT technologies and use, as the basis of a competitive digital economy. The public administration will offer all services that are commonly used by either citizens or companies in a fully electronic form that will enable citizens and entrepreneurs to seamlessly communicate with public administration bodies at the regional and national levels.		
<i>Specific objectives</i>	<i>Indicators of the specific objective</i>	<i>Model activities/projects/operations</i>
<b>E.1.1: Improving the effectiveness of the public administration's external communication and the communication with clients</b> The offered services will be adapted in terms of their procedural, legislative and technological aspects so that their use is 100% feasible using electronic communication without the need for any personal contact with the given office. Each service will be optimised in order to maximise the effectiveness of its provision, i.e. both in relation to the client and with respect to the public administration's costs for its provision (the use of the basic registries, the mutual links between the various services including the option of automatic loading and verification of data from the registries without any need to document or specifically request additional	- 100% of public administration offices at the regional and national level (regions, ministries, financial offices, land registry offices etc.) will be offering their 20 most frequently used services/tasks for citizens communication with public administration in fully electronic form that will not require any personal contact between the citizen and the appropriate office; - More than 20% of citizens will exclusively use electronic communication to communicate with authorities in 50% of cases - More than 70% of citizens will use at least one offered eGovernment service	- The comprehensive modernisation/transformation of the most frequently used public administration agendas both towards citizens and towards entrepreneurs into a form that is usable for fully electronic communication – i.e. the modification of the legislative conditions, the transformation/creation of new procedural models that use electronic communication, and the transformation of competence models with the aim of enabling electronic communication with clients; - The establishment or development (in terms of capacity and function) and modernisation of the information systems used for communication between public administration and clients to a level that will enable full electronic communication; - The modernisation of the existing information systems in order to fully connect them to the basic registers with the aim of maximising the automatic loading and verification of data using the basic registers

<sup>209</sup> The map of the Czech digital wasteland: Only 3 per cent of people have a truly fast Internet connection ([www.ihned.cz](http://www.ihned.cz)) and the Czech Telecommunication Office (<http://www.ctu.cz/ctu-online/pruzkum-nga.html>)



<p>actions on the part of the client/citizen). As a result, full electronisation will bring a win-win situation that generates clear benefits and savings for both parties.</p>	<p>per year</p> <ul style="list-style-type: none"> <li>- More than 50% of entrepreneurs will submit their tax returns in electronic form</li> <li>- The time required for carrying out 50% of the most frequently used services/tasks by citizens and entrepreneurs will be reduced by at least 50%</li> </ul>	
<p><b>E.1.2: Improving the effectiveness of internal communication of public administration</b> In terms of their procedural, legislative and technological aspects, the various administrative agendas will be set up so that they maximise the effectiveness of both communication with clients, and communication within and between various offices. The electronisation of the communication within each office will bring time and financial savings to the operators, which will translate into better quality of the services provided to clients. Easier exchange of information between the employees of each office and between the different offices will have a positive effect on the effectiveness of the entire office.</p>	<ul style="list-style-type: none"> <li>- More than 50% of all internal systems in public administration that use data stored in the basic registers will be connected to the registers online and will be able to automatically load and verify data;</li> <li>- More than 70% of the communication between the different offices (or within offices) will take place exclusively in electronic form;</li> </ul>	<ul style="list-style-type: none"> <li>- The introduction of standardised SW information systems that will be compatible to allow the potential exchange of information between individual offices without the need to keep records in duplicate in paper form;</li> </ul>
<p><b>E.1.3: Ensuring safety in the use of eGovernment</b> Each system will be set up so that their use by the clients is safe to the maximum extent possible and does not jeopardise the development of eGovernment services due to the clients' refusal to use them. All new systems and services will include an adequate promotional and educational campaign, which will ensure that potential clients are sufficiently educated both in terms of the use of the given service/system and in terms of basic safety rules in using electronic communications.</p>	<ul style="list-style-type: none"> <li>- More than 70% of citizens will be informed about the possibilities and advantages of using the new eGovernment systems and services</li> <li>- More than 80% of citizens and entrepreneurs using eGovernment services will have sufficient knowledge of the principles and rules for the safe use of electronic services and electronic communication</li> <li>- More than 50% of public administration offices at the regional level and more</li> </ul>	<ul style="list-style-type: none"> <li>- The implementation of information campaigns aimed at increasing the awareness among citizens and entrepreneurs about the advantages and benefits of using eGovernment services;</li> <li>- The implementation of educational seminars/the creation of an online educational programme (webinars) aimed at explaining the use of the different services, which is available to anyone, at any time and free of charge;</li> <li>- Support for activities leading towards the transformation of the procedural processes and the technological modernisation of public administration offices with the aim of introducing ISO certification for information security, or other international/European security standards;</li> </ul>

	<p>than 80% of public administration offices at the national level will have the necessary ISO certification for information security</p>	<p>- The implementation of regular surveys and studies that monitor the progress of the implementation of each project and its contribution towards the achievement of the set objectives, or that serve as a basis for the regular modification of implemented activities so that the set objectives are achieved (for example regular monitoring of users' ability to effectively use the newly introduced and offered services)</p>
<p><b>The strategies and national documents to which the strategic and specific objectives are related:</b></p> <ul style="list-style-type: none"> <li>• Digital Czech Republic v 2.0 – The Road to the Digital Economy (MIT)</li> <li>• Data source: DIGITAL AGENDA FOR EUROPE (EU)</li> </ul>		
<p><b>The conditions for and barriers to implementing interventions in this key area of change:</b></p> <ul style="list-style-type: none"> <li>• Before launching implementation, it is necessary to carry out initial surveys in order to determine the most frequently used services on the part of both citizens and entrepreneurs, to analyse their requirements in terms of time, personnel etc. as the basis for the subsequent determination of the main services that should – in accordance with the objective – be transformed into a fully electronic version;</li> <li>• Information and data audits that analyse the interconnectedness of the different services and data and serve as a basis for identifying the key points that need to be addressed;</li> <li>• Surveys of clients' knowledge in relation to the use of eGovernment and its safety, as a basis for the implementation of measures aiming to improve the computer literacy of the clients of eGovernment;</li> <li>• The implementation of parallel/follow-up projects focusing on the targeted education and training of public administration employees so that they are all able to operate the newly-introduced eGovernment services, comply with security standards for working with information systems and provide clients with at least basic assistance and advice;</li> <li>• The key prerequisite for the effective functioning of eGovernment is interoperability, which allows mutual communication between systems without any limitations. The conditions of interoperability must therefore be thoroughly monitored when awarding any public contracts for any of the systems being built.</li> </ul>		
<p><b>Strategic objective E.2: The development of eBusiness and ICT in enterprise</b></p> <p>eBusiness and ICT in enterprise as a driver of innovation and an impulse for improving the effectiveness of enterprise and developing new fields focusing on promising areas that use ICT to increase the added value of products and, by extension, to improve the competitiveness of the economy as a whole.</p>		
<p><b>Specific objectives</b></p>	<p><b>Indicators of the specific objective</b></p>	<p><b>Model activities/projects/operations</b></p>
<p><b>E.2.1: Increased use of ICT in enterprise</b></p> <p>ICT will play a significant role in increasing the effectiveness and improving the economic profitability of enterprise, especially due to the growing share of the use of ICT in unrelated fields where the automation of selected agendas may increase the effectiveness of enterprise and, in turn, the competitiveness of the given sector.</p> <p>Cooperation between ICT specialists and scientists and</p>	<ul style="list-style-type: none"> <li>- The number of joint research projects focusing on the use of ICT to increase the added value of promising fields leading to the implementation of a new ICT solution in the market;</li> <li>- The share of SMEs using cloud computing and the services of public or private data centres and R&amp;D organisations in ICT;</li> </ul>	<ul style="list-style-type: none"> <li>- Co-operation of SMEs and research organisations in order to jointly develop new ICT services for enterprise;</li> <li>- Improving the access of SMEs to centres of shared services and new sophisticated solutions focusing on cloud computing</li> <li>- Improving the access of SMEs to data centres and their services</li> <li>- The development of cloud services for entrepreneurs</li> </ul>

<p>entrepreneurs is essential for the establishment and successful development of new high-potential areas of enterprise that involves ICT. The combination of knowledge from several fields helps further and more intensively develop the newly-created areas of enterprise that have the potential to become the driving sectors of the economy.</p>		<p>- Co-operation of SMEs and large companies (and vice versa) in using ICT in enterprise and introducing/developing eBusiness</p>
<p><b>The strategies and national documents to which the strategic and specific objectives are related:</b></p> <ul style="list-style-type: none"> <li>• Digital Czech Republic v 2.0 – The Road to the Digital Economy (MIT)</li> <li>• Data source: DIGITAL AGENDA FOR EUROPE (EU)</li> </ul>		
<p><b>The conditions for and barriers to implementing interventions in this key area of change:</b> The need to define fields/areas of use of ICT that can be considered promising fields with a high added value, moreover with sufficient background in the form of R&amp;D, university or private capacities in the Czech Republic</p>		
<p><b>Strategic objective E.3: The development of infrastructure in ICT</b> A high-quality, high-capacity and high-end infrastructure corresponding to latest knowledge and technology as a basis for the development of the use of ICT across the entire society. Sufficient capacity, technological facilities and security of public data centres and networks providing the facilities both for the functioning of eGovernment and for the development of the use of ICT in all promising fields. High-capacity, technologically adequately equipped centres essential for the development, testing and further development of new possibilities for the use of ICT in public administration and the economy, with specialist personnel capacities capable of assisting in meeting the objectives for the development of eGovernment and eBusiness.</p>		
<p><b>Specific objectives</b></p>	<p><b>Indicators of the specific objective</b></p>	<p><b>Model activities/projects/operations</b></p>
<p><b>E.3.1: The development of ICT used for research and development</b> High-quality, high-capacity, technologically adequate and regularly upgraded infrastructure for R&amp;D in the area of ICT and the use of ICT in all associated promising fields. A national communication network – whose capacity, reliability, security and utility correspond to the latest standards and requirements – providing the interconnection of both R&amp;D organisations in the area of ICT and all other R&amp;D organisations, including their connection to relevant international core networks.</p>	<p>- Increased capacity and safety of the network interconnecting R&amp;D organisations - The capacity of the R&amp;D network - 100% of public R&amp;D organisations connected to the core network</p>	<p>- The building of new higher-capacity and more secure networks or the modernisation and development of the existing networks that connect R&amp;D organisations to each other and to selected public administration institutions; - Investments in the regular maintenance, modernisation and development of the network so that it meets European standards for security and capacity;</p>
<p><b>E.3.2: Increasing the capacity and quality of public ICT infrastructure</b> High-quality, high-capacity, secure and accessible</p>	<p>- More than 90% of public administration offices at the level of municipalities with extended competence or higher will be connected to a network with a minimum</p>	<p>- The development of high-capacity and modern infrastructure (NGA, LTE) - The renewal of HW so that public administration can</p>

<p>public infrastructure serving as a basis for the eGovernment services being offered.</p>	<p>capacity of 100 Mbit</p> <ul style="list-style-type: none"> <li>- More than 50% of public administration offices will be equipped with the IPv6 protocol.</li> <li>- More than 50% of public administration offices will be connected to public or private data centres offering cloud services</li> </ul>	<p>provide services at a high-quality, while meeting the safety standards of public administration and any other standards, for example in the latest IPv6 protocol</p>
<p><b>E.3.3: Improving the accessibility of infrastructure</b> High-quality, high-capacity and secure access to the Internet for the entire population as a basis for greater use of eGovernment and the development of eBusiness.</p>	<ul style="list-style-type: none"> <li>- Fulfilling the objectives of the Digital Agenda at the level of the EU, i.e. a minimum Internet connection speed of 30Mbit/s for all citizens and 100 Mbit/s for a half of the citizens by 2020</li> <li>- Increased transmission capacity of Internet connection in remote areas</li> <li>- Increased share of remote areas with high-capacity Internet connection coverage</li> </ul>	<ul style="list-style-type: none"> <li>- Investments in modernising and increasing the capacity of public networks that connect public administration offices to a level that corresponds to European standards and the expected needs with a view to 2020;</li> <li>- Investments in the development of high-capacity internet connection in remote areas and other locations that are not sufficiently attractive to private investors;</li> </ul>
<p><b>The strategies and national documents to which the strategic and specific objectives are related:</b></p> <ul style="list-style-type: none"> <li>• Digital Czech Republic v 2.0 – The Road to the Digital Economy (MIT)</li> <li>• Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic – updated in May 2011 (MEYS)</li> <li>• Data source: DIGITAL AGENDA FOR EUROPE (EU)</li> </ul>		
<p><b>The conditions for and barriers to implementing interventions in this key area of change:</b></p> <ul style="list-style-type: none"> <li>• Legislative modifications enabling the introduction of eGovernment services in full, i.e. in a form where all the communication between the office and the client will take place using electronic communication, without the need for physical contact or the need to supply any documents or any other information in written/printed form.</li> </ul> <p><b>Barriers:</b></p> <ul style="list-style-type: none"> <li>• In some areas, competences were not clearly defined until recently</li> <li>• Most changes require not only investments in infrastructure, but also extensive procedural changes including legislative changes so that eGovernment services can be introduced in full – this requires a longer timeframe and a well-conceived, strategic and systematic implementation process;</li> <li>• The unprofitability of some interventions (NGA in rural areas)</li> </ul>		

## 6.5. Social innovation

### **Key area of changes F: Improvement and better utilisation of social capital and creativity in addressing complex social challenges**

Europe faces unprecedented problems that threaten its currency, economy and social model. More than ever it is in desperate need of social innovations that will provide new and more efficient responses to tackle social challenges, to involve local actors to find responses to complex social and community needs and to bring together different actors for joint activities using new models of co-operation. Social innovations can be defined as the development and implementation of new ideas (products, services and models) satisfying social needs and establishing new social relationships and forms of cooperation aimed at improving the quality of human life. As opposed to “common innovations”, social purpose and added value, both economic and social, is a specific driver for “social innovations”. Social innovations are part of a wider concept of innovations that is turning away from the narrow concept of technologically-based innovations. Europe is lacking not only social innovations, but also instruments to incorporate those innovations that have proven their worth into mainstream public policies. More than ever it is desirable to support new partnerships of public, private and non-profit organisations and give them an opportunity to experiment in seeking new ways and responses to social problems through social innovations. It is necessary to provide safe room for creating and testing each social innovation, whose success is in many cases dependent on local conditions and the environment of their implementation, while also acknowledging the possibility of failure or their wrong direction. Territorial Employment Pacts (European Commission, 2013) are one of the successful examples of social innovations supported in the past by the European Commission that have made their way into the mainstream policy framework.

For the Czech Republic, social innovations will be an option how to improve and better utilise social capital and creativity while addressing complex social challenges. The first of these challenges is reflected in the National Priorities of Oriented Research, Experimental Development and Innovation up to 2030, the meaning and impact of which will increase over time and will have to be tackled with the same or even less amount of public resources. The second challenge is the low quality of public administration, which is one of the major disincentives to the competitiveness of the Czech Republic, as noted by many international studies and strategic documents<sup>210</sup>.

A common prerequisite for successfully addressing complex social challenges is the direct involvement of key actors in various forms of open co-operations partnerships. The main factors demonstrating the usefulness and added value that may be achieved by co-operation, include mainly the following: (a) targeting – by collecting opinions and input from actors from various classes of society, it is possible to more effectively determine the needs and priorities and act accordingly; (b) coordination – political measures and the targeting of programmes can be synchronized based on local conditions to increase their impact and eliminate duplicities; (c) access to resources – each of the problems and obstacles may be addressed and removed more effectively thanks to the access to various technical, human, knowledge-based, physical and financial resources; (d) social capital – contacts between organisations and mutual relationships in partnerships strengthen social networks and links, and promote mutual learning and better understanding of the values and importance of

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<sup>210</sup> E.g. Global Competitiveness Index 2013-14 (WEF) where the Czech Republic ranks 146th with regard to the trust in politics and 135th with regard to negative impact of government regulations out of 148 countries rated, or the International Competitiveness Strategy of the Czech Republic for 2012 to 2020.

partners and their role in the society; (e) innovations – the sharing of different perspectives, ideas and sources encourages more creative and dynamic approaches to social issues; (f) empowerment – improved capacity and direct involvement of key actors allows partners to voice their concerns more loudly about issues that concern them within the political arena; (g) legitimacy – wider mobilisation of those whom the issues concern, provides a more democratic “mandate for action” and promotes good administration; the involvement and support of organisations with “trust” of the community may contribute to the acceptance of strategic changes by the public; (h) stability – taking into account the interests of the civil society in the process of strategic planning, joint involvement in local projects and higher level of satisfaction with public policy will contribute to the integration and cohesion of the society, and (i) sustainability – the promotion of social inclusion, joint ownership and mutual advantages and co-operation of a larger number of entities may result in positive changes and better solutions to social challenges than if they were tackled by a single sector or institution. In the Czech Republic, the building of partnership is in an early stage; therefore it is necessary to improve the professional, technical and financial capacities for building partnerships.

<b>Key area of change F: Improvement and better utilisation of social capital and creativity in addressing complex social challenges</b>		
<b>Strategic objectives in the key area of change:</b> <b>F.1: Promoting open partnership co-operation while seeking experimental solutions to address social challenges and systemically utilising successfully proven models</b> <b>F.2: Promoting and better utilising co-operation of local actors in addressing problems in the area of employment, economic development and social inclusion in regions of the Czech Republic</b>		<b>Indicators of strategic objectives/key area of change:</b> <ul style="list-style-type: none"> <li>• Number of successfully proven and used experimental solutions</li> <li>• Number of regions, in which Territorial Employment Pacts (meeting key OECD and EU standards ) were established and are functional</li> <li>• Number of regions that have and implement integrated employment development programmes based on the TEP platform</li> </ul>
<b>Strategic objective F.1: Promoting open partnership co-operation while seeking experimental solutions to address social challenges and systemically utilising successfully proven models</b> The strategic objective is to promote experimental solutions to address social challenges through new forms of open partnership co-operation, new technologies and new business models. Social challenges are reflected in National Priorities of Oriented Research, Experimental Development and Innovation up to 2030, i.e.: <ul style="list-style-type: none"> <li>• Competitive knowledge-based economy</li> <li>• Sustainability of the energy sector and material resources</li> <li>• Environment for quality life</li> <li>• Social and cultural challenges</li> <li>• Healthy population</li> <li>• Safe society</li> </ul>		
<b>Specific objectives</b>	<b>Indicators of the specific objective</b>	<b>Model activities/projects/operations</b>
<b>F.1.1: Promoting open partnership co-operation while seeking experimental solutions to address social challenges and systemically utilising successfully proven models</b>	<ul style="list-style-type: none"> <li>▪ Number of successfully proven and used experimental solutions</li> </ul>	<ul style="list-style-type: none"> <li>▪ Creation and application of the system for testing (accelerator) and evaluating social innovations and subsequently disseminating and systemically using successful solutions</li> </ul>
<b>Strategic objective F.2: Promoting and better utilising co-operation of local actors in addressing problems in the area of employment, economic development and social</b>		

### **inclusion in regions of the Czech Republic**

The strategic objective is to change current models of good administration in the area of employment, economic development and social inclusion. In particular, in this area it is important to promote elements of multi-level administration with active involvement of partnership in creating and implementing relevant strategies and policies. There is already an involvement of social partners in this area at the highest political level, with well-established tripartite negotiations at the national and regional levels. These partners can also mobilise ad-hoc working teams and specific solution in case of crisis development of the economy as witnessed in recent years. However, employment, economic development and social inclusion are topics with permanent relevance and they require continuous activities of a wide range of partners in different sectors and at all levels of government. Therefore, the use of long-term functional partnerships and employment pacts, which is recommended by both OECD and the European Commission, is an important tool<sup>211</sup>. The most suitable and best available example of the systemic use of such partnership is Austria and its TEPs (Territorial Employment Pacts) in all federal countries, which are methodically supported by a Coordination Unit. It is even more important, as this example of good practice is slowly finding its way into the Czech Republic where the first Employment Pact was created in the Moravian-Silesian Region in 2011, as a result of direct inspiration by the Austrian model, which is gradually sharing its experience with interested parties in all regions of the Czech Republic. The strategic objective will be achieved through transferring these activities, which were initiated from the bottom-up, into the system of partnership co-operation in employment, economic development and social inclusion that is supported and used by the state.

<i>Specific objectives</i>	<i>Indicators of the specific objective</i>	<i>Model activities/projects/operations</i>
<b>F.2.1: Promoting and better utilising co-operation of local actors in addressing problems in the area of employment, economic development and social inclusion in regions of the Czech Republic</b>	<ul style="list-style-type: none"> <li>▪ Number of regions, in which TEP – Territorial Employment Pacts (meeting key OECD and EU standards ) were established and are functional</li> <li>▪ Number of regions that have and implement integrated employment development programmes based on the TEP platform</li> <li>▪ 100% involvement of TEPs in creating and implementing relevant EU and Czech strategies and policies at regional and local levels up to 2015</li> </ul>	<ul style="list-style-type: none"> <li>▪ The creation of the standard for the activities of TEPs in the Czech Republic and an evaluation system for their evaluation</li> <li>▪ The establishment and development of TEPs in regions of the Czech Republic as “bottom-up” initiatives with defined parameters of the required services (single model – regionally adapted solutions)</li> <li>▪ Integrated employment development programmes in the regions prepared based on the TEP platform</li> <li>▪ Regional observatories of the labour market and competitiveness</li> <li>▪ Coordination Unit for methodological and organisational support of TEP</li> <li>▪ Leadership Academy – a training programme for key TEP representatives and high-ranking officials from co-operating ministries and other central institutions</li> <li>▪ Sharing and mainstreaming of good practice examples</li> </ul>

#### **The strategies and national documents to which the strategic and specific objectives are related:**

- International Competitiveness Strategy of the Czech Republic for 2012–2020

<sup>211</sup> See the Vienna Action Statement on Partnerships (OECD LEED Forum on Partnerships, Vienna 2007) and the identification of key roles of partnerships in implementing the Europe 2020 strategy.

- National Priorities of Oriented Research, Experimental Development and Innovations
- The conditions for and barriers to implementing interventions in this key area of change:**
- Full understanding of and effective support for social innovations in the Czech Republic
  - Correct programming of social innovations into ESIF in the Czech Republic, using both the ESF (especially in OP E and OP RDE) and the ERDF (especially in OP EIC and IROP)
  - Promotion of partnerships as a fundamental form for social innovations
  - Simplification of administration for better access of partnerships to financing
  - Allowing for integrated approaches and tools to address complex social challenges
  - Possibility to experiment in the area of social innovations
  - Creating the conditions for the testing/verification/measurement of experimental solutions
  - Creating the conditions for systemic use of well-proven and tested experimental solutions

### 6.6. Responsibility for the implementation of strategic objectives in each key area of change:

Title of key area of change and strategic objective	Responsibility for implementing interventions pursuant to government resolution	Recommendation to implement interventions pursuant to government resolution
<b>Key area of change A: Higher innovation performance of companies</b>		
Strategic objective A.1: Increasing the innovation demand in companies (and in the public sector)	MIT	Prague
Strategic objective A.2: Increasing the level of enterprise in the society, with emphasis on the establishment of new, fast growing companies	MIT	Prague
Strategic objective A.3: Increasing the internationalisation of SMEs	MIT	Prague
<b>Key area of changes B: Improved quality of public research</b>		
Strategic objective 1: Improving the quality and problem-orientation of research in knowledge domains that are relevant for intelligent specialisation	MEYS	Prague
<b>Key area of change C: Increasing the economic benefits of public research</b>		
Strategic objective C.1: Increasing the relevance of research to the needs of the application sector	MEYS	
<b>Key area of change D: Improved availability of HR, in terms of both quality and quantity, for innovative enterprise, research and development</b>		
Strategic objective D.1: Improving the quality of school graduates	MEYS	Prague
Strategic objective D.2: Identifying and making use of talent	MEYS	Prague



Strategic objective D.3: Improving the quality of research and development staff	<b>MEYS</b>	<b>Prague</b>
<b>Key area of changes E: Development of eGovernment and eBusiness to improve competitiveness (development of ICT and digital agenda)</b>		
Strategic objective E.1: <i>The development of eGovernment</i>		<b>MLSA, MI</b>
Strategic objective E.2: <i>The development of eBusiness and ICT in enterprise</i>	<b>MIT</b>	
Strategic objective E.3: <i>The development of infrastructure in ICT</i>	<b>MEYS, MIT</b>	<b>MI</b>
<b>Key area of change F: Improvement and better utilisation of social capital and creativity in addressing complex social challenges</b>		
Strategic objective F.1: Promoting open partnership co-operation while seeking experimental solutions to address social challenges and systemically utilising successfully proven models		<b>MLSA</b>
Strategic objective F.2: Promoting and better utilising co-operation of local actors in addressing problems in the area of employment, economic development and social inclusion in regions of the Czech Republic		<b>MLSA</b>

## 7. Management and implementation of the Smart Specialisation Strategy (RIS3) at national and regional level

The building of structures for managing and implementing the RIS3 is coordinated with the building of structures for managing and implementing operational programmes, especially OP RDE, OP EIC, OP PGP and OP Employment, which are the main programmes through which the RIS3 will be implemented. The National Smart Specialisation Strategy (RIS3) was prepared under the responsibility of the Ministry of Education, Youth and Sports in co-operation with the representatives of the above mentioned operational programmes, representatives of regions and institutions responsible for the management of research, development and innovations in the Czech Republic and entrepreneurs.<sup>212</sup>

### 7.1. Implementation structures of the National RIS3 and regional implementation structures

#### 7.1.1. RIS3 national level

The Ministry of Education, Youth and Sports is responsible for preparing the National RIS3. Once the National RIS3 is approved and its implementation starts, the responsibility for managing the National RIS3 will transfer to the Office of the Government of the Czech Republic – Science, Research and Innovations Section.

#### ***RIS3 National Coordination Council***

During the preparation of the RIS3, the top-level coordination is provided by the National Coordination Council for Smart Specialisation presided over by an authorised deputy minister of the Ministry of Education, Youth and Sports. The council is comprised of the representatives of MEYS and other ministries that are affected by the planned RIS3 activities – i.e. especially MIT and also MRD (which is the National Coordination Authority for ESIF) as well as the Research, Development and Innovation Council, MI CR and MoA. Apart from central authorities, the RIS3 Coordination Council

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<sup>212</sup> The National RIS3 is coordinated with the “Mapping of Innovation Potential of the Czech Republic – INKA 2014+” project, which is implemented by the Technology Agency of the Czech Republic in co-operation with the MEYS and MIT. In the above project, the methodology for mapping the innovation capacity will be prepared and verified in practice, i.e. analytical materials will be prepared that will characterise the innovation system in the Czech Republic, analyse the position of the Czech Republic in terms of innovation performance and knowledge-based economy, and provide qualitative information concerning the regime of innovations in Czech companies and research organisations, including the characteristics of their co-operation.

Due to the timing of both projects, the results of analyses within the innovation potential mapping project cannot be incorporated into the National RIS3 in full. However, the results will serve during the implementation of the National RIS3 as the basis for designing specific interventions, planning calls under relevant operational programmes, targeting individual support instruments etc. From the perspective of the “entrepreneurial discovery” process, the innovation capacity mapping project represents one of the major inputs for further decision-making, for the work of innovation platforms, for additional specification of specialisation domains and, among others, also for the evaluation of the results of on-going interventions.

includes local self-government (regions, towns and municipalities) through the representatives of its associations (Association of Regions and Union of Towns and Municipalities), and also partners representing the research sector (AS CR, TA CR, Association of Research Organisations, Czech Rectors Conference) and partners representing the business sector (Confederation of Industry of the Czech Republic, Chamber of Commerce of the Czech Republic). At the moment, the National Coordination Council meets as required.

### ***RIS3 Management Committee***

Once the National RIS3 has been approved, its implementation will start and the responsibility will be transferred to the Office of the Government of the Czech Republic – Science, Research and Innovations Section that will become the supreme authority for managing the RIS3 in the Czech Republic. The National RIS3 manager (please see below) will be the Secretary of the RIS3 Management Committee.

The members of the RIS3 Management Committee will be:

- Deputy Prime Minister for Science, Research and Innovations
- Deputy Minister of Education, Youth and Sports for the management of OP RDE
- Deputy Minister of Education, Youth and Sports for universities and research
- Deputy Minister of Industry and Trade for the management of OP EIC
- A representative of the Capital City of Prague representing the Managing Authority of the OP Prague – the Growth Pole of the Czech Republic

In addition, the following persons will be invited to participate:

- A representative of the Ministry of Finance for public budgets
- A representative of the Ministry for Regional Development
- A representative of the Ministry of Labour and Social Affairs
- A representative of regions

Based on the contents of the themes discussed, the Management Committee may also invite guest at its discretion.

The RIS3 Management Committee will:

- discuss the National RIS3 and its updates including the related action plan and its updates,
- discuss and propose measures for the monitoring of the National RIS3,
- discuss proposals for interventions and issue recommendations, especially with regard to achieving the objectives of the National RIS3,
- discuss and approve annual monitoring reports and reports on the progress of the implementation of the National RIS3,
- discuss specialisation domains and proposals for their changes and further specification,
- coordinate the implementation of the National RIS3 with different ministries,
- monitor and discuss the fulfilment of national priorities, especially with regard to synergies between the relevant operational programmes and expenditure from the state budget,

- discuss reports on the implementation of RIS3 interventions and submit reports to the Government of the Czech Republic concerning the fulfilment of the objectives of the National RIS3.

The RIS3 Management Committee will also discuss conceptual and strategic issues related to the management of the RIS3. The RIS3 management Committee also comments on planned calls under relevant operational programmes and recommends the material targeting of interventions in line with the contents of the operational programmes concerned. However, the general management of operational programmes lies exclusively within the competence of their Managing Authorities.

The Management Committee will meet as required, usually 4 times per year.

The activity of the Management Committee will be regulated by rules of procedure.

The Management Committee has not yet been established.

### ***RIS3 National Manager***

The position of the RIS3 National Manager will be established within the Science, Research and Innovations Section of the Office of the Government of the Czech Republic, which will be responsible for managing and coordinating the implementation of the National RIS3. The RIS3 National Manager will be senior representative of the executive component for managing and coordinating the RIS3.

The role of the RIS3 National Manager:

- has the role of the secretary of the RIS3 Management Committee,
- using the capacities of the analytical team, he/she prepares proposal and reports for the RIS3 Management Committee, including reports on the progress of the implementation of the National RIS3, monitoring reports and reports on the fulfilment of the objectives of the National RIS3,
- prepares the implementation plan of the RIS3,
- following the approval by the RIS3 Management Committee he/she establishes National Innovation Platforms as required,
- structures the work and sets the schedule of activities of National Innovation Platforms,
- convenes meetings of National Innovation Platforms and presides over them,
- submits proposals and initiatives made by National Innovation Platforms to the RIS3 Management Committee and to the Managing Authorities of relevant operational programmes,
- coordinates and supervises over the implementation of the National RIS3 through operational programmes and communicates with managing authorities in this regard,
- participates in meetings of operational programme monitoring committees, through which the National RIS3 is implemented,
- coordinates and supervises the implementation of the National RIS3 through national resources and coordinates their utilisation for the fulfilment of the National RIS3 objectives in synergy with resources of relevant operational programmes so that their close interconnection is achieved within the long-term financing of the National RIS3 vertical priorities (interventions promoting smart specialisation) both from national sources and from resources of relevant operational programmes,
- prepares “monitoring reports”, documents etc.,

- does not interfere with the management of operational programmes, which is within the exclusive responsibility of the Managing Authority.

The position of the RIS3 National Manager has not yet been established.

### ***Analytical team***

To support the activities of the RIS3 National Manager, an analytical team will be established. Regional RIS3 managers will be part of the analytical team of the RIS3 manager.

The roles of the analytic team will be:

- to obtain information and documents concerning the implementation of interventions contributing to the fulfilment of RIS3 objectives and to prepare documents for the RIS3 National Manager and the RIS3 Management Committee,
- to monitor the implementation of the National RIS3 and prepare monitoring reports using documents from operational programmes and other resources,
- to gather, prepare and evaluate information on the development of the innovation system in the Czech Republic and to prepare proposals for updates of the National RIS3, including proposals for elaboration, specification and selection of knowledge domains/specialisations .

Secretaries of innovation platforms with responsibility for the preparation of documents for innovations platforms, communication with innovation platforms and maintenance of their agenda will be chosen from the analytical teams.

### ***National innovation platform***

The national innovation platforms are consulting groups that are established by the RIS3 Management Committee through the RIS3 National Manager. For the proposed specialisation domains, national innovation platforms are established. The innovation platforms are forums that have initiation and recommendation character. In the first round, the below 4 national innovation platforms were convened, but their number will be further specified during the “entrepreneurial discovery process”, which will lead to the thematic focus, diversification and selection of the proposed specialisation domains:

- Mechanical engineering + electricity production and distribution + electrical engineering related to the above sectors
- IT services and software + electronics and electrical engineering related to the above sectors
- Manufacture of transport equipment
- Drugs and medical technologies

The following persons are represented in national innovation platforms:

- Representatives of major application sector players/users of the R&D results (especially companies, but also e.g. medical facilities). Representatives of large companies and SME, both with research activities, will also be represented.
- Representatives of leading research organisations with an aim to identify knowledge domains (KETs) and link them to application areas.
- Representatives of public administration, such as market regulators in the relevant fields and so on.

The number of members of innovation platforms will vary from 15 to 20 persons. National innovation platforms are presided by the RIS3 National Manager.

Roles of national innovation platforms:

- to comment on proposed horizontal interventions, especially with regard to their contribution to the objectives of the National RIS3,
- to discuss and recommend the profiling, targeting and specification of specialisation domains at national level during the “entrepreneurial discovery process”,
- to provide feedback to the RIS3 National Manager and Management Committee regarding the long-term needs of the business and research sector with regard to annual and longer planning in the area of the RIS3 RDI Management Committee and the Office of the Government of the Czech Republic – Science, Research and Innovations Section,
- to provide feedback to the RIS3 Manager and RIS3 Management Committee regarding the interventions being prepared and on-going and completed interventions, especially with regard to their efficiency, effectiveness and contribution to the objectives of the National RIS3,
- to give recommendations to the RIS3 National Manager and RIS3 Management Committee.

National innovation platforms were established in 2014<sup>213</sup>. National innovation platforms will meet as required, usually twice per year.

They may be convened on the initiative of the RIS3 National Manager or a member of the RIS3 Management Committee.

### ***RIS3 implementation plan***

Following the approval of the National RIS3, the Implementation Plan of the National RIS3 will be created. It is prepared by the National RIS3 Manager and his/her team using information and documents from operational programmes and national programmes that contribute to fulfilling the objectives of the RIS3. The RIS3 Implementation Plan summarises information about interventions that are planned for at least one year and it includes interventions that are planned within the calls of operational programmes and within national programmes for the support of R&D. The RIS3 Implementation Plan is discussed and approved by the National RIS3 Management Committee and the Government of the Czech Republic is notified.

The Implementation Plan includes a list of upcoming interventions for a period of at least one year, indicating in particular the following information:

- Title and brief description of the intervention and its objectives
- Person/organisation responsible for preparing and managing interventions
- The financial scope of the intervention, including the source, if ESIF funds are used then an indicative breakdown to national and EU resources must be included

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<sup>213</sup> National innovation platforms met in early October 2014. Their meeting was preceded by the Delphi survey to verify and complement the proposed intervention. The innovation platforms, or meetings of entrepreneurs and researchers, represent the “entrepreneurial discovery” process, which is a key process for the preparation and management of the RIS3.

- Expected results of the intervention and how and to what extent it will contribute to the objectives of RIS3
- Indicative timetable of the intervention

The Implementation Plan will be prepared for the first time in the first half of 2015 for the period 2015–2016. Its updates are carried out annually. In its preparation, the National RIS3 manager works closely with the managing authorities and intermediate bodies of relevant operational programmes and national programmes through which the National RIS3 is implemented.

### **7.1.2. National level of operational programmes – OP RDE, OP EIC, OP PGP**

Operational programmes were defined through Resolution of the Government of the Czech Republic No 867 of 28 November 2012 regarding the preparation of programmes co-financed from the funds of the Common Strategic Framework for the 2014–2020 programming period. Through that resolution, the MEYS was tasked with managing the OP RDE, the MIT was tasked with managing the OP EIC, and the MEYS was tasked with managing the OP Employment<sup>214</sup>.

The so-called Smart Accelerator is being prepared as part of OP RDE to promote the development of regional partnerships and improve the institutional capacity in regions, with an aim to support the functioning of regional partnerships, regional RIS3 managers and project managers for the preparation and implementation of interventions/projects at regional level. As part of the Smart Accelerator, it will be possible to implement some types of projects that are proposed in regional annexes and are in line with the National RIS3. However, these will not be investment projects<sup>215</sup>. Regional self-governments or other applicants determined in the OP will apply for these projects in a way similar to any other projects. Neither regions nor other entities at the regional level will play the role of an intermediary body in this operational programme.

The implementation of projects, for which the applicants may apply at the national level is envisaged in OP EIC. It is assumed that the applicants from regions will include various regional entities that are actively involved in the regional innovation system – such as innovation centres, Science and Technology Parks, Regional Development Agencies etc. that will be applying for projects. The regions will act neither as intermediate bodies nor beneficiaries of grant schemes within the implementation system of the operational programme.

In Prague, OP EIC interventions in regions are complemented by the Operational Programme Prague – the Growth Pole (OP PGP), i.e. not within the entire spectrum of activities due to its budget. The National RIS3 as also an ex-ante conditionality for the OP Prague – the Growth Pole.

For all three operational programmes it is assumed that the role of regional partnerships (see below) will be a consulting one, i.e. also in the case of OP PGP.

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<sup>214</sup> The National RIS3 is an ex-ante conditionality for some interventions of OP EIC, OP RDE (except for education) and OP PGP, however, due to the fact that it also includes the theme of social innovations, it also relates to OP Employment, even though it is not an ex-ante conditionality for this programme.

<sup>215</sup> An exception may be the purchase of hardware and software for the needs of Smart Accelerator staff, provided that this expenditure will be included among eligible expenditure in the relevant OP and call. The RIS3 does not anticipate eligible expenditure. However, interventions within the Smart Accelerator cannot include construction investments or the purchase of scientific instruments or equipment for research and development.

Specific conditions for implementing the National RIS3 through OP, eligible applicants and other details will be specified in relevant operational programmes and individual calls.

### 7.1.3. Regional level

#### ***Regional Councils for Innovations***

At the level of regions, coordination authorities were established for RIS3 in the given region, which are an analogy to the RIS3 National Coordination Council and RIS3 Management Committee. Usually, these are regional councils for innovations/competitiveness – they are named depending on the specific situation and customary practice in the given region, as in some regions that successfully implement their regional innovation strategies, implementation structures already exist and they will be tasked with the role of the coordination authority. The representatives of self-government (regional and city, especially metropolitan areas), innovation businesses and research organisations are represented in the regional council for innovations or competitiveness.

The role of regional councils for innovations is similar to the role of the RIS3 Management Committee, provided that their competence applies to interventions that are proposed in the regional annexes to the National RIS3. The role of regional councils for innovations/competitiveness in the regions is determined by local conditions. In general, they have a coordinating and recommendatory role, not an executive role; in relation to interventions that are implemented within the responsibility or from the resources of regional self-governments, they have an advisory role. Similarly, in matters relating to the promotion of entrepreneurship, the application of the Act on Support for Research, Development and Innovations and the Higher Education Act, the competence of the regional councils for innovations or competitiveness is usually limited to the role of consulting platforms, but the situation in the different regions may vary<sup>216</sup>.

#### ***Regional innovation (business) platforms***

The supportive role in the formation of interventions/operations in regions is played by **regional innovation (business) platforms** that are named differently in different regions, in a way similar to regional councils for innovation. Innovation/business platforms are an advisory, consulting or working body of the regional council for innovation both in the fields on which the regional specialisation will be focused, and also in horizontal themes/areas of change at which the regional RIS23 are targeted. The role of regional innovation platforms is similar to the role of innovation platforms at the national level, and it primarily relates to the regional annexes to the RIS3 and to interventions that are implemented within the region from the national level. The role of regional innovation platforms is mostly an initiation, recommendatory and consulting one. In addition, regional innovation platforms provide feedback in the implementation of projects, the assessment of the results achieved, and the submission of proposals to strengthen the regional innovation system to the Regional Council for Innovations/Competitiveness. In matters concerning support for enterprise, the application of the Act on Support for Research, Development and Innovations and the Act on Higher Education, the competence of regional innovation (business) platforms is limited to a consulting role.

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<sup>216</sup> For example the Research, Development and Innovation Council of the Hradec Králové Region (RDIC HKR) fulfils the long-term role of an Expert Consulting Authority in evaluating public tenders in research, development and innovation that are announced by the Hradec Králové Region pursuant to Act No 130/2002 Coll., on support for research, experimental development and innovations, as amended.



### ***Regional self-government***

As it is assumed that, in addition to relevant operational programmes, regional budgets will also be a source of financing of specific regional interventions (at present mainly within OP RDE and OP PGP), **regional self-government** is one of the actors at the regional level that will implement specific interventions, mainly within OP RDE and OP PGP. The interventions will be implemented exclusively through projects, for which the regions will apply in individual calls in a manner that will be determined in the documents specifying the implementation of operational programmes. The financial resources or project, where regional self-government will be the beneficiary, are neither specified in advance nor guaranteed in the RIS3 or the operational programme.

Regional self-government may entrust the implementation of relevant interventions (provided that it wins the given project) to its own organisation, such as a development agency, innovation centre etc. in accordance with the rules on the protection of economic competition.

The operations may also be implemented from the budgets of other actors in the regions; regional self-government does not necessary have to participate in all interventions that are implemented from the regional level.

Specifically in the field of education there is a mechanism, proposed in the Partnership Agreement, stating that: “**In the field of regional education** a large portion of interventions will rely on the collection and evaluation of specific needs at both the regional and local levels. In co-operation with partners in the territory, these needs will be incorporated into regional and local action plans for the development of education, which will be used for the coordination and targeting of calls under OP RDE (PA 3), IROP (PA 2) and OP PGP (PA 4) and for improving the territorial concentration of investments. Synergies between OP RDE, IROP and OP PGP will be managed through the action plans.

### ***RIS3 regional manager***

At present, **RIS3 regional managers** are tasked with the role of coordinating and preparing the regional annexes to the National RIS3 and they also manage regional partnerships for preparing and implementing the RIS3. The RIS3 regional manager plays the role of the secretary of the Regional Council for Innovations/Competitiveness.

Currently, RIS3 regional managers are managed by MEYS and their role consists in supporting regional structures, building regional partnerships and promoting co-operation at the regional level. They prepare regional annexes to the National RIS3. RIS3 regional managers will be members of the analytical team of the RIS3 National Manager.

### ***Regional annex to the National RIS3***

Regional annexes to the National RIS 3 were developed in the regions. These annexes have multiple purposes:

- To complete the innovation system at the regional level, which is the main purpose, and regional annexes are one of the tools and documents for communication among major actors. In this case, it is about stimulating partnerships within the triple/quadruple helix and stimulating activities of regional players.

- To specify specialisation domains at the regional level. Regional domains may differ from national ones – they may refine them - or they may represent specialisation domains that are significant for the region but, since they are only concentrated in one or several regions, it is not appropriate for them to be defined at the national level.
- To identify regional interventions that respond to local conditions, both within the specialisation domains and within interventions of a general nature, which lead to the completion and strengthening of regional innovation systems.

The interventions proposed in the regional annexes will be implemented in various ways: (i) the proposed interventions serve as a basis for preparing projects that will seek support from sources and the national level, i.e. both from the resources of ESIF programmes and from national programmes; (ii) some interventions will be – to a limited extent – financed from regional budgets; (iii) interventions mainly in the area of capacity building at the regional level will be financed from the Smart Accelerator (see below).

### ***Smart Accelerator<sup>217</sup> – A tool for developing regional innovation systems***

Since the formation of regional innovation systems in most regions of the Czech Republic is in initial stages, this process requires targeted support. Support for RIS3 implementation in regions, including Prague capital city, and especially the strengthening of relevant institutional capacity (activity of regional managers, business/innovation platforms, support for generating appropriate types of pro-innovation schemes and projects) will be supported through OP RDE, for which a specific instrument is being prepared as part of this OP – the Smart Accelerator (see Chapter 7.1.2).

### ***Links to integrated territorial investments***

Regional standing conferences (RSC) are established for the purpose of coordinating and managing integrated territorial investments. In the specific territory of a self-governing region, the members of the Regional Standing Conference include a representative of the smart specialisation strategy (e.g. the regional RIS3 manager). Under the RSC, working sub-groups for regional RIS3 will be set up – the existing regional partnerships (generally referred to as “regional councils for innovation” in the National RIS3) belong to this sub-group, based on agreement with the MRD these should be termed as “expert platform for RIS3 under the regional standing conference”.

## **7.2. Monitoring, evaluation and updating of the National RIS3**

### ***Monitoring of the National RIS3***

The monitoring of the interventions through which the RIS3 is being fulfilled takes the form of monitoring reports that are prepared once a year. The monitoring reports are prepared by the National RIS3 Manager with support from the analytical team and are submitted to the RIS3

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<sup>217</sup> The Smart Accelerator is one of the possible tools for implementing the RIS3 strategy at the regional level.

Management Committee. The RIS3 Management Committee discusses and approves the monitoring reports. The monitoring report includes mainly the following:

- An overview of the drawing of resources that are used to implement the RIS3, broken down by the strategic objectives of the National RIS3, i.e. by:
  - ESIF programmes for operations through which the National RIS3 is implemented
  - state budget resources
  - regional budget resources
- An overview of implemented interventions broken down by strategic and specific objectives, indicating the amount of resources for these intervention.
- An overview of the fulfilment of indicators of the National RIS3 using the indicators of relevant OP, broken down by strategic objectives and specific objectives.
- Information on the progress of the implementation of the National RIS3 and the progress in fulfilling the objectives of the RIS3, using evaluation reports, analytical materials prepared by the analytical team etc.
- Information about meetings of innovation platforms and their proposals for the targeting of interventions.

In preparing the monitoring reports, the National RIS3 Manager and the analytical team work closely with the managing authorities of operational programmes and the intermediate bodies that provide information and documents concerning the contribution of each OP towards the fulfilment of the objectives and indicators of the National RIS3. Similarly, the organisations responsible for managing national R&D programmes provide the National RIS3 Manager with the information that is required for monitoring interventions.

The monitoring also includes preparing reports on the progress of the implementation of the National RIS3 and reports on the fulfilment of the objectives of the National RIS3, which are prepared 4 times a year. They mainly contain information about on-going interventions/operations, coordination of interventions between the different authorities that implement RIS3 interventions, and information on the results of the interventions. The implementation progress reports also include information about identified barriers to interventions and proposals for their elimination.

### ***Evaluation of the National RIS3***

Evaluations of the National RIS3 or its component parts, individual interventions or groups of interventions, and evaluations of various aspects of the implementation of the National RIS3 are prepared as needed, but at least once every two years in advance of updating the National RIS3. Evaluations are prepared by the National RIS3 Manager, either at his/her own discretion or upon decision of the RIS3 Management Committee. Evaluation reports are prepared either by the analytical team or by external evaluators, possibly a combination of both these methods. Evaluation

reports that are prepared in the period between RIS3 updates are one of the inputs for the proposed update of the National RIS3.

### ***Updates of the National RIS***

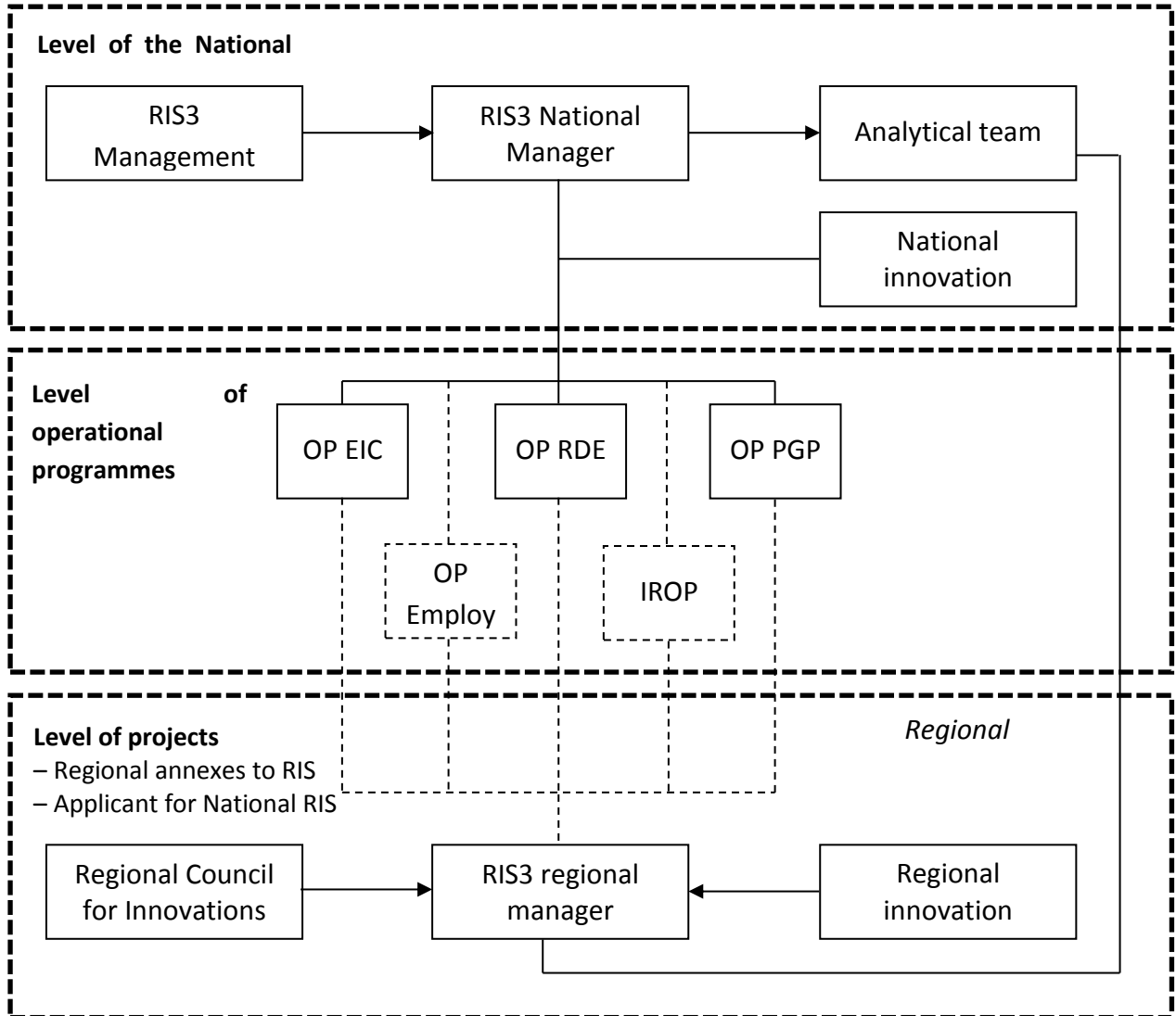
The National RIS3 is updated every two years. Underlying documents for the update of the National RIS3 are prepared by the National RIS3 Manager with support from the analytical team and are submitted to the RIS3 Management Committee. The RIS3 Management Committee discusses the proposed updates and submits them to the government of the Czech Republic for approval. The update of the RIS3 is prepared mainly on the basis of information that includes the description and analysis of:

- Changes in the environment, i.e. the description and analysis of problems and their causes as identified in the National RIS3 (changes relating to the analytical section of the RIS3).
- The progress of the interventions, their success and the progress in fulfilling the objectives of the National RIS3 and regional annexes, including the fulfilment of indicators.
- The progress of interventions that focus specifically on developing selected specialisation domains, including recommendations for the refinement or narrowing of the specialisation domains at the national level, or on identifying new specialisation domains in response to recommendations by innovation platforms based on analytical documents.
- Barriers to implementation and success of the proposals for their removal.

The inputs for updates of the National RIS3 include evaluation reports that are prepared in the period between updates. ***RIS3 management structure***<sup>218</sup>

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<sup>218</sup> Note: The OP Employment and IROP are mentioned because the interventions proposed in the National RIS3 also concern these programmes, however, the National RIS3 does not constitute an ex-ante conditionality for these OPs. Within the OP Employment, the proposals of the National RIS3 mostly concern social innovations, and within the IROP, they concern e-government in the broader sense.



## 8. Financing of the National RIS3 from operational programmes

### Indicative allocation of operational programme resources to RIS3 key areas of change (EUR)

Key area/strategic objectives	Operational programme/ specific objective	ESIF contribution	National co-financing (public + private)	Total	
Key area of change A: Higher innovation performance of companies	OP EIC	SO 1.1	974,888,932	974,842,633	1,949,731,565
		SO 1.2	339,889,931	339,873,790	679,763,721
		SO 2.1	609,428,042	293,096,703	902,524,745
		SO 2.2	56,540,420	27,192,400	83,732,820
		SO 2.4	8,459,483	4,068,481	12,527,964
		<b>TOTAL</b>	<b>1,989,206,808</b>	<b>1,639,074,007</b>	<b>3,628,280,815</b>
Key area of changes B: Improving the quality of research	OP PGP	PA 1	62,492,932	62,492,932	124,985,864
	OP RDE	PA2 SO5	55,434,927	9,782,634	65,217,561
	OP RDE	PA1 SO1	1,006,013,636	177,531,818	1,183,545,454
OP RDE	PA1 SO2				
Key area of change C: Increasing the economic benefits of public research	OP RDE	PA2 SO5	55,434,927	9,782,634	65,217,561
	OP EIC	SO 1.2	37,765,548	37,763,754	75,529,302
	Key area of change D: Better supply of HR, in terms of both quality and quantity, for innovative enterprise, research and development	OP RDE	PA2 SO1	599,600,013	105,811,767
PA2 SO4					
PA2 SO5			55,434,927	9,782,634	65,217,561
PA3 SO2			677,538,007	119,565,530	797,103,538
PA3 SO3					
PA3 SO5					
<b>TOTAL</b>	<b>1,332,572,947</b>	<b>235,159,931</b>	<b>1,567,732,879</b>		
Key area of changes E: Development of eGovernment and eBusiness to improve competitiveness (development of ICT and digital agenda)	OP EIC	SO 4.1	521,380,364	471,203,877	992,584,241
		SO 4.2	222,277,225	200,885,759	423,162,984
		<b>TOTAL</b>	<b>743,657,589</b>	<b>672,089,636</b>	<b>1,415,747,225</b>
	IROP	SO 3.2			
	OP Employment	SO 4.1.1	52,713,438	10,898,366	63,611,804
Key area of change F: Improvement and better utilisation of social capital and creativity in	OP Employment	SO 3.1.1	42,170,750	3,171,511	45,342,261

addressing complex social challenges	nt				
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Notes and legend:

- i. Allocations are based on the proposed allocations of operational programmes available in September 2014.
- ii. Allocation are indicative, as the list of model projects/activities in the proposal section of the RIS3 is not exhaustive.
- iii. Throughout the process of ensuring the participation of entrepreneurs and researches in RIS3 (entrepreneurial discovery process) the amounts of allocation may change as a result of this process.
- iv. The allocations do not take into consideration unique model projects/activities that may be financed from other operational programmes, such as Reconciling maternity and parental leave with a career in science and research, which may be funded from the OP Employment; these disregarded activities and interventions will not affect the fulfilment of the ex-ante conditionality, because they relate to thematic objectives, for which the RIS3 is not an ex-ante conditionality.
- v. For the OP EIC, zero co-financing of business entities from public resources is specified and, if sufficient absorption capacity of the OP EIC is demonstrated (i.e. if the committed share of ERDF resources is at least 15% higher than the sum of allocations for 2014–2017 as of 31 December 2017) and, at the same time, automatic cancellation of commitment is not applied in 2017, the government of the Czech Republic will decide on the increase of the contribution from the state budget up to 15% of the programme allocation (ERDF)<sup>1</sup>. If this condition is met, the OP EIC will receive national co-financing from the state budget up to EUR 761,658,109 in 2018–2020.
- vi. For OP EIC, SO 2.1, this objective concerns interventions of financial instruments and services of the innovation infrastructure especially for start-up entrepreneurs.
- vii. For OP RDE, financial allocations for entire priority axes are indicated. At this point, allocations for specific objectives are not available. PA2 SO 5 is the only exception.
- viii. For IROP, allocations for the given specific objective are not available.

### **National resources and synergies with Community programmes.**

The government-approved draft act on the state budget for 2015 with a view to 2016 and 2017 contains the following values in the “Expenditure on research, development and innovation” indicator:

<b>Year</b>	<b>Expenditure on research, development and innovation</b>
2015	CZK 26,90 billion
2016	CZK 26,56 billion
2017	CZK 26,56 billion

These resources will be used in accordance with Act No 130/2002 Coll., on support for research, experimental development and innovations.

The actual amounts of the national share in the financing of the RIS3 will be part of the interim evaluation that is always carried out by the Office of the Government for the past year.

In the financing of interventions supported within the various strategic and specific objectives of the Smart Specialization Strategy, it is envisaged that – in addition to funds ESIF resources and national sources – resources from some Community programmes will also be used, especially from Horizon 2020 (in key area of change B: Improving the quality of research, and to a lesser extent in other key areas of change) and the COSME programme (especially in key areas of change A: Higher innovation performance of companies). However, the specific use of these resources will depend on the success of the different Czech entities in the competition for grant resources. Interventions implemented within the Smart Specialisation Strategy will be configured in a way that allows maximum use of the potential synergistic effects of these resources, as indicated e.g. in the recommendation entitled Synergy Guide (EC, 2014), e.g. in the form of complementary calls within the OP RDE to strategically significant calls announced within Horizon 2020 (Teaming, EIT KICs, joint ventures under Article 187, etc.).



## 9. Annexes

**Table 9: Employment in industry in selected EU countries (share in pp), 2002–2013**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Change 2002–13
EU 27	26.1	25.7	25.4	25.2	25.0	25.0	24.8	23.8	23.1	23.0	22.6	22.4	-3.7
EU 15	24.8	24.4	24.0	23.7	23.4	23.3	23.0	22.1	21.5	21.2	20.9	20.6	-4.2
Czech Rep.	38.7	38.2	38.7	38.8	38.3	38.2	38.0	36.6	36.0	36.4	36.5	36.2	-2.5
Germany	27.5	26.9	26.4	25.8	25.5	25.4	25.5	25.0	24.6	24.7	24.7	24.7	-2.8
Hungary	32.3	32.0	31.5	31.0	31.0	31.0	31.0	30.1	29.4	29.7	29.5	28.9	-3.4
Austria	25.4	25.1	24.7	24.4	24.1	24.3	24.3	23.8	23.5	23.4	23.4	23.3	-2.1
Poland	:	:	29.1	29.5	30.2	30.9	31.8	30.9	30.0	30.4	30.2	30.3	1.2
Romania	31.7	30.7	33.2	32.0	32.3	31.5	31.5	29.8	28.8	28.9	28.7	28.8	-2.9
Slovenia	35.7	35.2	34.7	34.6	34.1	34.2	34.2	32.6	31.0	30.6	29.9	29.4	-6.3
Slovakia	33.7	34.2	33.8	33.9	34.0	33.9	34.4	32.6	32.1	32.1	31.6	31.2	-2.5

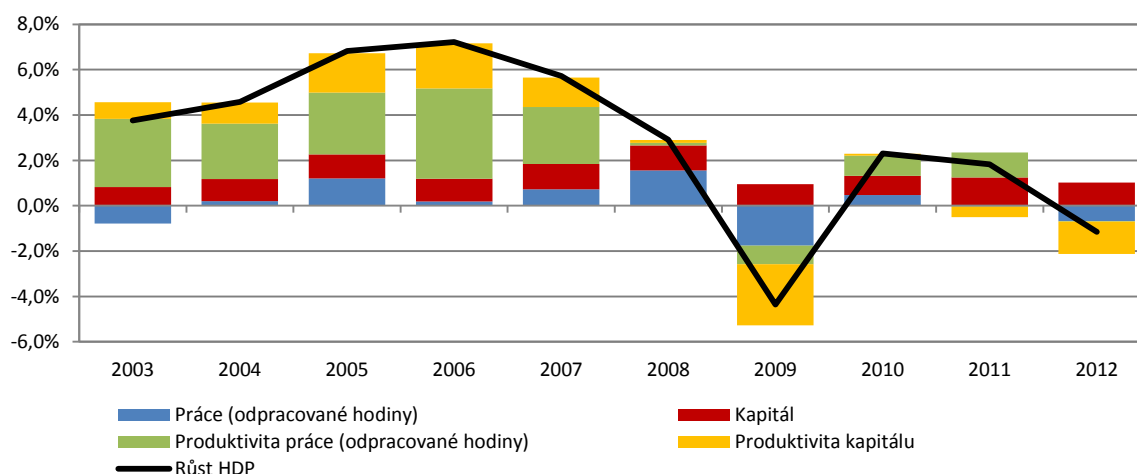
Source: Eurostat (Labour market – Labour Force Survey)

**Table 10: Newly established firms in the Czech Republic, 2000–2013**

	2000	2002	2004	2006	2008	2009	2010	2011	2012	2013
Newly established firms	102,886	64,084	84,908	84,979	116,367	117,288	120,475	117,652	104,952	99,287
Share in active economic entities	8.8%	5.1%	6.7%	6.8%	8.6%	8.7%	8.6%	8.1%	6.9%	6.7%

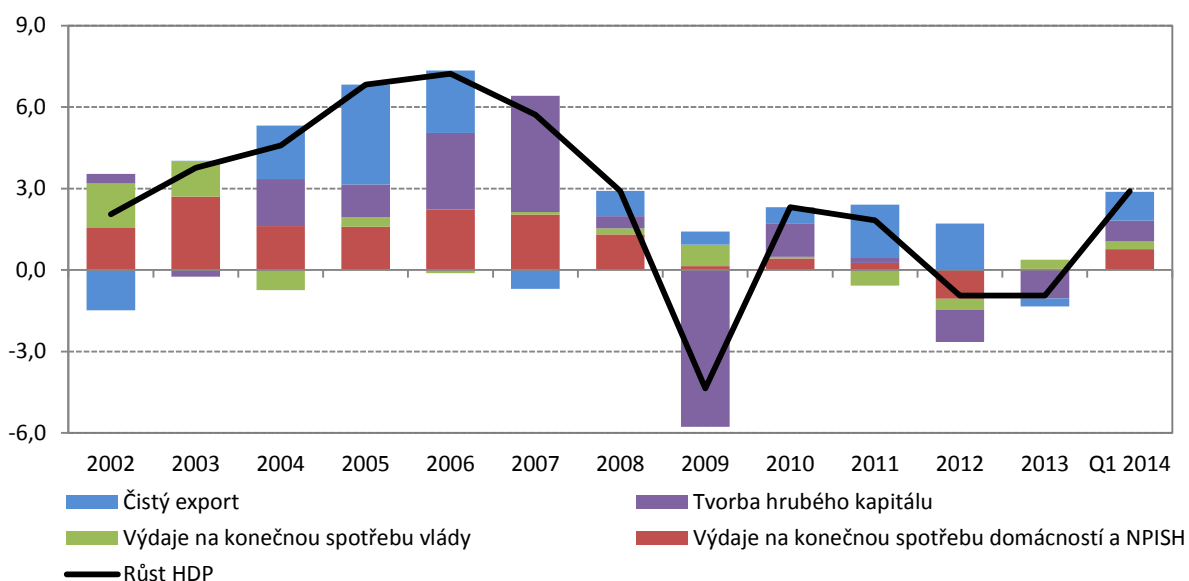
Source: CSO – Statistical Yearbook of the Czech Republic

**Chart 6: Contributions of sources of long-term GDP growth in the Czech Republic (constant prices, pp)**



Source: CSO – Trends and factors in macroeconomic development and quality of life in the Czech Republic in 2012

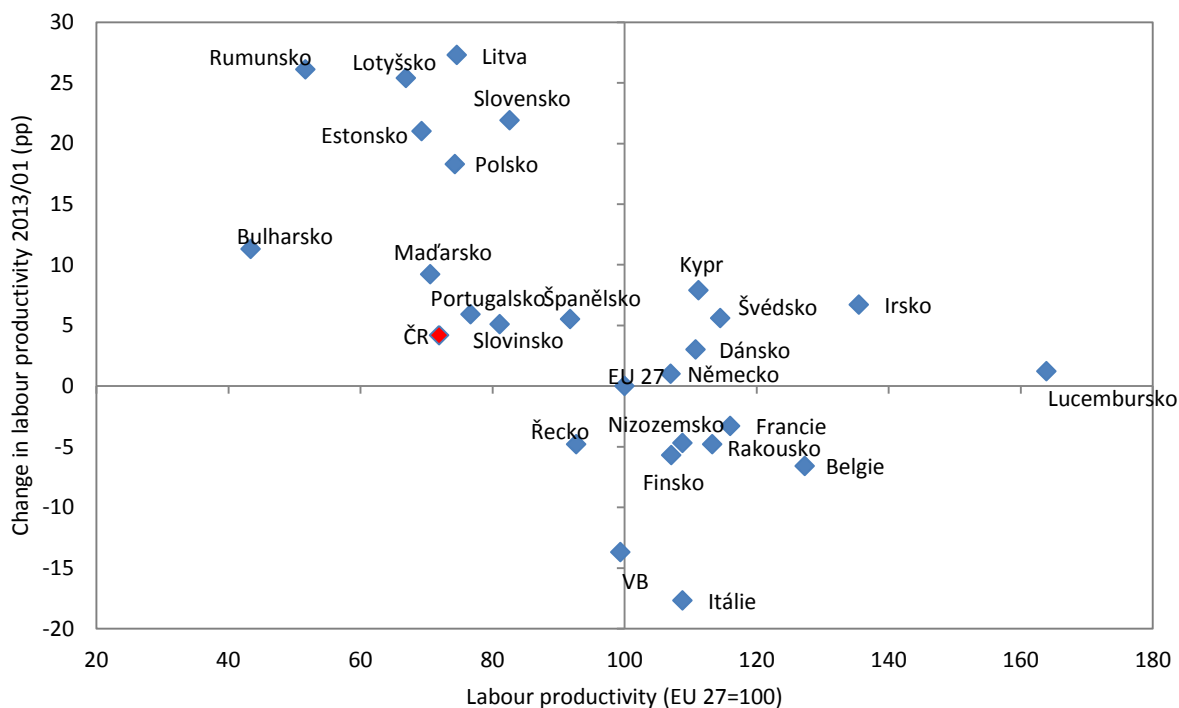
**Chart 7: Contributions to GDP growth on the expenditure side, trends in the Czech Republic in 2002–2013**



Note: NPISH – Non-Profit Institutions Serving Households as used by the CSO

Source: CSO – national accounts (Contributions to GDP development – time series of indicators of quarterly accounts)

**Chart 8: Labour productivity per employed person and its change in 2013–2001 (EU 27=100)**



Source: Eurostat – National Accounts

**Table 11: Gross territorial structure of foreign trade of the Czech Republic (CZK billion)**

	Exports (CZK billion)		Imports (CZK billion)		Balance	
	2012	2013	2012	2013	2012	2013
Total	3,062,779	3,173,543	2,752,018	2,820,403	310,761	353,140
Of which: Developed market economies	2,698,506	2,795,366	1,980,049	2,041,308	718,457	754,059
Of which: EU	2,473,592	2,557,099	1,763,581	1,829,584	710,011	727,515
Other developed market economies	224,914	171,872	216,468	152,476	8,446	19,395
Developing economies	124,703	129,592	212,195	209,870	-87,492	-80,279
Transition economies and CIS	202,108	199,183	237,962	239,983	-35,854	-40,800

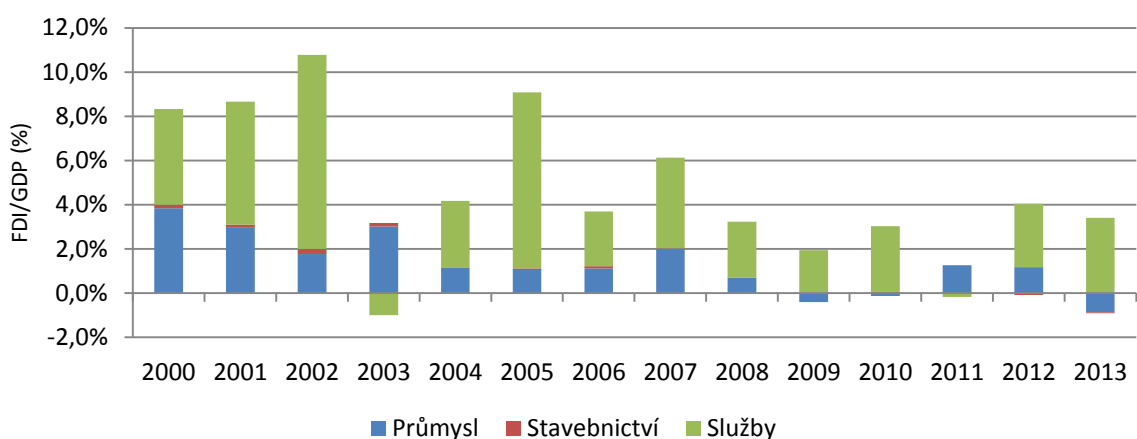
Source: CSO – foreign trade (cross-border concept)

**Table 12: Main export partners of the Czech Republic, 2006 and 2013**

	2006		2013		Change (pp)
	Exports (CZK billion)	Share (pp)	Exports (CZK billion)	Share (pp)	
Germany	684,974	31.9	991,075	31.3	-0.7
Slovakia	180,459	8.4	281,945	8.9	0.5
Poland	121,387	5.7	188,732	6.0	0.3
France	118,723	5.5	156,383	4.9	-0.6
United Kingdom	102,599	4.8	152,642	4.8	0.0
Austria	109,503	5.1	143,845	4.5	-0.6
Russian Federation	42,589	2.0	116,213	3.7	1.7
Italy	99,034	4.6	114,183	3.6	-1.0
Netherlands	77,986	3.6	88,619	2.8	-0.8
Hungary	64,176	3.0	82,111	2.6	-0.4
Belgium	61,610	2.9	79,897	2.5	-0.4
United States	49,275	2.3	69,093	2.2	-0.1
Spain	57,799	2.7	67,916	2.1	-0.6
Switzerland	29,585	1.4	49,095	1.5	0.2
Sweden	35,028	1.6	47,327	1.5	-0.1
Turkey	12,287	0.6	43,233	1.4	0.8
Romania	26,112	1.2	39,489	1.2	0.0
EU 27	1,837,052	85.7	2,557,099	80.7	-4.9

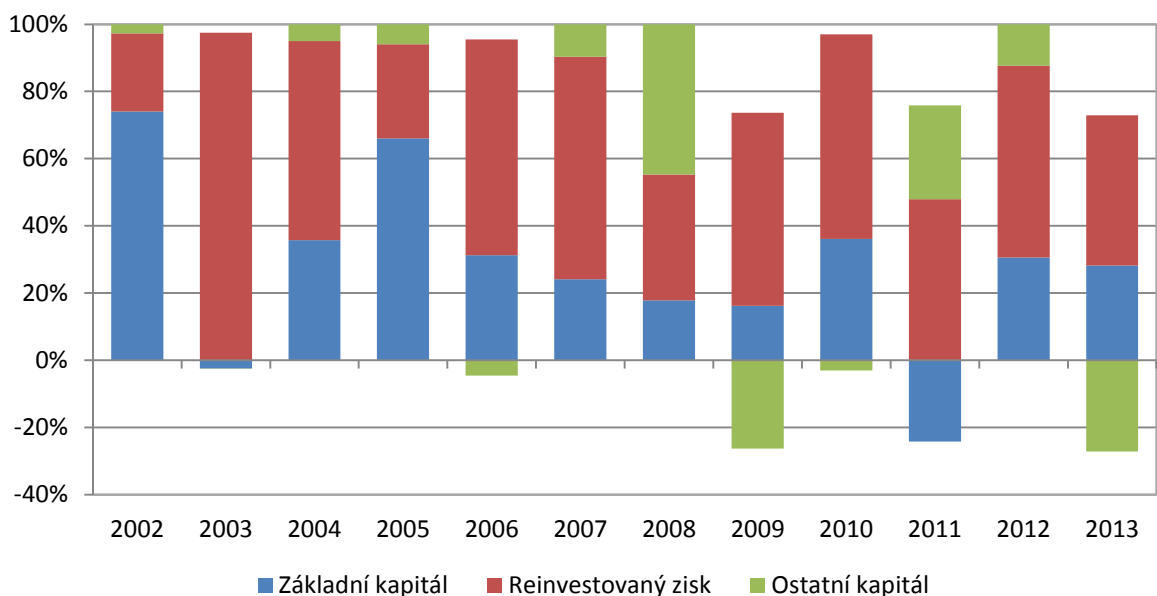
Source: CSO – foreign trade database (cross-border concept)

**Chart 9: Trends in FDI inflows by sector of economy, 2000–2013**



Source: CNB (FDI statistics), CSO – national accounts

**Chart 10: Trends in FDI inflows by type of capital**



Source: CNB (FDI statistics)

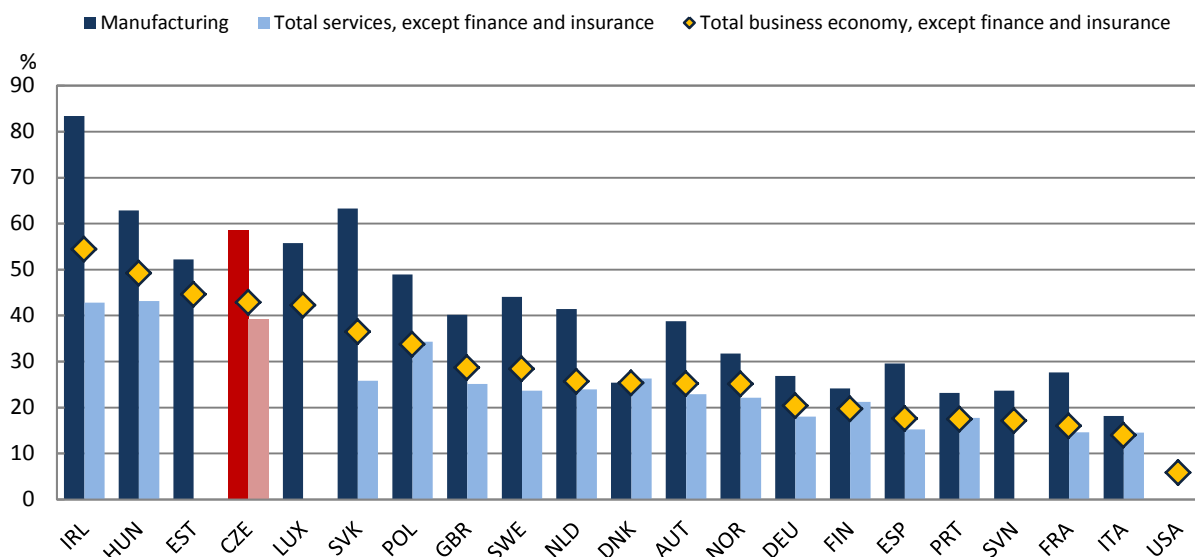
**Table 13: FDI situation by main source country as of 31 December 2012 (CZK billion)**

	Registered capital	Reinvested profit	Other capital	Total	Share (%)
Netherlands	345,556	323,721	84,809	754,086	29.0
Germany	179,092	164,161	22,097	365,350	14.0
Austria	124,468	177,061	33,365	334,895	12.9
Luxembourg	80,805	7,606	71,558	159,969	6.2
France	76,372	75,615	-21,185	130,801	5.0
Switzerland	42,578	66,309	6,172	115,059	4.4
Belgium	28,554	63,453	11,561	103,568	4.0
Cyprus	59,479	38,754	4,134	102,367	3.9
United States of America	32,531	51,018	3,372	86,921	3.3

Spain	55,682	18,838	2,043	76,563	2.9
Slovakia	38,710	14,204	22,167	75,082	2.9
World	1,304,238	1,038,388	258,251	2,600,877	100.0

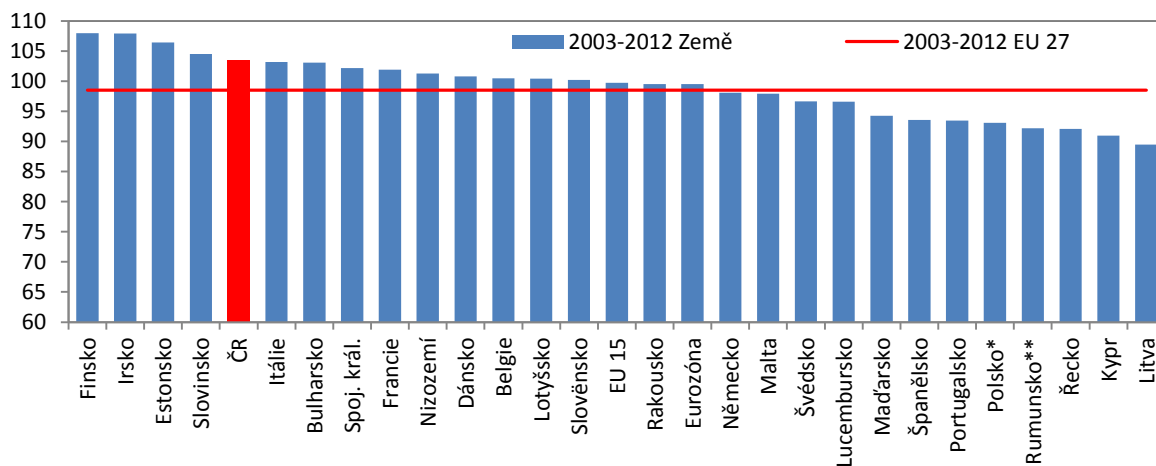
Source: CNB (FDI statistics)

**Chart 11: Formation of GAV in branches of multinational companies (pp), 2010**



Source: OECD - Science, Technology and Industry Scoreboard 2013

**Chart 12: Trends in real unit labour costs in EU-27 countries in 2003–2012 (year 2003=100)**



Note: Real unit costs compare cost of work (compensation per employee at current prices) and productivity (GDP at current prices per employment). Their growth represents the degree to which labour as a production factor contributes to the value of the output produced.

Source: CSO, Eurostat

## INTERNATIONAL COMPETITIVENESS

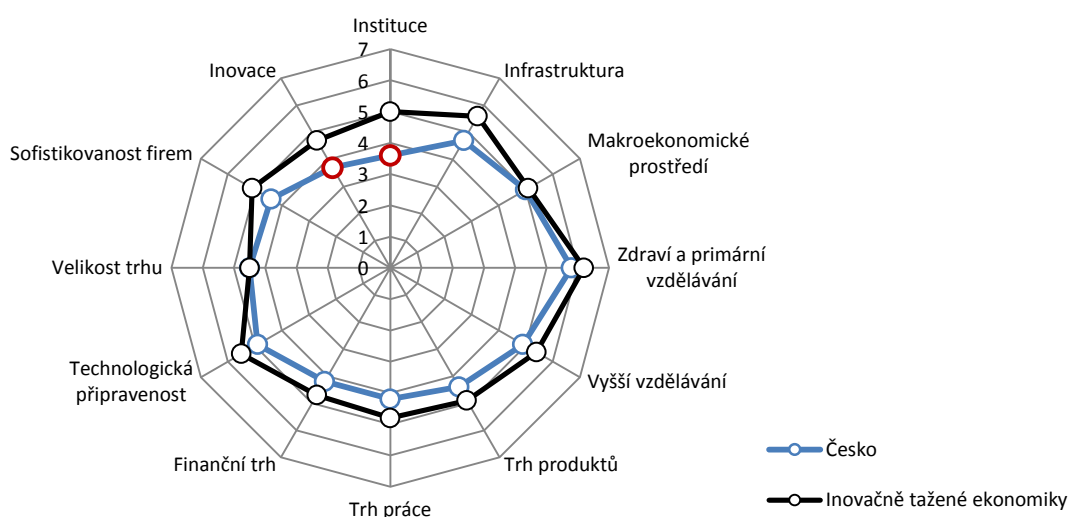
Table 14: Selected indicators of the Competitiveness Index (WEF), 2009–2013

		2009	2011		2012		2013		Trend
		Rank (value)	Value	Rank	Value	Rank	Value	Rank	
<b>Overall GCI</b>		<b>33 (4.7)</b>	<b>4.5</b>	<b>38</b>	<b>4.5</b>	<b>39</b>	<b>4.4</b>	<b>46</b>	↓
<b>Pillar: Institution – total</b>		<b>62 (3.9)</b>	<b>3.6</b>	<b>84</b>	<b>3.7</b>	<b>82</b>	<b>3.6</b>	<b>86</b>	↓
Institutions	Public trust in politicians	115	1.7	134	1.6	139	1.5	146	↓
	Judicial independence	61	3.7	74	3.7	75	3.8	68	↑
	Transparency of government policymaking	103	4	96	4	98	3.8	98	–
	Ethical behaviour of firms	74	3.3	109	3.4	115	3.6	109	↓
<b>Pillar: Higher education – total</b>		<b>24 (5.1)</b>	<b>5</b>	<b>30</b>	<b>38</b>	<b>4.9</b>	<b>4.9</b>	<b>39</b>	↓
Higher education	Quality of the education system	25	4.1	49	3.9	59	3.7	57	↓
	Quality of math and science education	10	4.1	66	3.8	78	4	83	↓
	Quality of management schools	36	4	82	3.8	95	4	90	↓
No. days to start a business		41	20	81	20	86	20	88	↓
Brain drain		44	3.2	79	3.3	82	Not monitored		↓
Venture capital availability		55	2.4	85	2.4	84	2.6	74	↑
Availability of latest technologies		48	5.6	40	5.5	43	5.2	53	↓
<b>Pillar: Business sophistication – total</b>		<b>25 (4.8)</b>	<b>4.4</b>	<b>36</b>	<b>4.5</b>	<b>35</b>	<b>4.4</b>	<b>38</b>	–
Business sophistication	Local supplier quality	15	5.4	17	5.4	17	5.3	21	↓
	State of cluster development	34	3.9	47	4	50	4.1	45	↑
	Nature of competitive advantage	35	3.9	38	4.1	36	4.1	38	–
	Value chain breadth	21	4.3	30	4.5	25	4.6	24	↑
	Control of international distribution	91	3.6	111	3.6	112	3.5	120	↓
<b>Pillar: Innovation – total</b>		<b>25 (4.0)</b>	<b>3.8</b>	<b>33</b>	<b>3.8</b>	<b>34</b>	<b>3.7</b>	<b>37</b>	↓
Innovation	Quality of scientific research institutions	19	4.8	26	4.9	26	4.9	26	–
	Company spending on R&D	25	3.9	28	3.9	28	3.8	32	↓
	University-industry collaboration in R&D	26	4.5	30	4.5	28	4.4	35	–
	Gov't procurement of advanced tech products	23	3.5	81	2.9	122	2.8	124	↓
	Availability of scientists and engineers	24	4.5	42	4.5	43	4.2	64	↓

Note: In 2009 the comparison included 133 countries, in 2011 – 142 countries, in 2012 – 144 countries, and in 2013 – 148 countries; values for the various factors are on a 1-to-7 scale (1 = the worst).

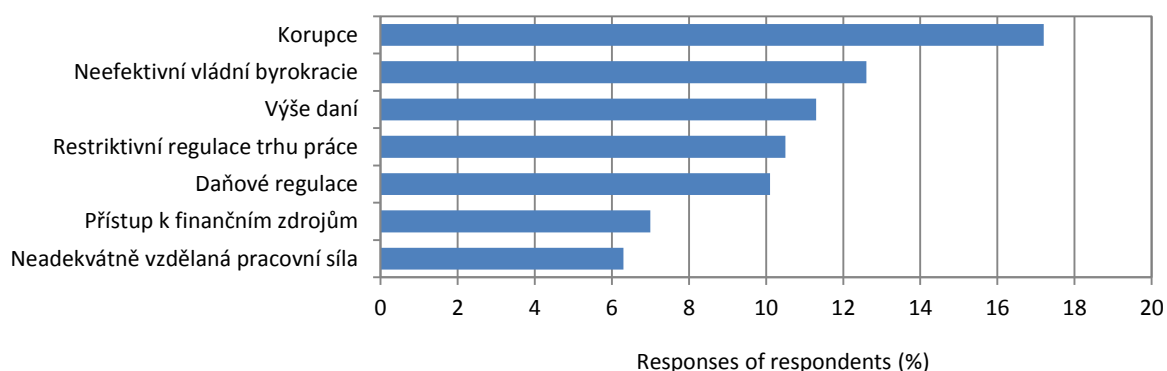
Source: World Economic Forum (Global Competitiveness Reports 2009–2013)

**Chart 13: Global Competitiveness Index (GCI) and its pillars, 2013–2014**



Source: WEF – Global Competitiveness Report 2013–2014

**Chart 14: Main barriers to doing business in the Czech Republic according to the Global Competitiveness Report 2013**



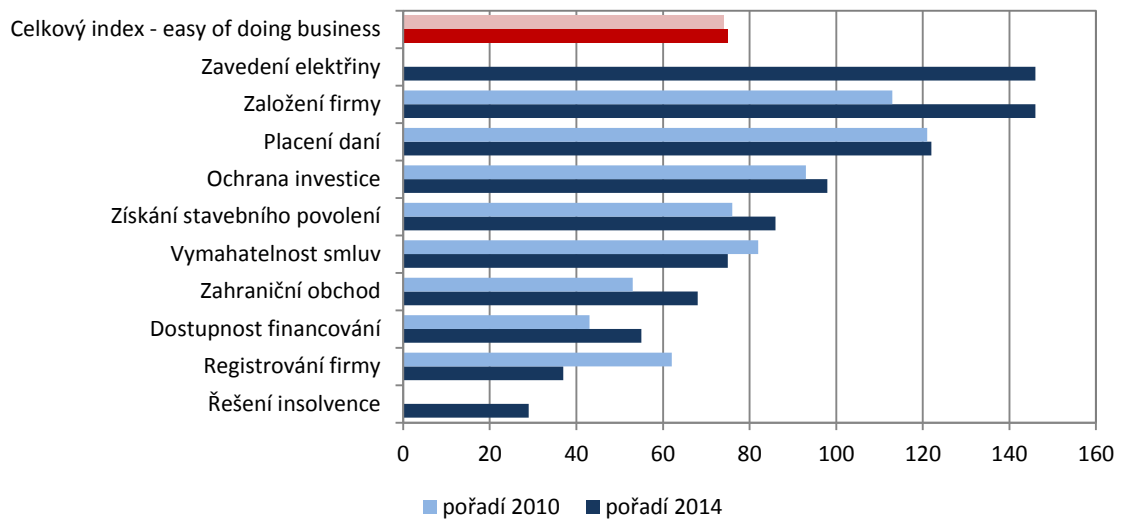
Source: WEF – Global Competitiveness Report 2013

**Table 15: GCI – Trends in values and ranking within pillar: Institutions in the Czech Republic and surrounding countries, 2006–2013**

Country	Rank 2006	Value 2006	Rank 2013–14	Value 2013	Change in rank	Change in index
Czech Rep.	60	3.84	86	3.6	26	-0.24
Romania	87	3.4	114	3.3	27	-0.1
Hungary	46	4.18	84	3.7	38	-0.48
Slovakia	53	4.03	119	3.3	66	-0.73
Poland	73	3.62	62	4	-11	0.38
Slovenia	43	4.27	68	3.9	25	-0.37
Austria	13	5.45	21	5.1	8	-0.35
Germany	7	5.69	15	5.3	8	-0.39

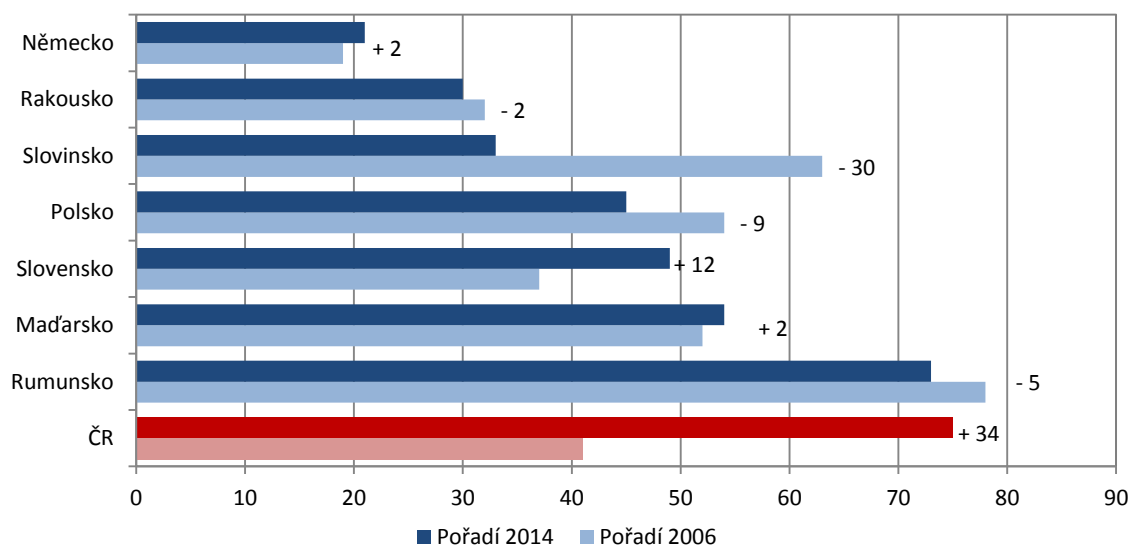
Source: WEF – Global Competitiveness Report 2006 and 2013

**Chart 15: Position of the Czech Republic in the Doing Business rankings and sub-areas, change between 2010 and 2014**



Source: Doing Business 2014 (2010) – World Bank

**Chart 16: Summary Easy of Doing Business Rank for the Czech Republic and surrounding states, 2006 and 2014**



Source: Doing Business 2014 – World Bank



**Table 16: NACE sections by share in exports and business expenditure on R&D 2010–2012**

<b>NACE</b>	<b>NACE – Description</b>	<b>Share in the Czech Republic's exports 2010–12</b>	<b>Share in non-investment R&amp;D expenditure in the Czech Republic</b>
29	Manufacture of motor vehicles	17.10%	30.62%
26	Manufacture of computers, electrical and optical equipment	15.88%	2.97%
28	Manufacture of machinery and equipment	11.33%	6.83%
27	Manufacture of electrical equipment	11.23%	3.73%
32	Other manufacturing	5.59%	0.80%
25	Manufacture of fabricated metal products	5.28%	1.58%
24	Manufacture of basic metals; metallurgy; casting	4.59%	0.74%
20	Manufacture of chemicals and chemical products	4.36%	2.00%
22	Manufacture of rubber and plastic products	3.29%	1.68%
23	Manufacture of other non-metallic mineral products	2.10%	0.93%
1	Crop and animal production	2.04%	0.27%
13	Manufacture of textiles	1.86%	0.56%
35	Electricity, gas, steam and air conditioning supply	1.85%	0.06%
31	Manufacture of furniture	1.65%	0.10%
10	Manufacture of food products	1.63%	0.48%
17	Manufacture of paper and paper products	1.49%	0.03%
21	Manufacture of pharmaceutical products and preparations	1.15%	2.35%
38	Waste collection, treatment and disposal activities	1.11%	0.09%
19	Manufacture of coke and refined petroleum products	1.03%	0.03%
30	Manufacture of other transport equipment	0.95%	5.29%
14	Manufacture of wearing apparel	0.92%	0.16%
5	Mining of coal and lignite	0.91%	0.00%
16	Manufacture of wood, and of products of wood and cork	0.66%	0.02%
2	Forestry and logging	0.65%	0.02%
15	Manufacture of leather and related products	0.48%	0.05%
11	Manufacture of beverages	0.32%	0.01%
12	Manufacture of tobacco products	0.31%	0.00%
8	Other mining and quarrying	0.14%	0.04%
3	Fishing and aquaculture	0.08%	0.02%

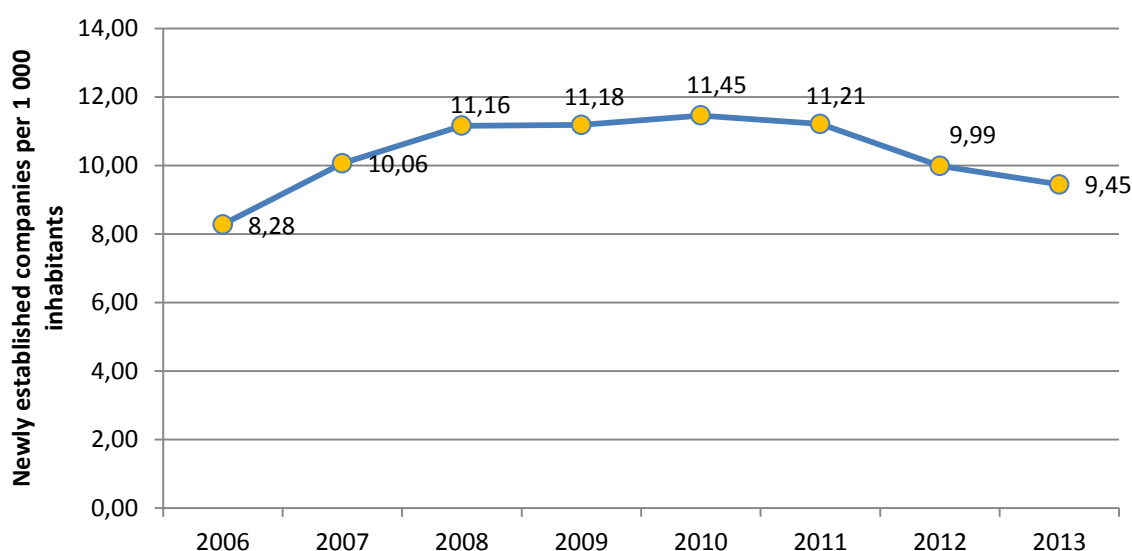
Source: own calculation based on CSO (Research and development) and UN COMTRADE data

## 9.1. Annexes to vision

### 9.1.1. Trends in reference values for the measurement of vision

**The Czech Republic will be a country with an increasing intensity of business activities per 1 000 inhabitants**

**Chart 17: Number of newly established companies per 1 000 inhabitants, 2006–2013**



Source: CSO, Organisation statistics

**The Czech Republic will be a country with an increasing share of young people up to 35 years of age doing business for a living**

**Table 17: Share of entrepreneurs up to 35 years of age, 2012–2013**

	Self-employed (thousands)		Economically active (thousands)		% of self-employed	
	2012	2013	2012	2013	2012	2013
From 15 to 24 years of age	28.7	23.2	368.9	355.8	7.8	6.5
From 25 to 29 years of age	57.4	53.8	555.9	560.8	10.3	9.6
From 30 to 34 years of age	94.4	82.2	659.0	635.4	14.3	12.9
<b>Total 15–34 years of age</b>	<b>180.5</b>	<b>159.2</b>	<b>1,583.8</b>	<b>1,552.0</b>	<b>11.4</b>	<b>10.3</b>

Source: Eurostat, LFS

**The Czech Republic will be a country with an increasing share of newly established and surviving companies**

**Table 18: Share of newly established companies in the total number of active entities, 2000–2013**

	2000	2002	2004	2006	2008	2009	2010	2011	2012	2013
Newly established companies	102,886	64,084	84,908	84,979	116,367	117,288	120,475	117,652	104,952	99,287
% of all active economic entities	8.8%	5.1%	6.7%	6.8%	8.6%	8.7%	8.6%	8.1%	6.9%	6.7%

Source: CSO, Organisation statistics

The number of companies doing business in cultural, creative and similar sectors (incl. industrial design) will increase in the Czech Republic

Table 19: Accounts of cultural and creative industry in 2010

SEKTOR	OBLAST	PŘÍJMY (VÝNOSY) CELKEM	VÝDAJE (NÁKLADY) CELKEM	ROZDÍL, sl.1 - sl.2	SPOTŘEBA materiálu, energií, zboží a služeb	HRUBÁ PŘIDANÁ HODNOTA	POČET ZAMĚSTN. (PŘEPOČ.) v tis.os.	VÝDAJE NA INVESTICE	EXPORT ZBOŽÍ A SLUŽEB	IMPORT	POČET PRÁVNICKÝCH A FYZICKÝCH OSOB	NACE
a	b	1	2	3	4	5	6	7	8	9	10	
KULTURNÍ SEKTOR	Historická památka	2 110 236	2 115 133	-4 897	920 148	1 190 088	1 888	740 371	31 479	36 001	288	91.03
	Muzeum a galerie	4 368 396	4 493 921	-125 525	1 719 140	2 649 256	6 100	1 629 410	108 771	203 940	478	91.02
	Knihovny a archivy	3 631 299	4 008 450	-377 151	1 338 180	2 293 119	6 888	449 463	.	.	5 446	91.01
	Scénická umění	12 449 528	12 171 083	278 445	5 939 838	6 509 690	15 035	383 758	61 172	187 89	746	90.01,02,04
	Výtvarná umění	4 768 214	3 961 066	807 148	2 378 458	2 389 756	1 778	236 470	28 381	31 053	6 031	74,20,90.03
	Kulturní a umělecké vzdělávání	989 266	820 012	169 254	478 524	510 742	735	31 052	.	.	1 288	85.52
	Řemesla	.	.	.	.	.	.	.	5 551 545	2 108 429	.	.
<b>Sektor celkem</b>		<b>28 316 939</b>	<b>27 569 665</b>	<b>747 274</b>	<b>12 774 288</b>	<b>15 542 651</b>	<b>32 424</b>	<b>3 470 524</b>	<b>5 781 348</b>	<b>2 567 352</b>	<b>14 277</b>	<b>2,227,702</b>
KULTURNÍ PRŮMYSLY	Film a video	13 239 930	12 569 145	670 785	10 124 600	3 115 330	1 728	807 534	6 356 763	4 762 862	1 155	59,11,12,13,14
	Hudba	2 006 431	1 708 638	297 793	1 400 590	605 841	342	103 798	9 770	10 620	3 272	59.20
	Televize	20 262 248	19 083 431	1 178 817	9 495 408	10 766 840	4 520	1 839 877	109 900	70 769	128	60.20
	Rozhlas	3 368 623	3 113 618	255 005	1 708 033	1 660 590	1 639	188 558	1 751	649	61	60.10
	Knihy a tisk	47 218 459	43 576 674	3 641 785	22 351 008	24 867 451	16 528	1 395 578	6 410 257	4 506 631	35 724	59,11,13,14,63,91,74,30,47,61,62
	Videohry	1 761 347	1 710 665	50 682	467 164	1 294 183	1 375	45 000	.	.	22	58.21
<b>Sektor celkem</b>		<b>87 857 038</b>	<b>81 762 171</b>	<b>6 094 867</b>	<b>45 546 803</b>	<b>42 310 235</b>	<b>26 132</b>	<b>4 380 345</b>	<b>12 888 441</b>	<b>10 086 531</b>	<b>40 362</b>	<b>36</b>
KREATIVNÍ PRŮMYSLY	Architektura	26 992 029	24 470 579	2 521 450	17 824 762	9 167 267	8 792	1 525 591	318 200	59 441	695	71.11
	Reklama	70 231 516	66 905 432	3 326 084	50 676 196	19 555 320	13 333	2 687 785	12 122 622	8 450 021	1 242	73.11
	Design	2 343 689	1 929 421	414 268	1 318 012	1 025 677	637	254 148	363 958	1 857 434	475	74.10
	<b>Sektor celkem</b>	<b>99 567 234</b>	<b>93 305 432</b>	<b>6 261 802</b>	<b>69 818 970</b>	<b>29 748 264</b>	<b>22 762</b>	<b>4 467 524</b>	<b>12 804 780</b>	<b>10 366 898</b>	<b>2 412</b>	<b>36</b>
SEKTOR	OBLAST	PŘÍJMY (VÝNOSY) CELKEM	VÝDAJE (NÁKLADY) CELKEM	ROZDÍL, sl.1 - sl.2	SPOTŘEBA materiálu, energií, zboží a služeb	HRUBÁ PŘIDANÁ HODNOTA	POČET ZAMĚSTN. (PŘEPOČ.) v tis.os.	VÝDAJE NA INVESTICE	EXPORT ZBOŽÍ A SLUŽEB	IMPORT	POČET PRÁVNICKÝCH A FYZICKÝCH OSOB	NACE
a	b	1	2	3	4	5	6	7	8	9	10	
	Neznámá oblast	13 368 426	17 178 560	-3 810 134	2 907 881	11 037 765	5 700	1 429 844	.	.	6 209	47,63,78,79,77,22,84,11,94,99,2
	<b>KULTURA CELKEM</b>	<b>229 109 637</b>	<b>219 815 828</b>	<b>9 293 809</b>	<b>131 047 942</b>	<b>98 638 915</b>	<b>87 018</b>	<b>13 748 237</b>	<b>31 474 569</b>	<b>23 020 781</b>	<b>63 260</b>	

Source: Žáková E. Cikánek M. (2012): Problem analysis of cultural and creative industries (CCI) in the context of EU cohesion policy 2014+ <http://www.idu.cz/media/document/problemova-analyza-kulturnich-a-kreativnich-prumyslu.pdf>

**The Czech Republic will be a country with an increasing trend in the technological balance of payments – foreign trade in advanced technological services**

**Table 20: Technological balance of payments, services (CZK million), 2011–2012**

	Exports		Imports		Balance	
	2011	2012 <sup>1</sup>	2011	2012 <sup>1</sup>	2011	2012 <sup>1</sup>
<b>Total</b>	<b>52,385</b>	<b>60,396</b>	<b>55,525</b>	<b>63,278</b>	<b>-3,140</b>	<b>-2,882</b>
Computer equipment services	27,343	33,907	19,278	19,902	8,065	14,005
Technical services	16,662	18,120	10,686	15,341	5,976	2,779
Research and development	3,188	3,986	7,043	9,205	-3,855	-5,220
License fees	1,591	3,426	15,905	14,679	-14,315	-11,252
Sale of ownership rights	3,602	958	2,614	4,152	989	-3,194

Source: CSO, Science, research, innovations

Note: 1) Preliminary data

**Table 21: Technological balance of payments, % of total income from exports of services, 2011–2012**

	Exports		Imports		Balance	
	2011	2012 <sup>1</sup>	2011	2012 <sup>1</sup>	2011	2012 <sup>1</sup>
<b>Total</b>	<b>19.1%</b>	<b>20.5%</b>	<b>20.5%</b>	<b>21.2%</b>	<b>-1.4%</b>	<b>-0.7%</b>
Computer equipment services	10.0%	11.5%	7.1%	6.7%	2.9%	4.8%
Technical services	6.1%	6.2%	3.9%	5.1%	2.1%	1.0%
Research and development	1.2%	1.4%	2.6%	3.1%	-1.4%	-1.7%
License fees	0.6%	1.2%	5.9%	4.9%	-5.3%	-3.8%
Ownership rights	1.3%	0.3%	1.0%	1.4%	0.3%	-1.1%

Source: CSO, Science, research, innovations

Note: 1) Preliminary data

**The Czech Republic will create and offer a friendly working environment, i.e. a creative ecosystem for enterprise (at all levels)**

**Table 22: Ease of doing business**

Indicator	Rank 2014
Resolving insolvency	29
Registering a business	37
Availability of financing	55
Foreign trade	68
Enforceability of contracts	75
Obtaining building permit	86
Investment protection	98
Payment of taxes	122
Setting up a business	146
Electricity connection	146
<b>Total index – Ease of doing business</b>	<b>75</b>

Source: World Bank – Doing Business

**The Czech Republic will have a positive “talent balance” – BRAIN GAIN**

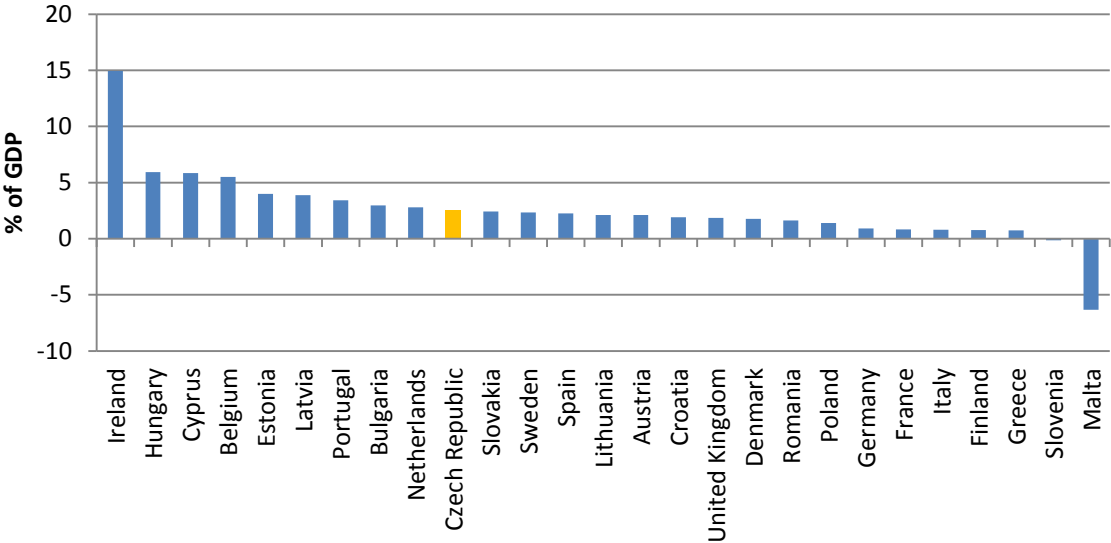
**Table 23: Capacity to retain and attract talent**

Global Competitiveness index		2014-2015		2013-2014	
		Value	Rank	Value	Rank
<b>7th pillar: Labour market efficiency</b>					
7.08	Country capacity to retain talent	3.3	80	2.8	109
7.09	Country capacity to attract talent	3.1	93	3.2	87

Source: World Economic Forum – Global Competitiveness Report

**The Czech Republic will be among top 10 EU countries with the highest inflow of foreign direct investments relative to GDP**

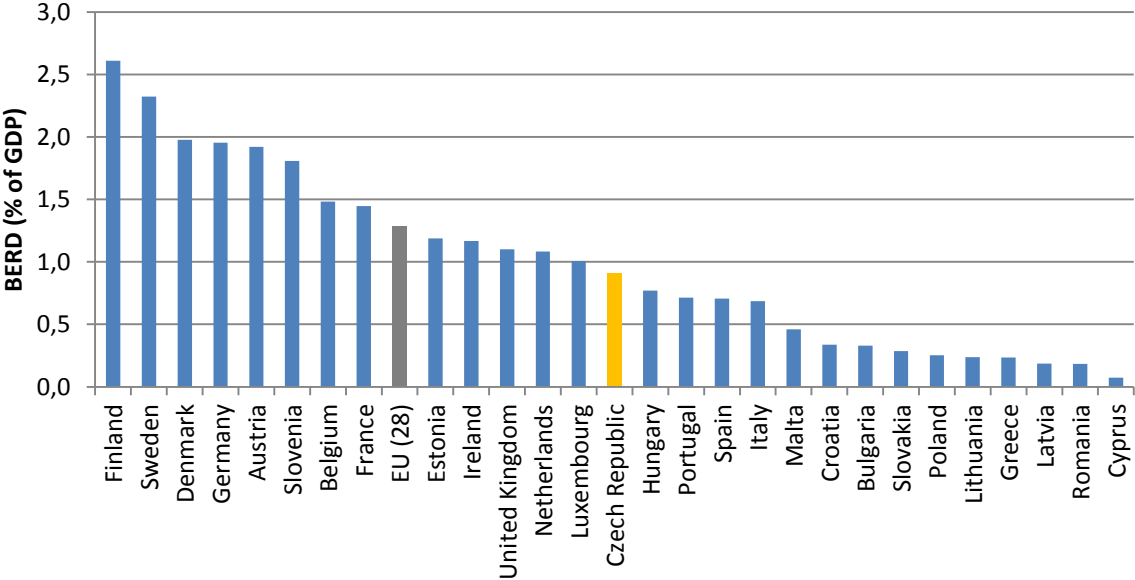
**Chart 18: FDI relative to GDP, average for 2011–2013**



Source: Eurostat, Auxiliary indicators (tipsax)  
 Note: Due to its high proportion, Luxembourg is not shown in the chart (688% of GDP)  
 The Czech Republic ranks 11th  
 Calculated using a 3-year average to eliminate random fluctuations

**The Czech Republic will be among top 10 EU countries with the highest volume of private expenditure on science and research relative to GDP**

**Chart 19: BERD relative to GDP, average for 2010–2012**



Source: Eurostat, Statistics on research and development  
 Note: The Czech Republic ranks 14th  
 Calculated using a 3-year average to eliminate random fluctuations

## 10. Bibliography

ARNOLD, E., GIARRACCA, F. (2012): Getting the Balance Right: Basic Research, Missions and Governance for Horizon 2020. Technopolis Group, 70 p.

BALCAR, J. (2011): Future skills needs in EU and skills transferability in 2020: sector meta-analysis, Ekonomická revue, 14(1), pp. 5-20.

BALCAR, J., FILIPOVÁ, L., GOTTVÁLD, J., SIMEK, M., ŠMAJSTRLOVÁ, S. (2008): Uplatnitelnost absolventů škol v podnicích a institucích Moravskoslezského kraje. VŠB-TUO, Ostrava, CD-ROM.

BALCAR, J., HOMOLOVÁ, E., KARÁSEK, Z. et al. (2011): Transferability of skills across economic sectors: Role and importance for Employment at European level. Publications Office of the European Union, Luxembourg, 96 p.

BURDOVÁ, J., PATEROVÁ, P. (2009): Šetření potřeb zaměstnavatelů a připravenosti absolventů v zemědělské sféře. Národní ústav odborného vzdělávání, Prague.

BERMAN GROUP (2010): An analysis of the material priorities and the needs of the different areas within the responsibility of the MIT for the purposes of targeting support from the EU Structural Funds in the next programming period (2014+). (<http://www.mpo.cz/dokument82084.html>)

Berman Group (2010b): Terénní průzkum veřejných vědecko-výzkumných pracovišť v Jihomoravském kraji. ([http://www.risjmk.cz/userfiles/file/Z%C3%A1v%C4%9Bre%C4%8Dn%C3%A1%20zpr%C3%A1va%20z%20TP%20VaV%20pracovi%C5%A1%C5%A5%20v%20JMK%20\(2010\).pdf](http://www.risjmk.cz/userfiles/file/Z%C3%A1v%C4%9Bre%C4%8Dn%C3%A1%20zpr%C3%A1va%20z%20TP%20VaV%20pracovi%C5%A1%C5%A5%20v%20JMK%20(2010).pdf))

BOEKHOLT et al. (2011): International Co-operation in R&D. Final Report – 6. International Audit of Research, Development&Innovation in the Czech Republic. Manchester Institute of Innovation Research&Technopolis Group.

BOSMA, N., WENNEKERS, S., AMOROS, J.E. (2012): (2012): Global entrepreneurship monitor 2011.

Czech Telecommunication Office (2013): Mapping of infrastructure for the provision of high-speed Internet access in the Czech Republic.

CHRISTENSEN, C. (1997): The Innovator's Dilemma. Harvard Business School Press, Boston, 286 p.

DICKEN, P. (2011): Global Shift: Mapping the Changing Contours of the World Economy. The Guildford Press, 607 p.

JAHN, M. et al. (2005): Economic Growth Strategy of the Czech Republic. Prague, 136 p. (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=13633&ad=1&attid=13719>)

ETZKOWITZ, H., LEYDESDORFF, L. (200): The dynamics of innovation: from national systems and „Mode 2“ To a triple helix of university-industry-government relations. Research Policy, vol. 29, pp. 109–123.

European Commission (2007): Remuneration of Researchers in the Public and Private sectors. Publications Office of the European Union, Luxembourg.

European Commission (2010): The Role of Community Research Policy in the Knowledge-based Economy.

European Commission (2010b) Study on mobility patterns and career paths of EU researchers. Brussels. ([http://ec.europa.eu/euraxess/pdf/research\\_policies/MORE\\_RI\\_report\\_final\\_version.pdf](http://ec.europa.eu/euraxess/pdf/research_policies/MORE_RI_report_final_version.pdf))

European Commission (2012): The Researchers Report 2012: Monitor human resources policies and practices in research. Scorecards.

European Commission (2013): Digital Agenda for Europe. (<http://digital-agenda-data.eu>)

European Commission (2013b) She Figures 2012: Gender in Research and Innovation. Brussels. ([http://ec.europa.eu/research/science-society/document\\_library/pdf\\_06/she-figures-2012\\_en.pdf](http://ec.europa.eu/research/science-society/document_library/pdf_06/she-figures-2012_en.pdf))

European Commission (2013c): Researchers' Report 2012. DG Research and Innovation.

European Commission (2013d): Guide to Social Innovation.

European Commission (2014): Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes ([http://ec.europa.eu/regional\\_policy/sources/docgener/guides/synergy/synergies\\_en.pdf](http://ec.europa.eu/regional_policy/sources/docgener/guides/synergy/synergies_en.pdf)). Eurostat (2013): Statistics database.

FAGERBERG, J. (2005): Innovation: A Guide to the Literature. In: Fagerberg, J., Mowery, D. C., Nelson, R.: The Oxford Handbook of Innovation, Oxford University Press, Oxford, pp. 1–26.

HEBÁKOVÁ, L., GRANGER, R. (2013): Smart Specialisation Strategy (S3) and the Czech Republic.

HIRSCH-KREINSEN et al. (2008): Innovation in low-tech firms and industries. Edward Elgar, London, 320 p.

IHNED.cz (2013): The map of the Czech digital wasteland: Only 3 per cent of people have a truly fast Internet connection. (<http://byznys.ihned.cz/zpravodajstvi-cesko/c1-61402650-mapa-ceske-digitalni-pustiny-opravdu-rychly-internet-maji-jen-3-procenta-lidi>)

JENSEN, M. B., JOHNSON, B., LORENZ, E., LUNDEVALL, B. Å. (2007): Forms of knowledge and modes of innovation. Research Policy, 36, 5, pp. 680-693.

KALOUSKOVÁ, P. (2007): Potřeby zaměstnavatelů a připravenost absolventů škol - šetření v kvartérním sektoru. Národní ústav odborného vzdělávání, Prague.

KALOUSKOVÁ, P. (2006): Potřeby zaměstnavatelů a připravenosti absolventů škol - šetření v terciární sféře. Národní ústav odborného vzdělávání, Prague.

KALOUSKOVÁ, P., ŠTASTNOVÁ, P., ÚLOVCOVÁ, H., VOJTĚCH, J. (2004): Potřeby zaměstnavatelů a připravenost absolventů pro vstup na trh práce - 2004. Národní ústav odborného vzdělávání, Prague.

KOPICOVÁ, M. (2013): Mají absolventi „techniky“ budoucnost? Presentation at international professional conference: Univerzita – firma – prosperita, Brno, November 2013.

KOSTELECKÁ Y., BERNARD J., KOSTELECKÝ T. (2007): Zahraniční migrace vědců a výzkumníků a nástroje k jejímu ovlivnění. Institute of Sociology of the AS CR, v.v.i., Prague.

KOSTIĆ, M., PAZOUR, M., POKORNÝ, O. (2012): Manažerský styl řízení na vysokých školách a ostatních výzkumných organizacích. TC AS, Prague.  
(<http://www.vyzkum.cz/Priloha.aspx?idpriloha=665607>)

KUČERA, Z. a VONDRÁK, T. (2014): Key Enabling Technologies v ČR. TC AS, Prague, 106 p.  
(<http://www.strast.cz/cs/publikace/key-enabling-technologies-v-cr>)

LEISYTE, L. et al. (2011): Human Resources in R&D. The Final Report of the International Audit of Research, Development and Innovations in the Czech Republic.

LUKEŠ, M., JAKL, M. (2011): Podnikatelská aktivita v ČR, VŠE, 87 p.

MAZZUAZZUCATO, M. (2013): The Entrepreneurial State: Debunking Public vs. Private Sector Myths. London: Anthem Press.

MCKINSEY & COMPANY (2010): Klesající výsledky českého základního a středního školství: fakta a řešení.

Technopolis Group (2011): International Audit of Research, Development & Innovation in the Czech Republic. Final report, Prague.

Ekonom (2013): Interview with prof. Lubomír Mlčoch. Ekonom No. 50/2013.

MIT (2011): National Innovation Strategy of the Czech Republic Prague, 40 p.  
(<http://download.mpo.cz/get/44911/50470/582602/priloha002.pdf>)

MIT (2012): Export strategy of the Czech Republic for 2012 to 2020. Prague:

MIT (2012b): International Competitiveness Strategy of the Czech Republic for 2012–2020. Prague, 53 p. (<http://www.vlada.cz/assets/media-centrum/aktualne/Strategie-mezinarodni-konkurenceschopnosti-Ceske-republiky.pdf>)

MIT (2013): National Policy in Electronic Communications – Digital Czech Republic v. 2.0 – Roadmap to a digital economy

MIT (2014): Priorities of the MIT for industrial research, development and innovation.

MÜNICH, D, PROTIVÍNSKÝ, T. (2013): The impact of education on economic growth in the light of the new PISA 2012 results.

MEYS (2011): Roadmap for large research, experimental development and innovation infrastructures in the Czech Republic. Updated May 2011, 49 p.

MEYS (2014): Education Policy Strategy of the Czech Republic up to 2020. Prague, 52 p.  
([http://www.vzdelavani2020.cz/images\\_obsah/dokumenty/strategie-2020\\_web.pdf](http://www.vzdelavani2020.cz/images_obsah/dokumenty/strategie-2020_web.pdf))



NTF (2011): Mapa výzkumného a aplikačního potenciálu Česka, Situace na trhu práce: nabídka a poptávka po pracovnících ve vědě a výzkumu.

NTF (2011b): Vstupní analýza lidských zdrojů pro vědu a výzkum, 68 p.

NTF (2011c): Motivation of graduates for research work. Underlying materials for assessing the National RDI Policy: Human resources.

NTF (2011d): Attractiveness of R&D jobs in salary terms. Background studies for the preparation of national RDI priorities. (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=15138>)

NTF (2011e): Human Resources Development Strategy for the Czech Republic Prague, 51 p. ([http://www.esfcr.cz/file/3772\\_1\\_1/download/](http://www.esfcr.cz/file/3772_1_1/download/))

OECD (2003): First Results from PISA 2003, Executive Summary.

OECD (2013): OECD Skills Outlook 2013: First Results from the Survey of Adult Skills, OECD Publishing.

OECD (2013b): OECD Science, Technology and Industry Scoreboard 2013, OECD Publishing.

OECD (2013c): PISA 2012 Results in Focus. What 15-year-olds know and what they can do with what they know.

PALEČKOVÁ, J., TOMÁŠEK, V., BASL, J. (2010): Hlavní zjištění výzkumu PISA 2009. Umíme ještě číst? Ústav pro informace ve vzdělávání, Prague.

PALEČKOVÁ, J., TOMÁŠEK, V. et al. (2013): Hlavní zjištění výzkumu PISA 2012. Matematická gramotnost patnáctiletých žáků. Czech School Inspectorate, Prague.

PAVLÍNEK, P., ŽENKA, J. (2011) Upgrading in the automotive industry: Firm-level evidence from Central Europe, Journal of Economic Geography, 11(3), pp. 559–586.

PAZOUR, M., KUČERA, Z. (2012): Suggestions for improving the effectiveness of the research, development and innovation management system in the Czech Republic. Analyses and underlying documentation for implementing and updating the National Research, Development and Innovation Policy.

Research, Development and Innovation Council (2009): R&D system reform in the Czech Republic. (<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=495405>)

Research, Development and Innovation Council (2009): National Research, Development and Innovation Policy of the Czech Republic for 2009–2015. Office of the Government of the Czech Republic, Prague, 37 p.

(<http://www.vyzkum.cz/FrontClanek.aspx?idsekce=532844&ad=1&attid=680526>)

Research, Development and Innovation Council (2011): National Priorities of Oriented Research, Experimental Development and Innovations. Office of the Government of the Czech Republic, Prague, 32 p.

([http://www.tacr.cz/sites/default/files/shared/priority\\_orientovaneho\\_vyzkumu\\_experimentalniho\\_vyvoje\\_a\\_inovaci.pdf](http://www.tacr.cz/sites/default/files/shared/priority_orientovaneho_vyzkumu_experimentalniho_vyvoje_a_inovaci.pdf))

Research, Development and Innovation Council (2012): The Updated National Policy for Research, Development and Innovation of the Czech Republic for 2009 to 2015 with a view to 2020. Office of the Government of the Czech Republic, Prague, 45 p.  
(<http://www.vyzkum.cz/Priloha.aspx?idpriloha=705455>)

Research, Development and Innovation Council (2013): Analysis of the State of Research, Development and Innovation in the Czech Republic and a Comparison with the Situation Abroad in 2012. Office of the Government of the Czech Republic, Prague, 154 p.

Science Europe (2013): Comparative Benchmarking of European and US Research Collaboration and Researcher Mobility. (<http://www.scienceeurope.org/downloads>)

Science Europe (2012): Science Europe Position Statement: Horizon 2020: Excellence Counts. (<http://www.scienceeurope.org/downloads>)

STIGLITZ, J. E. (2002): Globalisation and its Discontents, W. W. Norton & Company, 435 p.

STRAKOVÁ, J. et al. (2009): Analýza naplnění cílů Národního programu rozvoje vzdělávání v České republice (Bílé knihy) v oblasti předškolního, základního a středního vzdělávání, ver. 13 March 2009.

TECHNOLOGY CENTRE AS CR (2014): The working draft of the main conclusions of the analytical foundation for establishing the research specialisation of the Czech Republic.

TENGLEROVÁ, H. (2011): Position of women in Czech science – monitoring report for 2010. Prague: Institute of Sociology of the AS CR, v. v. i. (<http://www.zenyaveda.cz/files/monitorovaci-zprava-2010.pdf>)

TENGLEROVÁ, H. (2012): Position of women in Czech science – monitoring report for 2011. Prague: Institute of Sociology of the AS CR, v. v. i. (<http://www.zenyaveda.cz/files/postaveni-zen-v-ceske-vede-2011-zlom-final-www.pdf>)

TENGLEROVÁ, H. (2014): Position of women in Czech science – monitoring report for 2012. Prague: Institute of Sociology of the AS CR, v. v. i. (<http://www.zenyaveda.cz/files/monitorovaci-zprava2012.pdf>)

TIDD, J., BESSANT, J., PAVITT, K. (2005): Řízení inovací: zavádění technologických, tržních a organizačních změn. Computer Press, Brno, 549 p.

Office of the Government of the Czech Republic (2014): National Reform Programme of the Czech Republic 2014. Prague, 58 p. (<http://www.vlada.cz/assets/evropske-zalezitosti/aktualne/Narodni-program-reforem-pro-rok-2014.pdf>.)

VAN NORDEN, R. (2012): 2012 in Review. Nature, vol. 492, pp. 324–327.

VANĚČEK, J. (2011): Oborová a institucionální analýza výsledků výzkumu a vývoje ČR. TC AS CR, Prague, 39 p. ([www.vyzkum.cz/Priloha.aspx?idpriloha=645356](http://www.vyzkum.cz/Priloha.aspx?idpriloha=645356))

WEF (2013): World Competitiveness Report 2013–14.

World Bank (2013): Doing Business 2014.