

INKA

**Innovation capacity
of the Czech Republic:
The main conclusions
of the verification
analyses**

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Č R



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Partnership of entities involved



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Graphics

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INTRODUCTION

02 The assignment for the project of INKA – Mapping the innovation capacity 2014+ was formed during the debate on the preparation of the RIS3 strategy in 2013. It turned out that each of the entities involved in the debate – the MEYS, the MIT, the Technology Agency of the Czech Republic, the MFA, the Secretariat of the Research, Development and Innovation Council – had experience in identifying the innovation potential in the Czech Republic and had their own knowledge in this field, but there was no uniform mapping methodology. In 2014–2015 a project was contracted out by the TA CR and was implemented by the consortium of Berman Group, the South Moravian Innovation Centre and Technopolis. The main conclusions of the INKA project are presented in this publication.

INKA is a unique project – first, a new methodology was developed which enables to repeat a mapping exercise over time; second, it provides results which are unusually abundant in information even within European context. I am grateful to all partners and implementers of the project for their cooperation and I hope that everything published at inka.tacr.cz will be of use to interested parties.



Rut Bízková, Chairperson of TA CR

1. BASIC INFORMATION ABOUT THE PROJECT

PURPOSE OF THE PROJECT

Provide relevant data and strategic information about the situation and development of the innovation capacity in the Czech Republic

A thorough knowledge of the market position, long-term goals and needs of different groups of companies and other entities involved in the national innovation system is the basic prerequisite for an accurate targeting and thus effectiveness of the support tools of the innovation policy. The purpose of the INKA project is to develop and test a methodology for the collection and analysis of data and information necessary to provide this strategic knowledge. Following this methodology, the TA CR will analyse the innovation capacity in the Czech Republic on a regular basis. The methodology will be used for the creation of contextual analyses as a basis for the development of new programmes and the evaluation of the implementation and impacts of the existing ones.

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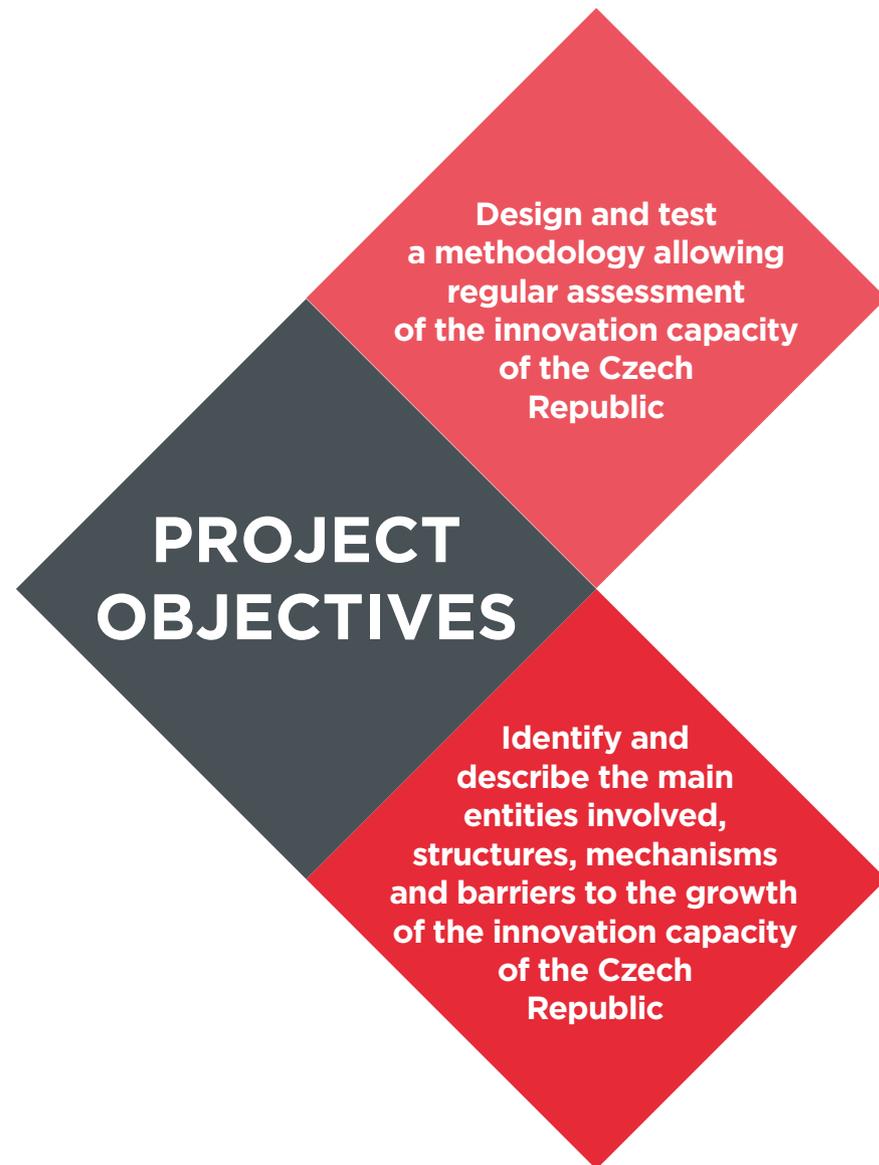
How is the Czech Republic doing in innovations?

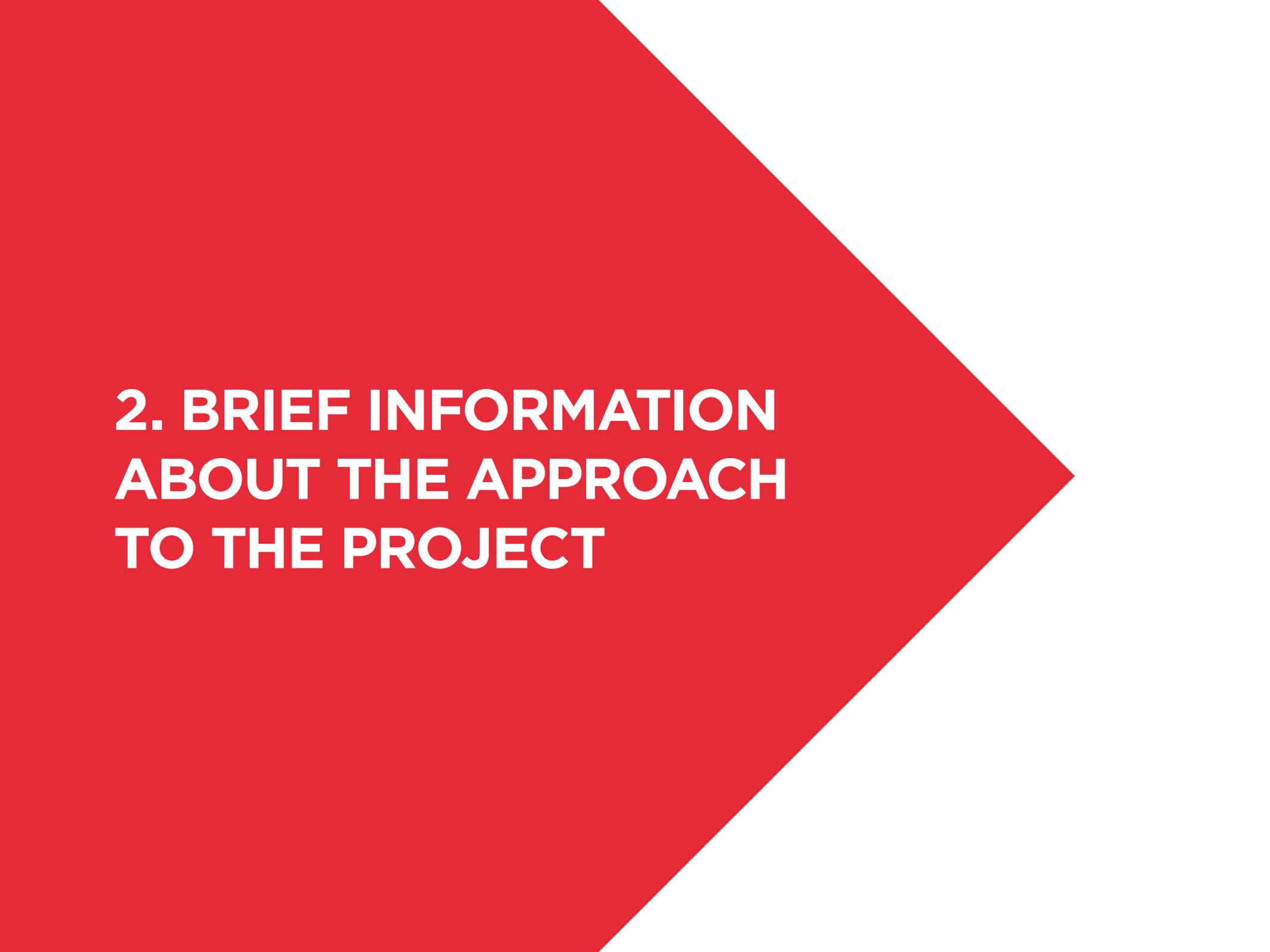


How to measure innovation in the economy?

MAIN OUTPUTS

- Comprehensive methodology for evaluating the innovation capacity of the Czech Republic
- Methodology of the secondary data collection and processing
- Methodology of the primary data collection and processing
- **Innovation capacity of the Czech Republic: The main conclusions of the verification analyses**
- Innovation capacity of the Czech Republic: an analysis of secondary data
- Innovation capacity of the Czech Republic: an analysis of the environment for innovation in enterprises



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2. BRIEF INFORMATION ABOUT THE APPROACH TO THE PROJECT

How to understand the main concepts of mapping the innovation capacity?

Corporate visions are the cornerstones of the innovation ecosystem

Companies and people are the key element of any innovation ecosystem. As strategic innovation is an integral part of corporate strategies, corporate visions and the strategies of their fulfilment constitute the cornerstone for the assessment of the innovation capacity of the economy. When working with information on the companies' growth and innovation aspirations, emphasis is placed on the size and the market position of companies as well as on the specifics of the individual industries. Given the strong dependence of the economy on the activities of companies under foreign control, entrepreneurial autonomy is a major issue of the innovation capacity of the country.

The innovation ecosystem in the Czech Republic is part of the global economy

Two long-term trends in the global economy are extremely important for the analysis of the innovation capacity in the Czech Republic: the constantly intensifying global competition for talent and the expansion of research and development activities of multinational companies outside the home countries of their headquarters. The second trend occurs especially in correspondence with existing strategic production capacities. How do these two global trends interact and how do they affect the innovation capacity of the country? The answers to these and other questions related to local manifestations of changes in the global economy constitute the fundamental framework for evaluating the innovation capacity in the Czech Republic. An adequate interconnection of the global and local perspectives is very important for many other reasons. An example may be a gradual shift of the focal point of the global economic growth from developed to developing economies. The accelerating pace of changes in the global economy driven especially by new technologies and shortening of the innovation cycles thus increases the demands on ensuring a sufficient strategic intelligence for the creation of an effective economic policy.



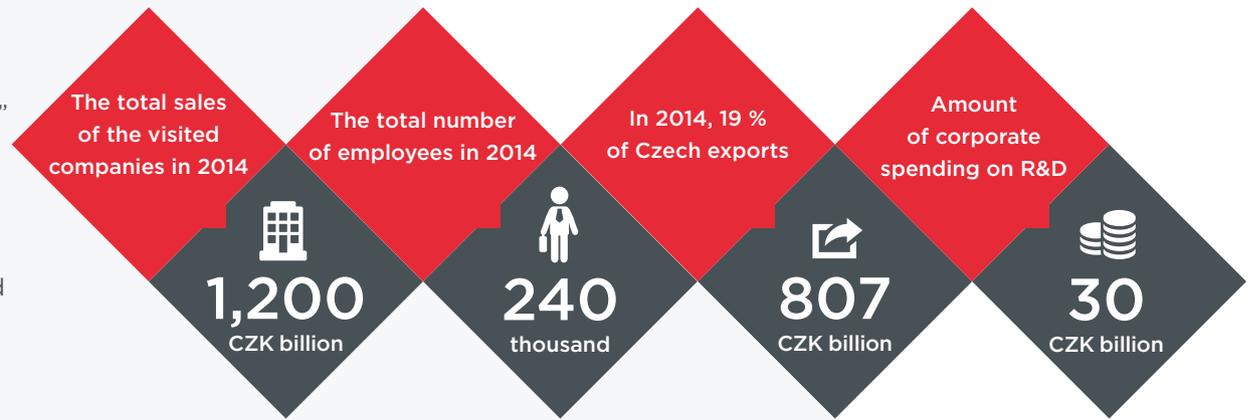
The process of improving and modifying products and services including the method of their production, sale and distribution.

The ability of companies to establish themselves in the global markets through their own innovations.

A set of companies and various kinds of organisations, people, relationships, habits and norms together forming an environment for innovation.

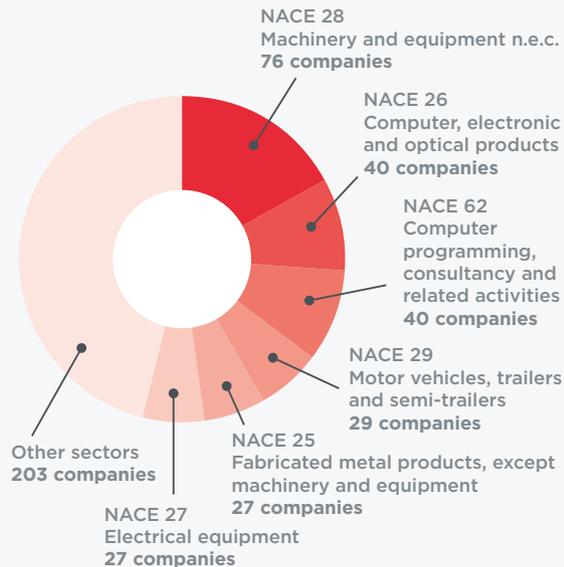
Innovation takes many forms

The proposed methodology reflects the diversity of innovation to a great extent. Innovation in the form of “partial improvements” in production as well as new products or breakthrough technological changes, in which companies usually are not the only important agents of changes, are important for the competitive advantage. Attention is focused on innovation which provides companies with a competitive edge. However, this does not mean that the role of innovation which imitates competitors is not addressed. At the same time, attention is paid to higher levels of innovation, whose substantial or critical inputs rely on the outcomes of research and development.



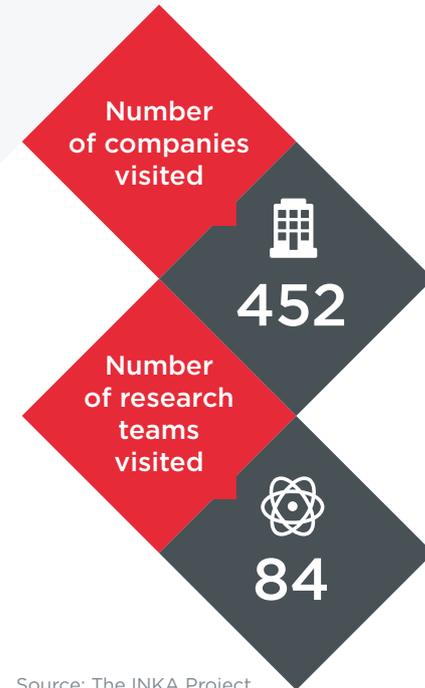
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Chart 1: Industrial structure of the companies visited



Innovation is not invention

Many people perceive the concepts of “innovation” and “invention” as synonyms. Invention means a new technological solution. It is a tangible outcome of research and development. Only some inventions lead to innovation. The basic feature of innovation is addressing specific needs in a manner that is economically viable. This means that the users of innovation are able and willing to pay for innovation. Many factors influence the economic benefit of inventions. Innovation requires first of all the interconnection of the market and technological competencies. This interconnection mostly occurs in companies. Therefore, the conditions for innovation in companies constitute a critical element for the assessment of the country’s innovation capacity.



Source: The INKA Project

How were companies selected for in-depth interviews?

The main selection criteria were (i) the knowledge intensity, (ii) the importance of export, and (iii) the dynamics of the performance growth.

Knowledge intensity was measured as a share of R&D expenditure in company output. The importance of export was expressed according to its share in output. The growth dynamics was determined according to the average annual change in output. At the same time, the minimum shares of large companies, SMEs and start-ups in the whole sample were determined. Finally, the minimum limits of representation of selected industrial sectors were established.

The selection of companies took into account the highly asymmetric distribution of the number of companies by the size characteristics important for the examination of the innovation capacity. The principle of “many minima – few maxima” is documented in the figure on the example of business investment in R&D. In 2014, 419,444 corporations were registered in the Czech Republic. However, “only” 2,391 R&D facilities were found among them. Only 629 corporate R&D facilities invested more than CZK 10 million in R&D in 2014. Only 82 corporate R&D facilities reported R&D expenditure over CZK 100 million.

The resulting sample was designed to include a disproportionately large number of companies with relatively high R&D expenditure rather than companies without internal R&D capacities. The emphasis is put on the firms’ knowledge intensity because their innovation capacity in the area of higher innovation is largely determined by the critical size of financial, technical and other capacities centred in R&D.

However, this does not mean that sufficient attention is not paid to innovation which does not require in-house R&D. The selection of companies and its justification is described in detail in the relevant methodological chapters – see the links on page 5.



Source: CZSO Statistical Yearbook of the Czech Republic, 2015, Research and development in 2014. Data in the figure are for 2014

3. MAIN FINDINGS CONCERNING THE INNOVATION CAPACITY IN THE CZECH REPUBLIC

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TWO MAJOR FACTORS FORMING TODAY'S ECONOMY IN THE CZECH REPUBLIC

In order to understand the current situation of the Czech economy, it is necessary to identify the main long-term forces shaping the present and constituting the bases of the future development

Foreign direct investment

The main cause of many findings is the **initial geopolitical and economic position of the Czech Republic** in Europe after gaining political independence in 1989 and the breakup of Czechoslovakia in 1992. At that time, **there was a significant cost differential in Europe west and south of our borders**. This cost differential **has virtually persisted to this day** despite the transformation and catching up with the western economies that have been ongoing for twenty years. This geographically unique and distinctive **cost differential determining the price of inputs** (especially labour) **has made our economy more attractive for the activities of foreign companies, in particular for activities where the increase in the cost-effectiveness is the source of competitiveness and growth**. The importance of the cost differential gradually increased in the context of the accession of the Czech Republic to the EU, which stimulated the **influx of foreign direct investment**. This was at its highest from the second half of the 1990s to the middle of the following decade, and constituted the **key factor of the modernisation of the Czech economy**.

Entrepreneurship, business experience and concentration of capital

The second fundamental aspect of the starting position which keeps affecting the situation lies in the **decades-long absence of free enterprise. Consequently, there was a lack of experienced entrepreneurs (large and small), a lack of the capital linked to them, and ultimately a lack of the competencies to find new opportunities and customers in the ever stronger competitive conditions of the global markets**. Although the situation has improved dramatically in this respect, these effects are still apparent in the economy. 25 years from the commencement of the return to a market economy, the phenomenon of “succession” is manifested more and more often. From the perspective of the innovation capacity of the economy, it is an important and at the same time risky process. The generations of entrepreneurs – founders are more ambitious and innovative on average than the generations of entrepreneurs – heirs or professional managers hired by owners who have inherited the companies. A special feature of the economy (and society) lies in large concentrations of capital arising in the post-privatisation phase of ownership consolidation. In the early years of this consolidation, the legislative environment did not correspond to the established market economies and enabled many practices which adversely affected the perception of the social role of entrepreneurs and the importance of entrepreneurship for the development of the economy and society.

The result of the interaction of the two forces

The combination of these forces inevitably led to a **dynamic internationalisation of the economy with all its pros and cons. Activities of foreign companies were the main drivers of modernisation of the entire economy**. The main benefits consisted in providing access to the global markets, new technologies and the expansion of modern management methods. It can be reasonably assumed that without a massive influx of foreign direct investment (FDI), the Czech Republic would not be among the countries with the lowest unemployment rate in Europe. At the same time, FDI has contributed to a certain restriction of entrepreneurial autonomy and the creation of different types of dependencies of the local economy. The limited entrepreneurial autonomy and the dependent market position of many companies may pose a risk for the country's future innovation capacity under certain circumstances.

3.1 PROSPERITY LEVEL AND PRODUCTIVITY

The long-term economic performance primarily depends on the development of productivity. The importance of innovation for competitiveness and economic growth lies in the way in which innovation affects productivity.

These benefits take place at different levels – the company, the industry, the entire economy. When conceiving the economic policy, it is useful to take into account two distinct forms in which innovation affects productivity. The first is optimisation. This means that due to innovation, a larger volume of production may be created from the same resources, or the same volume of production may be created from a smaller volume of resources.

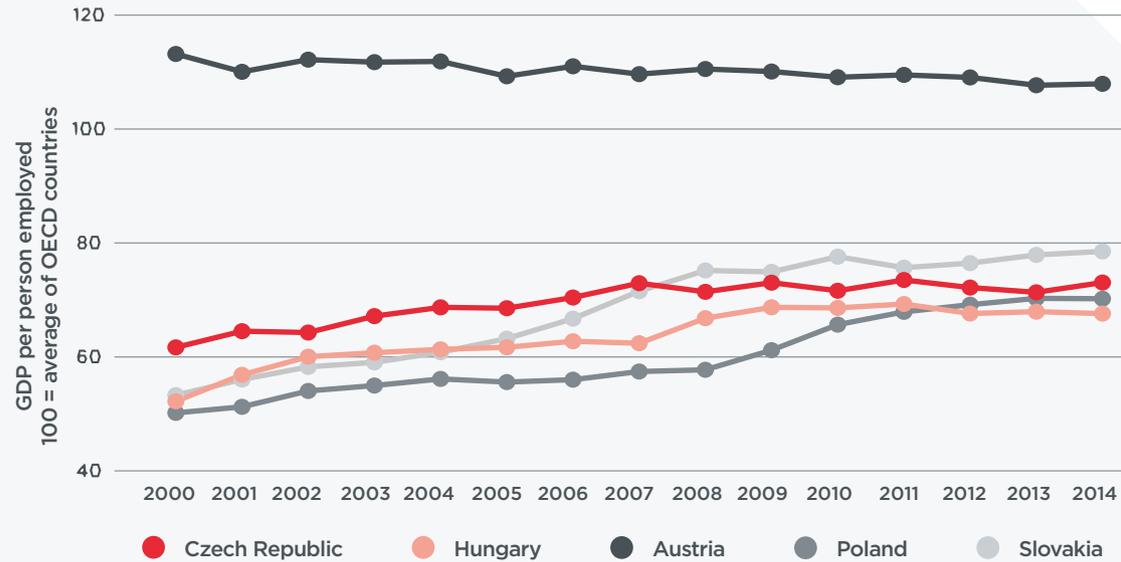
The second form is the creation of new values. It is based on the ability to find new needs and thus opportunities for the creation of new values. Due to ongoing technological and the resulting economic and social changes, innovation generating new values will be crucial for a long-term

level of prosperity. An increasing number of justified arguments of leading economists imply that it can be expected that the new jobs will be created much more slowly than disappearing of jobs due to the technological development. Professors Brynjolfsson and McAfee explain this issue in detail in the internationally successful economic bestseller *The Second Machine Age* published in 2014.

Productivity measurement

Productivity at the level of the entire economy can be measured in several ways. The findings are based on the measurement of the labour productivity expressed as GDP volume per person employed. Persons employed mean employees, entrepreneurs as well as self-employed persons. The international comparison is limited by the differences in the working hours and the share of part-time jobs. However, the measurement of the labour productivity on the basis of the number of hours worked is in turn hampered by the limited accuracy of data on the time worked. As part of the performed analyses, different methods of measuring the labour productivity were compared at all three basic levels (the economy, industry, company).

Chart 2: Development of productivity - compared to selected countries



Source: Own calculation according to OECD data

Table 1: Rate of productivity convergence in V4 countries compared to the average of OECD countries

	Comparison with the OECD average in 2000	Comparison with the OECD average in 2014	Change
● Czech Republic	61.7	73.1	+11.4
● Hungary	52.2	67.6	+15.4
● Poland	50.2	70.2	+20.0
● Slovakia	53.3	78.5	+25.2

Source: Own calculation according to OECD data

The Czech productivity reached 73 % of the OECD average in 2014

In the period of 2000–2007, the Czech Republic was getting significantly closer to the OECD average

From 2007 stagnation – no getting closer to the level of productivity of the most advanced countries

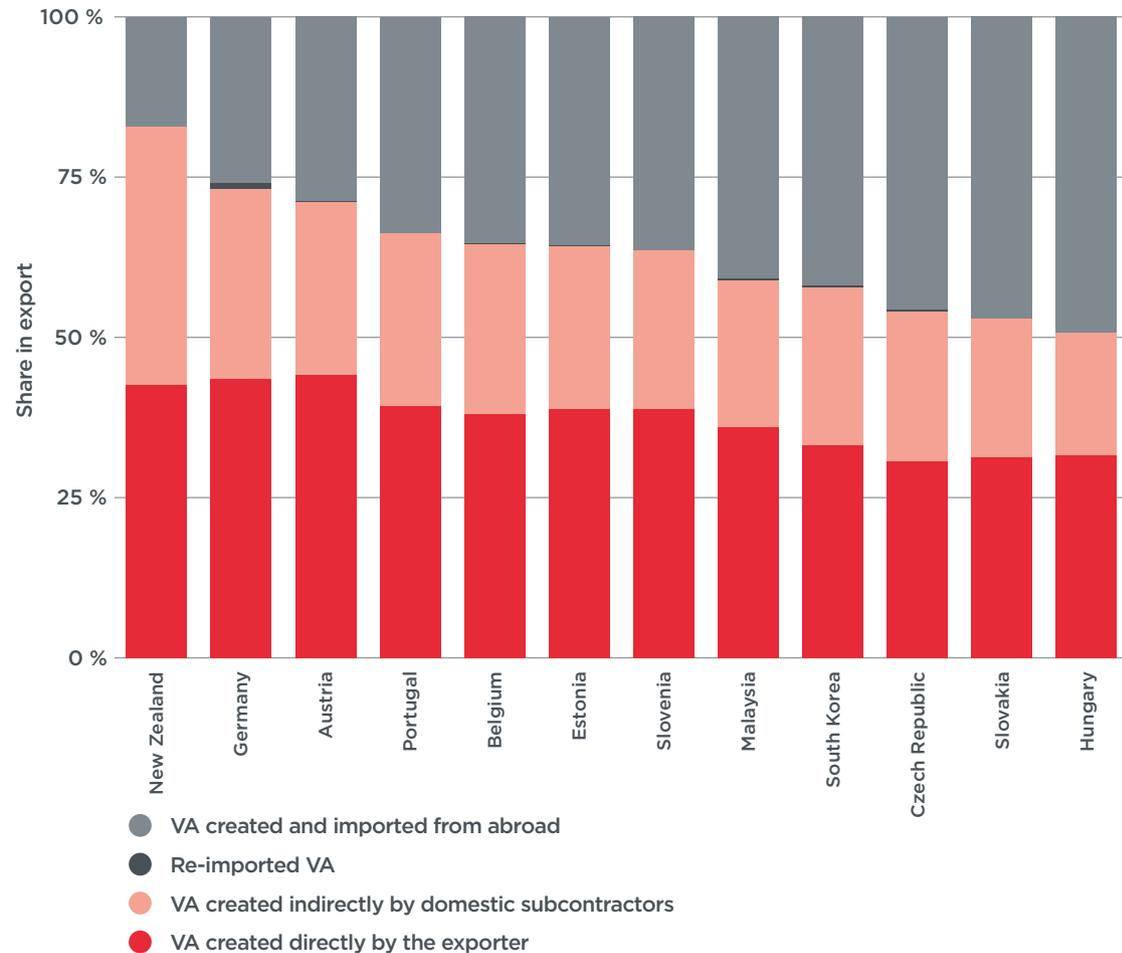
Slovakia overtook us and Poland caught up – countries whose productivity significantly lagged behind the Czech Republic in 2000

3.2 EXPORT

“...export to the most demanding global markets, such as the U.S., Germany and Japan, is our strongest incentive to innovate...” a spontaneous reaction of seven companies which are characterised by global business and innovation ambitions.

- In 2014, the ratio of the Czech exports to GDP reached 85 %.
- Due to economic globalisation there is continuous increase of the part of the value added in export which was brought from abroad as supplies to produce goods for export. Therefore, the traditional indicators of export performance are gradually losing their value for describing the export performance.
- In the case of the Czech Republic, the imported added value formed 45 % of the total export value. That is significantly more than in countries which are innovation leaders (see Germany and Austria in the chart).

Chart 3: Export structure according to the origin of the value added (VA)



Source: OECD – TiVA Database 2015 (data for 2011)

The difference in the “export value created domestically” (see the previous page) indicates that **we are internationally competitive in foreign trade especially due to a “partnership” with foreign direct investors.** The export performance

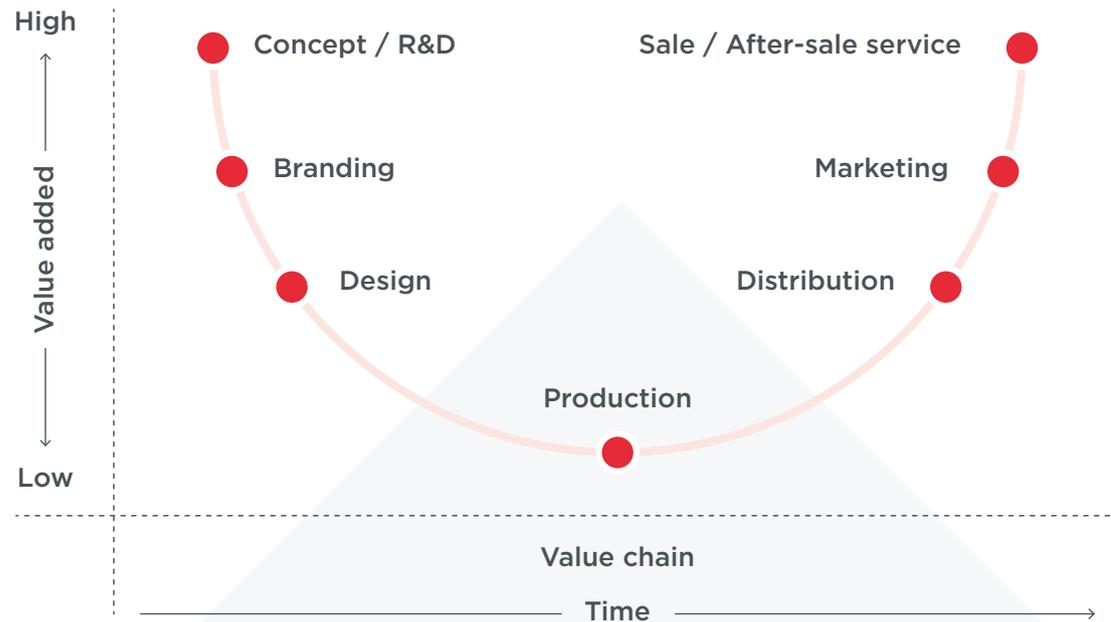
of the Czech economy is mainly due to the **combination of (i) a qualified workforce and (ii) its localisation in the imaginary centre of the rich European market, on the edge of a big price break** (the price of one hour of skilled labour in Germany

and further west versus the price of one hour of skilled labour in the Czech Republic and further east). **We provided this strategic advantage as an input into the partnership with foreign companies, which provided the capital, technologies and especially the access to the markets and the established relationships with customers.**

Although this “partnership” with foreign companies is gradually changing and acquires new forms in a number of companies, a large part of the economy can be seen as dependent in terms of business and trade. In this context, it is important to realise that **a growing number of endogenous¹ companies can also succeed in the demanding foreign markets.** From the perspective of the entire economy, however, the crucial export volume is provided by companies which are part of multinational companies and whose entrepreneurial autonomy is limited to varying degrees (for more information on this topic see below). This means that such companies do not decide independently on what, to whom and for how much they will sell and how and with whom they will produce their goods. **For the future innovation capacity, it is important that the segment of companies which independently decide on their overall strategies and thus strategic innovation considerably strengthens.**

¹ An endogenous company is a company originally established in the given economy regardless of its current territory of operation. Generally, these companies have the highest levels of decision-making and the related strategic activities in their home countries.

Distribution of the value added across the value chain



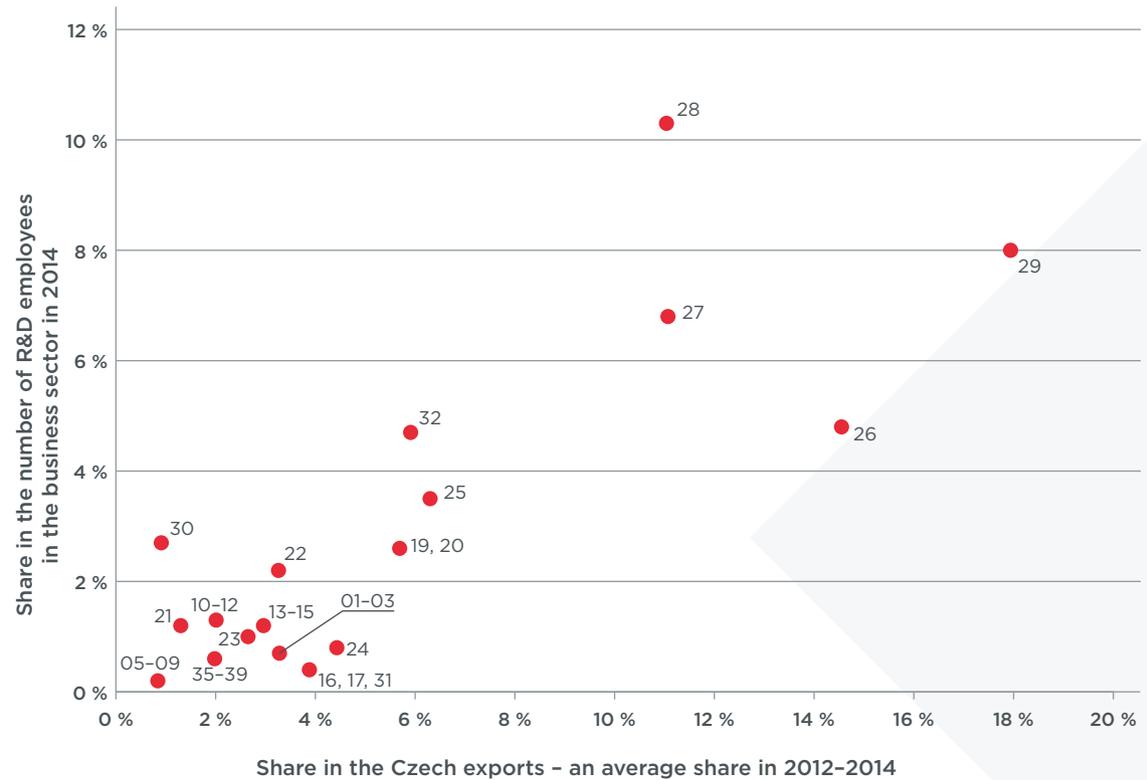
Many companies that are part of international groups perform only a part of their activities forming a value chain in the Czech Republic. We cannot generalise; nevertheless, these companies often implement activities with a lower added value within the production chains, especially assembly, production and distribution. Marketing, development and other activities with a higher added value are the key component of corporate innovation processes. In terms of the long-term innovation capacity, it is important that many of these companies gradually expand their activities to other parts of the production chain (see below).

The export performance of the Czech Republic is driven mainly by these four sectors (see Chart 4):

- Automotive industry
- Electronics industry
- Mechanical engineering
- Electrical industry

Their combined share in the Czech exports was 62 % in 2014. The share in the employees of the corporate R&D sector was 30 % in 2014.

Chart 4: Export structure and knowledge intensity of four key export sectors in the Czech Republic



01-03 - Agriculture, forestry, fishery; 05-09 - Mining industry; 10-12 - Food, beverages and tobacco;
 13-15 - Textile, clothing and boot industry; 16, 17, 31 - Wood-working, paper and furniture industry;
 19, 20 - Refining and chemical industry; 21 - Pharmaceutical industry; 22 - Rubber and plastics industry;
 23 - Glass and ceramics manufacture; 24 - Metallurgy; 25 - Metal-working industry; 26 - Electronics industry;
 27 - Electrical industry; 28+331 - Mechanical engineering; 29 - Automotive industry; 30 - Other vehicles;
 18, 32, 332 - Other manufacture; 35-39 - Utilities (electricity, water, waste...)

Note: The names of NACE codes are simplified to save space
 Source: CZSO - Export Database, Research and development

Table 2: Share (%) of export value created abroad (imported)

	Austria	Germany	Czech Republic
Production of motor vehicles (NACE 29)	48	31	53
Mechanical engineering (NACE 28)	33	27	46
Production of electrical equipment (NACE 27)	35	26	53
Production of electronics (NACE 26)	25	25	67

Table 3: Knowledge intensity – R&D expenditure / gross value added (%)

	Austria	Germany	Czech Republic
Production of motor vehicles (NACE 29)	13.7	21.1	2.5
Mechanical engineering (NACE 28)	10.8	6.2	3.7
Production of electrical equipment (NACE 27)	19.1	3.8	2.5
Production of electronics (NACE 26)	26.7	25.1	5.0

Tables 2 and 3 provide a comparison of the Czech Republic with Germany and Austria according to the share of the imported value added in the export and the knowledge intensity in the four major export sectors of the Czech Republic. The comparison in the tables above implies that the imported value added forms a substantially higher portion of export in the Czech Republic than in Germany or the (in terms of size) comparable Austria. In the case of the electronics industry, the difference is enormous. Two thirds (67 %) of the export value consist of the imported added value.

The knowledge intensity of the driving sectors is significantly lower than in the countries selected for comparison. Despite the difference in price levels, this difference shows a relatively lower intensity of investment in higher levels of technological innovation. Thus aggregated data for the entire sectors may however mask important information about their internal structure (see the box).

Even aggregated data structured in detail do not always provide adequate information.

For example, the production of electronics and optics (NACE 26) seems to be a field with a relatively low value added and low knowledge intensity in the international comparison according to the aggregated data “in Tables 2 and 3”. However, the same sector includes the production of electron microscopes, which is an ultra-high-tech sector in which the Czech Republic is among the global leaders, with more than a one-fifth share in the global market. This example illustrates the need for a sensitive approach to the identification of areas for selective support tools.

3.3 GLOBALISATION: THE ROLE OF FOREIGN COMPANIES AND ENTREPRENEURIAL AUTONOMY

The Czech Republic is a dependent economy in terms of a limited entrepreneurial autonomy.

Many companies do not decide the subject, customers or price of their production. Many large companies that export most of their production are in this position, while marketing and sale are wholly or largely managed by the parent corporations.

Companies under foreign control as a whole are significantly more productive than the segment of domestic enterprises. Their share in the gross value added was 31.7 % in 2013. Their share in the employment was 21.7 %.

A significantly higher productivity in the segment of companies under foreign control and a significant share of this segment in the entire economy are strong preconditions for the formation and development of many forms of economic dependence. The existing statistics do not reflect the essence of the entrepreneurial autonomy of companies. A detailed analysis of the innovation environment in companies, based on field survey, revealed many forms of economic dependence.

In terms of the innovation capacity in the Czech Republic, economic dependence is advantageous in many cases.

In particular these are the cases of companies which are part of global technology leaders (such as Siemens, Bosch, ABB). In the Czech Republic, there are no companies

with the aspirations or capacity to be at the forefront of the global development of major technological changes, e.g. to develop their own autonomous vehicle and cover over a million test miles in different conditions, as Google was able to do. However, the possibilities of using the opportunities stemming from the relationships with global technology leaders are subject to a rapid development within these companies as well as in the local and global economies. Therefore the current growth potential of the relationships with these companies for a long-term innovation capacity may erode over time.

Many companies subordinated to management of parent corporations abroad are gradually expanding their roles in the concern. This simultaneously increases their entrepreneurial autonomy as well as room for innovation.

Many leading global companies began in the Czech Republic only with a manufacturing plant or sales office for the local market. With the growth of the knowledge of the local environment and in the context of changes in the global economy, some companies chose the Czech Republic as a strategic location for the development of many business operations including development, sale and other activities with a higher added value.

The massive influx of foreign direct investment over two decades has created various forms of economic dependence, some of which stimulate the innovation capacity of the country.

Entrepreneurial autonomy and room for innovation

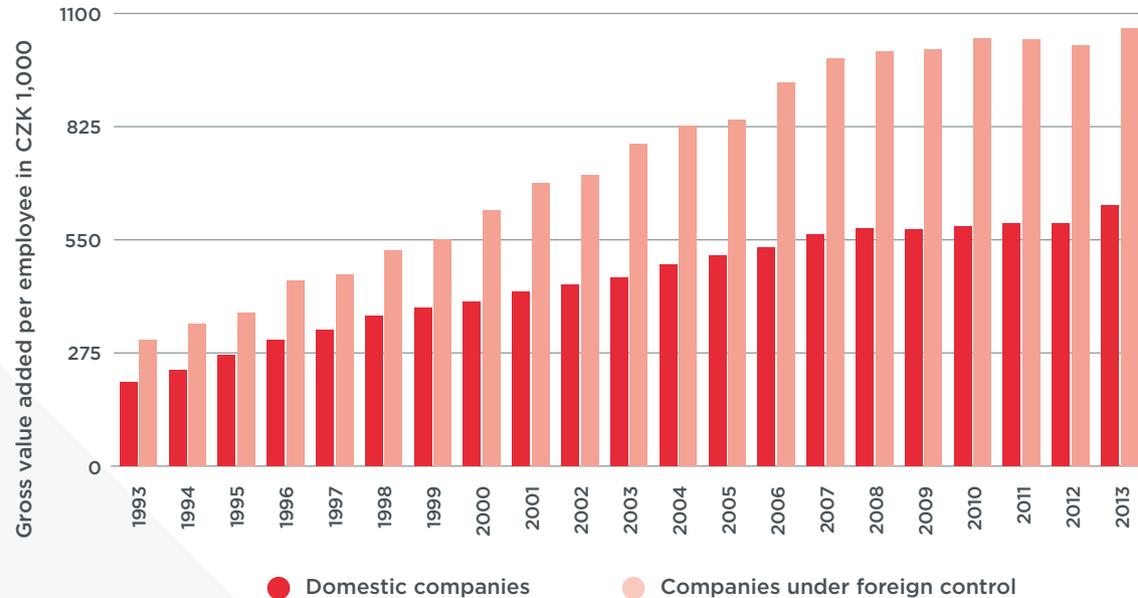
Strategic innovation forms an integral part of the overall corporate strategy. Therefore, the ability to make separate and independent decisions on the overall direction (vision) and strategy significantly affects the innovation capacity of the company. The reason for this is the scope of the room for innovation, i.e. areas and ways in which a company can innovate. For example, if the company is subordinate to an international group and is in charge of “only” production and distribution, its room for innovation is considerably narrowed. The company will not be much concerned with how to improve communication with customers or what new products the group will be producing in three or five years. It is likely that depending on the assignment by the superior part of the group, the innovation efforts of the company will focus on the process and technology optimisation of production.

Dependence of the “economy” on companies with a limited entrepreneurial autonomy

The difference in the labour productivity between domestic companies and companies under foreign control no longer increases

The economy becomes dependent if a significant part of the output and employment is formed by companies which do not decide by themselves on their long-term direction. This occurs particularly in a situation where the segment of non-autonomous companies represents a high share in the economy and achieves a considerably higher level of productivity than the segment of autonomous companies.

Chart 5: Development of “labour” productivity in domestic companies and companies controlled from abroad



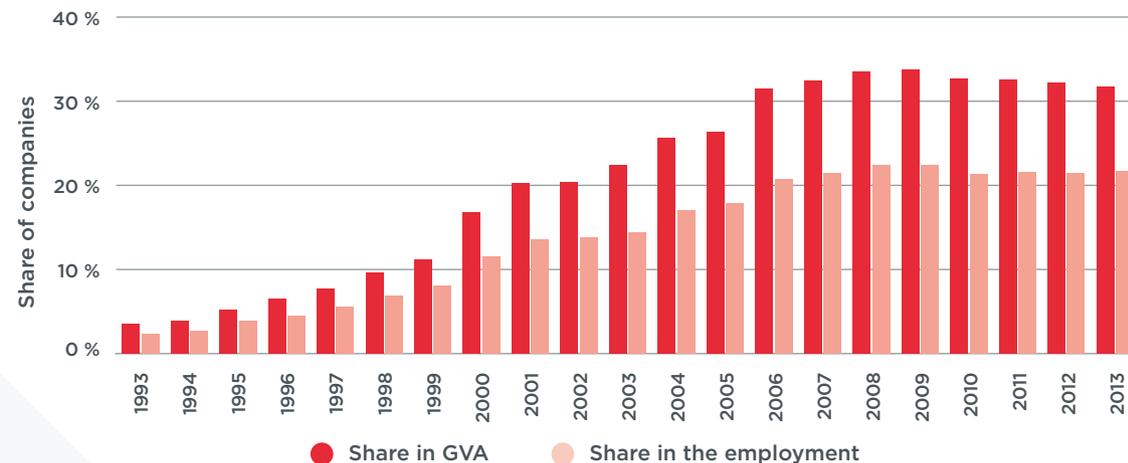
Source: CZSO – National accounts

Note: Foreign control means more than a 50% ownership interest

- Companies under foreign control as a whole report a 40% higher labour productivity than the segment of domestic enterprises. The vast majority of companies under foreign control have a more or less limited entrepreneurial autonomy. It is the other way round in the case of domestic companies.
- This difference in labour productivity was increasing until 2007. Now it remains the same. This striking temporal coincidence with the stagnation of convergence compared to the average level of OECD countries raises questions about the importance of the productivity growth in the segment of domestic companies as the prerequisite for the Czech Republic further advancing to the level of economic performance of Austria or Germany.

A new phase of internationalisation of the Czech economy?

Chart 6: Development of the share of foreign-controlled companies in the Czech economy



Source: CZSO - National accounts

- Before the onset of the global recession in 2008, the economic growth of the Czech Republic (CR) was driven mainly by a massive influx of foreign direct investment and its consequences (for example through the relationships with local suppliers).
- However, the growth of the share of foreign-controlled companies in the gross valued added has not changed much since 2008. At the same time, the deepening of the difference in the productivity levels between foreign and domestic companies also ceased. Interviews in companies and aggregate data indicate that the **CR is gradually moving to the qualitative phase of internationalisation of the economy.**
- This means that further productivity growth and thus development of the Czech economy will be strongly determined by the transformation of activities performed

by the foreign companies in the CR. This is also associated with the transformation of needs and barriers to a further influx of foreign direct investment. For instance, the setting of the immigration policy and local services for incoming foreign experts and their family members will become increasingly important for investment in corporate development and innovation centres.

- Besides the transformation of activities performed by foreign companies in the CR, **the development in the segment of autonomous companies will be crucial for the growth of the overall productivity.** The important aspects will include the international expansion of large established companies as well as the emergence and development of new ambitious enterprises able to establish themselves in the global markets.

Measurement of entrepreneurial autonomy

The fact that a company is owned by a foreign group does not automatically mean a limited entrepreneurial autonomy. There are no reliable data for an aggregate analysis of this issue. The reported findings are therefore based on a combination of analyses of aggregate data and information obtained through interviews in companies.

Main findings concerning entrepreneurial autonomy

In all developed economies, there is a growing number of companies whose overall direction and often specific procedures and processes are controlled from abroad. This is a side effect of globalisation, which will continue to intensify. It is important for the innovation capacity and thus for the economic performance of individual economies for how many and what such globally expanding companies they are home countries.

Many forms of the relationship between the foreign owner and local management

Aggregate data and the cases of many companies confirm a high degree of economic dependence of the CR on strategic management from abroad. However, the consequences for the innovation capacity are not clear. They vary greatly between individual companies. They depend on the specific form of the relationship between the foreign owner and local management. The innovation capacity of a company strongly depends on the assignment by the superior part of the group, which evolves over time. It also depends on the degree of the decision-making autonomy of local managers as well as on the culture and practices across the group.

Economic dependence has its positives

From a global perspective, the CR is an economy of small companies, but, with some exceptions, with no global technology leaders. Different forms of dependence on companies which are global technology leaders thus provide an extraordinary potential for a growth in innovation performance. Through the development of R&D and other activities of these companies in the CR, the local economy gets into the centre of the global development of technologies, management practices and, increasingly, new business models.

Strengthening the decision-making autonomy and expanding the range of activities

Many companies that used to be “mere” assembly or production plants have changed. Many of these companies have gradually become strategic production plants. There is an increasing number of engineering and development activities associated with such companies. There are also Centres of Excellence of global technology companies that attract experts from many not only European countries to the CR. To some companies, the CR is becoming a strategic European base. There are also more and more activities in the area of marketing and sale, although not to the same extent as challenging technological activities. With this expansion of activities, the room for independent strategic decision-making, and thus innovation, inevitably grows.

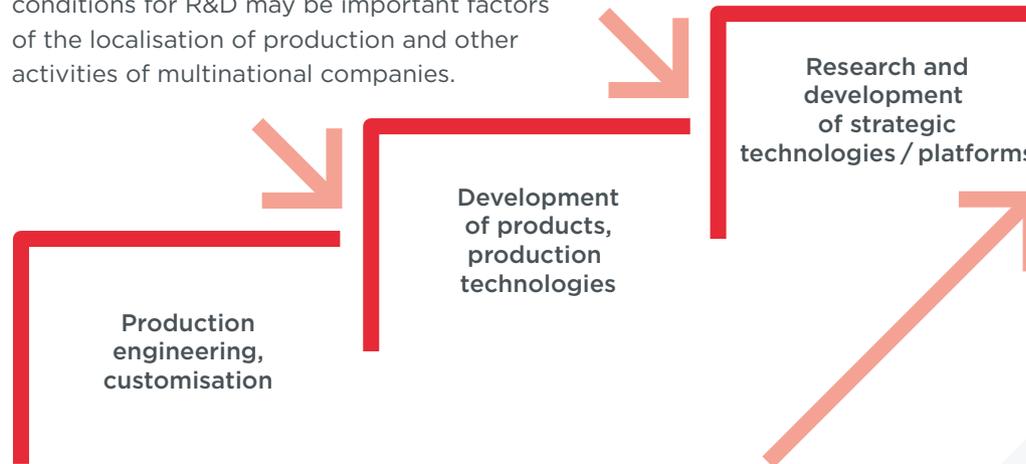
Success in the competition among suppliers by entering the global economy

Numerous fast-growing local companies have grown because of a successful cooperation with the local branches of global companies. Although these companies were and often still are dependent on one or a few customers, the fast growth enabled their owners to accumulate a critical mass of resources (funds, HR etc.) for a gradual development of the company's own production. Some of these companies already have a larger income from their own production than the cooperative production, and they gradually expand their export territories, buy foreign companies etc. Many local SMEs lack such competencies and capital to implement otherwise ambitious business plans. Many cases of temporarily economically dependent companies show the importance of business aspirations and the will to implement risky changes.

Globalisation of corporate R&D capacities: An opportunity for the Czech Republic?

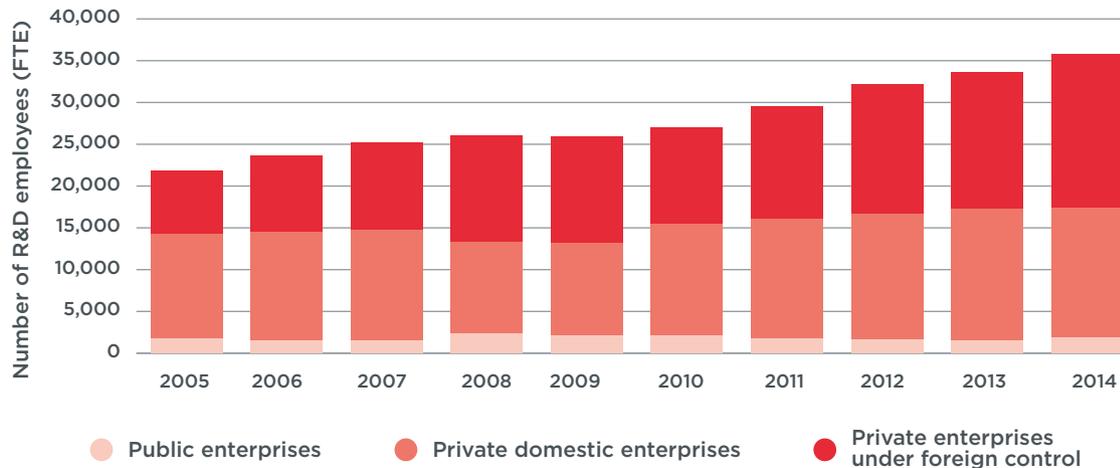
There is an increasing number of development centres of foreign companies in the Czech Republic. These centres are gradually gaining an increasing role in the group hierarchy (see figure). Some of them have become global Centres of Excellence for the entire group. The concentration of talent and suitable

conditions for R&D may be important factors of the localisation of production and other activities of multinational companies.



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Chart 7: Development of the number of R&D employees in enterprises according to the enterprise ownership



The Czech Republic is not a country of assembly plants. The employment in R&D in enterprises has been growing rapidly in recent years

Source: CZSO - Research and development 2014

An opportunity for the Czech Republic?

Multinational companies optimise the localisation of their activities on the basis of the conditions and resources offered by individual countries and regions, among other things. In this respect, the trend of R&D activity localisation in strategic production plants is extremely important to the Czech Republic. The need for a closer communication and connection between development and production is continually increasing, especially in new technologically demanding areas. The Czech Republic can offer an attractive combination of conditions for a further development of partnerships with multinational companies:

- Its location in the heart of Europe, from where over 200 million rich customers can be reached within a one-day truck trip.
- Qualified, relatively available personnel with technical or science education and relatively low labour costs. Despite strong reservations of many domestic companies, many foreign companies' representatives believe that the local university graduates are more available than university graduates in many developed economies.
- The industrial tradition in combination with many strategic production plants of foreign companies, whose local management seeks to obtain R&D projects / capacities as part of the competition within the group.

The public sector can also assist in using this opportunity. According to the visited companies, a fundamental reform of the education system should be a priority. A growth in the demand for university graduates in technical fields already has negative consequences. These take many forms from blunt methods of “stealing” employees to the demotivation of local entrepreneurs in terms of investment in the development of their own employees and thus company growth (“...we will no longer train experts for foreign companies that have long-term tax holidays funded by our taxes...”). The main changes required in the education system relate to changes of funding from quantity to quality, a systematic cultivation of creativity, technical competencies and skills for the 21st century in combination with an emphasis on practical development. Companies are aware that it is not possible or desirable for the education system to “produce” ready employees.

Companies are also calling for the creation of flexible conditions for hiring experts and managers from abroad, including targeted services for their family members. Finally, there are more and more voices asking for streamlining the system of management of the research and innovation policy, including a clear definition of specific research priorities.

3.4 CORPORATE ASPIRATIONS AND INNOVATION

A company's operation is significantly influenced by the overall business vision. It predetermines the path the company is trying to follow in the long term. It establishes specific short- and medium-term objectives, including the resources needed to achieve them. Aspiration means a specific idea of what the company should achieve in the long term. Aspiration often changes over time depending on the achieved results. In terms of the evaluation of the economy's innovation capacity, corporate aspirations and aims of company owners are of great importance. This is because they shape the focus and boundaries of the innovation effort of the company.

On the basis of a qualitative analysis of information obtained through interviews in companies, the following types of companies were identified in terms of their innovation aspirations:

Leader

A company aspiring for leadership with respect to changes in the global market in the field of its business. In addition to a clear declaration of the ambition and specific steps to fulfill it, the company must have a global scope of sale or strive after achieving a global coverage.

Dependent branch of a foreign company

A company which is part of a multinational company (MNC) and in which the business vision is defined by another part of the group. Some of these companies are true technology as well as global market leaders. Nevertheless, for the purposes of evaluating the innovation capacity of the Czech Republic, what is important is the question how the local branch contributes to the position of the global company.

Follower

A company which intends to stay as close as possible to the leaders in its market and to be able to respond as fast as possible to their actions. The company strives for the best possible level of its own competencies, carefully examines the actions of leaders and seeks its own ways of responding to them. It focuses on differentiation and the search for market segments or niches where it could gain a dominant position with respect to the market leaders.

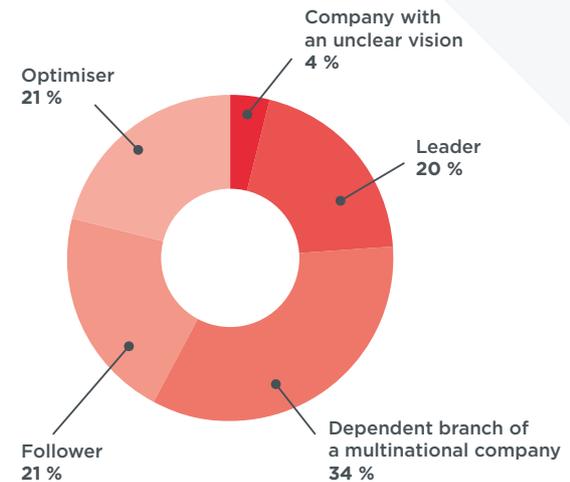
Optimiser

A company which gives up on the aspiration to be at the forefront of changes in the global market. The innovation efforts are focused on optimising products, production and distribution methods etc. that have been in the market for a long time; the company adopts changes and is strongly oriented at process perfection and the minimisation of unit costs while maintaining the target quality standards.

Company with an unclear vision

A company whose representative stated that the company had no vision, or it was clear from the answers that the idea of the company's direction was vague and the management focused on operation.

Chart 8: Aspiration of companies to lead in the area of changes in the global market



Source: Own classification according to information obtained in interviews in 452 companies

The business and thus innovation aspirations of individual companies vary significantly

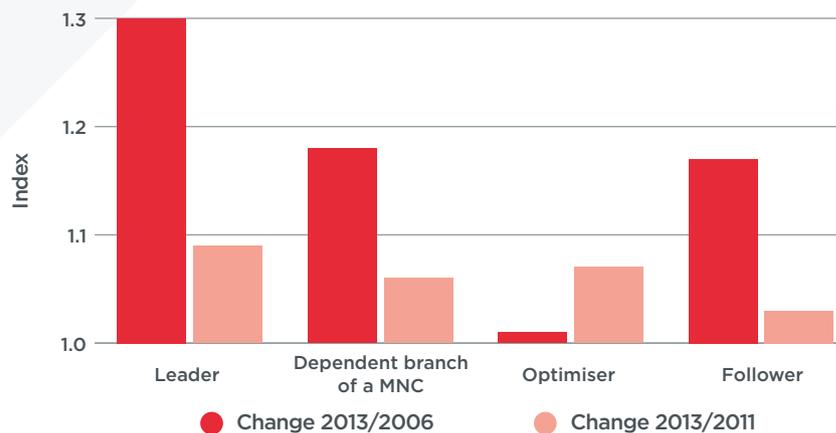
The size and significance of differences are illustrated by the following two quotes by owners of the visited companies:

"...I want to build a global corporation managed from the Czech Republic which will be among the drivers of the local economy..."

versus

"...we want to continue operating only in the Czech Republic; we might establish a branch in Slovakia one day, but we will never be more than a local family business..."

Chart 9: Average change of the number of corporate employees by the categories of innovation aspiration



Note: The figures show the median of the change in the number of employees in the individual company categories by their innovation aspirations

Source: Own arrangement according to information obtained in interviews in 452 companies

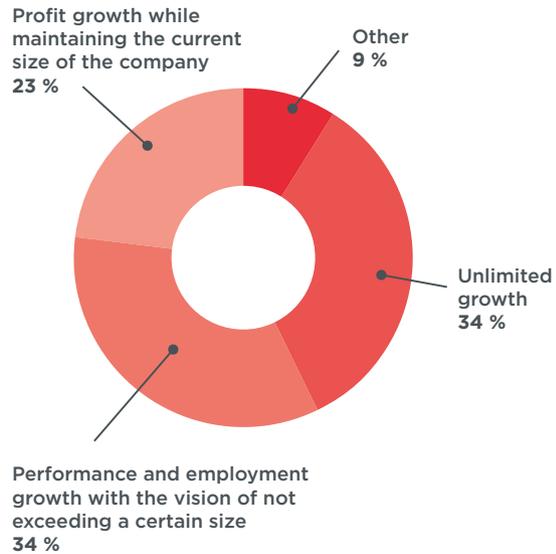
Aspirations for leadership in changes in the global markets are rare in the Czech Republic...

Leadership in terms of changes in technological innovation usually requires considerable R&D capacities. The sample of companies with the largest absolute as well as relative R&D capacities contains one fifth of companies with such aspirations. However, it should be taken into account that only about three thousand companies out of more than four hundred thousand registered companies have their own R&D capacities. Many companies with these aspirations are pioneers of new solutions rather than true market leaders.

...and at the same time very important for employment

In the period of 2006–2013, companies with the aspirations of an innovation leader increased their numbers of employees by 30 % on average, which is significantly more than all other company categories – see Chart 9.

Chart 10: Aspiration for the company growth



Source: Own arrangement according to information obtained in interviews in 452 companies

There are numerous reasons why owners do not want their companies to grow further or grow beyond a certain size. The most common reasons are the following (usually multiple reasons are combined):

- Lack of interest in entering other product or export markets in the case of the current production market saturation.
- The succession phenomenon - many companies are in the process of the generational replacement of the original founders.
- Restrictions imposed by the superior headquarters, which decide on the product portfolio or the sales territory or both.
- The owners' fears regarding the magnitude of the changes and the associated risks related to significant expansions.
- The ongoing search for new areas of operation of the company during a rapid decline in the current production sales.

- Lack of suitable personnel and capital.
- The preference of small steps and relative certainty over a rapid expansion, viewed as "too risky" by many entrepreneurs.

The entrepreneurial aspirations evolve over time in response to companies' results

Some entrepreneurs have global aspirations as early as the commencement of their business. Some entrepreneurs subsequently lose them upon accumulating business experience. Others begin with small aspirations that, gradually and accompanied by successes, transform into global ones.

Two out of three of the visited companies have limited growth aspirations; every fourth company does not wish to increase the number of employees

3.5 WHO ARE THE INNOVATION LEADERS?

In the search for the answer to this question, it is necessary to take into account the many forms that innovation can take. Are innovation leaders companies in traditional sectors which achieve outstanding productivity and customer satisfaction through continuous small improvements? Or are they companies which introduce for example a revolutionary new method of diagnosis of a fatal disease? In terms of the benefit of innovation for productivity and thus national prosperity, both types of innovation companies are important.

The innovation capacity assessment includes the search for global innovation leaders, among other things. These are companies marketing new innovations worldwide. A methodological problem arises in the assessment of a worldwide novelty. A worldwide novelty may be for example a single-purpose machine tailored to the needs of one unique customer for its unique production line. However, it can also be a 3D printer, drone or autonomous vehicle. Products / technologies that potentially have a mass market and many variations therefore lead to the creation of entirely new fields and gradually transform many traditional fields.

- The Czech Republic is a highly innovative economy in terms of the share of companies with technological innovations.
- Many companies are able to develop unique “business to business” solutions for global technology leaders.
- No companies which are global leaders in the mass markets are based in the Czech Republic. Nevertheless, such companies develop their activities there.
- Companies which are the creators of globally new generic technologies or products, whose introduction creates new mass markets, are not established in the Czech Republic.
- Innovation of a disruptive nature is exceptional, i.e. innovation that radically changes the functioning of the markets of established products.

From the perspective of the local economy, innovation leaders are:

1. Strategic production plants and R&D centres of global technology leaders

These companies hold leading positions according to the share in the market, the volume of internal R&D capacities and the ambitiousness of their own innovation activities. Some of these companies represent an imaginary “bridge” between the local economy and the global technology and innovation leaders.

2. Ambitious fast-growing autonomous (domestic) companies

The number of companies that are considered large for the Czech environment is growing dynamically, and these companies are expanding their export territories and increasing the internal R&D capacities. Within them, the companies gradually solve more and more ambitious innovation projects. The companies are rarely among the top global leaders in their fields. There are many other companies which intensively work on shifting towards the global leaders.

3. Dynamically growing small and medium-sized technology enterprises and start-ups

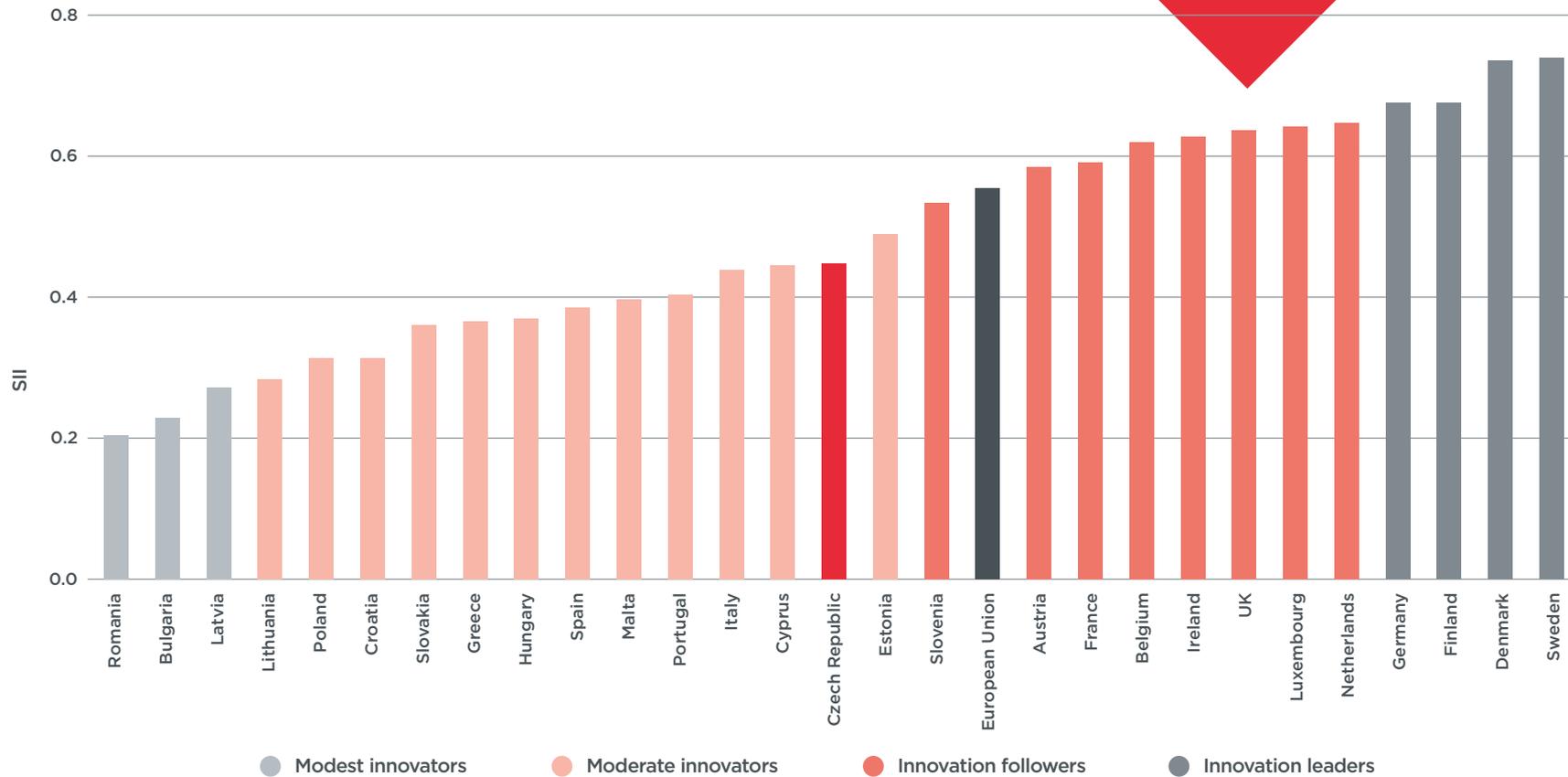
Many companies are able to find very specific, narrow market niches, and become major European and sometimes even global players in such markets.

3.6 INNOVATION ECOSYSTEM: INTERNATIONAL COMPARISON

In terms of its innovative economy, the Czech Republic is a moderate innovator.

Chart 11: Comparison of the EU Member States according to the Summary Innovation Index (SII)

28



Source: Innovation Union Scoreboard 2015

How do you measure the innovativeness of the economy?

There is no separate – clear-cut – indicator that adequately expresses the innovation performance of the economy. Therefore, “innovation indexes” based on a multi-criteria evaluation of the innovation ecosystem are mostly used. Selected indicators measure important inputs, processes and outputs of the innovation ecosystem (for example the intensity of corporate R&D expenditure, the availability of university graduates, the number of patents relative to the size of the economy, the investment of risk capital).

Different weights are assigned to these components, the values for comparability are standardised and an innovation index is created. The most widely used indicator of this type in Europe is the Summary Innovation Index (see Chart 11 on the previous page), which is part of the regular publication of the Innovation Union Scoreboard.

Its advantage is the ability to compare individual countries according to the indicators and in terms of the entire innovation ecosystem. Its disadvantage is the formal multi-criteria approach regardless of the specifics of individual countries. This makes the interpretation of the obtained data difficult and may distort it. Other approaches are also used to measure the innovativeness of the economy (see other outputs of the INKA project). However, their application produced the same

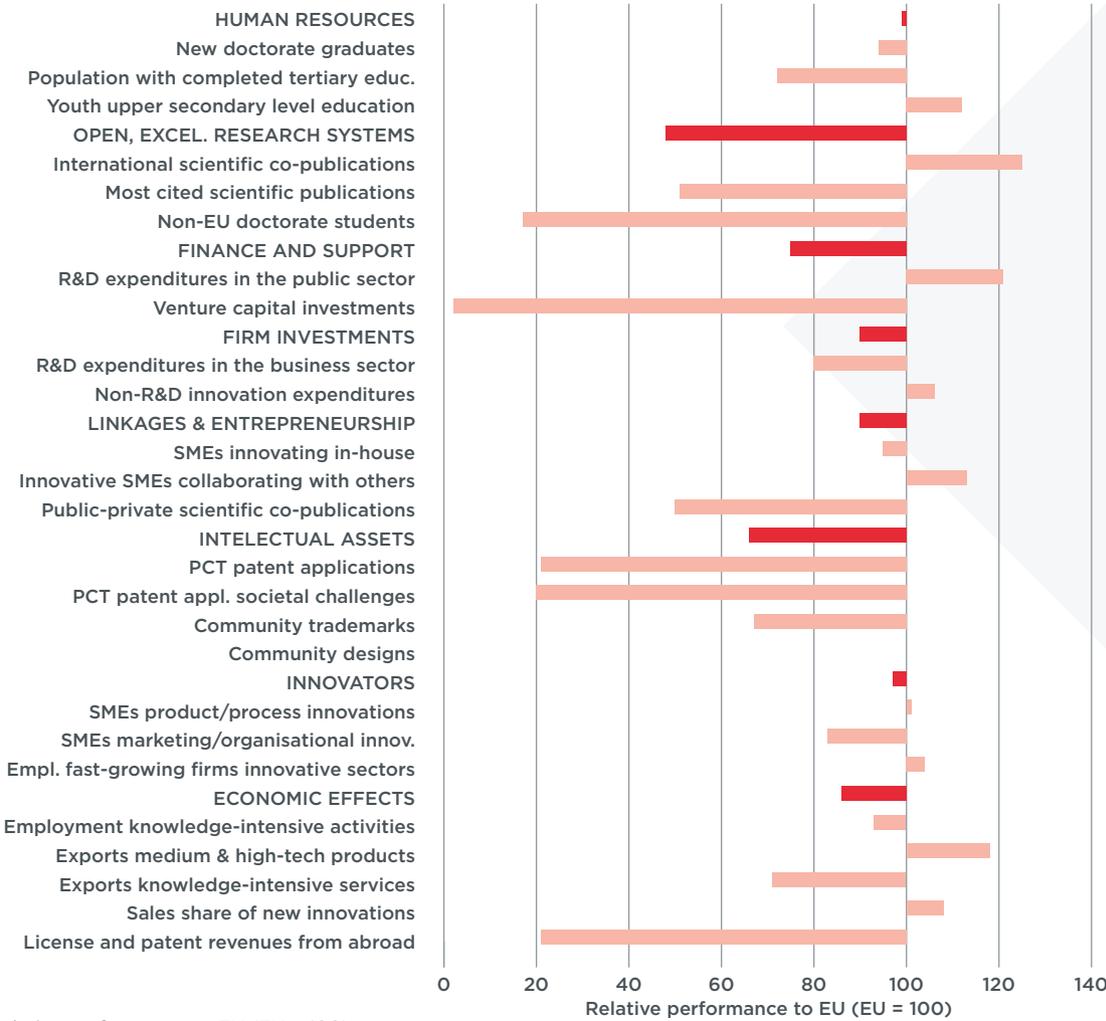
conclusion about an “average innovativeness” of the Czech Republic.

The simplest and also the most common criterion for measuring the innovativeness of the economy is knowledge intensity. It is usually calculated as the amount of the total or only business research and development (R&D) expenditure in relation to GDP. It is expressed in percentage. It is a fairly rough criterion of measurement of the scope of innovation inputs regardless of the outcomes of innovation. On this basis, simplified conclusions are often made that the Czech Republic is underdeveloped in terms of innovation or that the level of R&D expenditure is insufficient. When using this rough indicator, it is necessary to take into account the structural differences between the compared economies. For example, when comparing Europe and the U.S., it is necessary to take into account the large differences in the intensity of R&D expenditure in individual industries. In the IT and biotechnology (relatively more represented industries in the U.S.), the ratio of R&D expenditure to the created product is considerably higher than in the automotive industry (relatively more represented in Europe). The frequent assumption that industries with a higher knowledge intensity (the so-called high-tech industries) are more important for the economic growth than industries with a lower knowledge intensity has not been empirically verified.

**Multiple methods,
but the same
conclusion**

The following chart shows the sub-indicators used for the Summary Innovation Index. The values of the individual indicators show what percentage of the average EU28 value the Czech Republic achieves. The value of 100 corresponds to the average of EU28.

Chart 12: Comparison of the Czech Republic to the EU28 average according to the sub-indicators of Innovation Union Scoreboard 2015



Multi-criteria evaluations require a sensitive interpretation; comparison using the method “the more the better” is often misleading

Volume, structural and other aggregate statistics often fail to capture major qualitative differences between the compared countries. According to statistics, the Czech Republic is among the markedly above-average exporters of medium-tech and high-tech products. However, the chapter devoted to export showed that a large part of the export value is represented by production imported from abroad.

Another example may be new worldwide innovation. In the Czech Republic, the novelty is often intended for a very narrow market niche or it is a single-purpose device, whereas in other countries, the same statistics apply to generic technologies or products for the mass markets. There are many similar problems in measuring the economic benefit of innovation.

Relative performance to EU (EU = 100)

Source: Innovation Union Scoreboard 2015 Note: Sub-indexes are shown in large font and marked in a darker colour

3.7 PEOPLE: THE PRIMARY ELEMENT OF INNOVATION PROCESSES

A company has been chosen as the basic unit of analysis of the innovation capacity in the INKA project. This decision has been made with full awareness of the importance of people for the corporate innovation processes. In terms of the innovation capacity in the Czech Republic, the following two groups of findings are the most important:

1. According to the visited companies, people are by far the most significant barriers to innovation

Companies are aware of many different barriers to their innovation efforts. These barriers are mostly related to people. Every third company mentioned the human resources as the most significant barrier to innovation.

2. The existing education system shows a number of characteristics which do not support the innovation capacity of the Czech Republic

Given the importance of knowledge and skills for the innovation capacity, the finding that the quality of education in the Czech Republic is decreasing according to many internationally comparable criteria is worrying.

According to the international comparison of competitiveness of individual countries conducted by the World Economic Forum (WEF), the Czech Republic is rapidly falling among the compared countries according to most of the monitored education indicators (see Table 4). Many of the interviewed companies see the deterioration in the quality of university and secondary-school graduates as a serious problem.

Table 4: Development of the position of the Czech Republic in selected indicators in GCI (2008–2009, 2013–2014)

GCI indicator	Rank of the Czech Republic in 2008–2009	Rank of the Czech Republic in 2013–2014
Wages and labour productivity	13 th place ●	19 th place ●
Czech Republic: Overall position	33 rd place	46 th place
Quality of primary schools	15 th place ●	51 st place ●
Quality of the education system	26 th place ●	67 th place ●
Availability of scientists and engineers	11 th place ●	64 th place ●
Scope of employee training	28 th place ●	68 th place ●
Quality of STEM education	8 th place ●	83 rd place ●
Brain gain (ability to attract talent)	-	87 th place ●
Brain drain (ability to retain talent)	43 rd place ●	109 th place ●

● Above-average ratings compared to the overall score ● Below-average ratings compared to the overall score

Source: Global Competitiveness Report 2013–2014 (World Economic Forum – WEF)

The comparison of the quality of the education systems of individual countries is methodologically very complicated. One of the important parts of the evaluation consists in the indicators of subjective perception of the respondents in individual countries. Nevertheless, the information presented in the table fits into the logic of other obtained information. Pupils who achieve the best results in the individual literacy types (see Chart 13) constitute the most promising group for the innovation capacity. **The Czech Republic has lost its competitive advantage in a favourable proportion of pupils in the highest levels of mathematical literacy**, as their proportion fell from 18 % in 2003 to 13 % in 2012. South Korea has become the leader in this area; these levels are achieved by almost a third of all pupils there. **The negative development is also shown in scientific literacy**, where the proportion of pupils in the top two groups fell from 12 % to 8 %, and the Czech Republic thus fell from average to below-average. The recent results of the international comparison in IT literacy showed the Czech Republic in a very positive light; however, the question is to what extent this is the outcome of a high-quality education.

Chart 13: Comparison of the highest literacy rates in selected countries in 2003 and 2012



Note: Scientific literacy refers to the year 2006 in all countries. In the cases of Chile, Estonia and Slovenia, mathematical literacy and reading literacy also refer to 2006.

Source: OECD - PISA 2012

Companies' different perceptions of the availability of qualified personnel in the labour market

There are profound differences between companies in terms of the ways in which they work with people as the most valuable resource of innovation

Two out of five of the interviewed companies see a major barrier to innovation in an insufficient number of qualified personnel in the labour market. Each of the companies perceives quality as a (to a certain extent varying) combination of education, skills, experience and motivation. According to a half of the interviewed entities, it is a major problem to expand the internal R&D capacities. There are also cases where small local companies gave up on the development of internal R&D capacities due to the perceived inability to compete with R&D branches of foreign companies that are continuously increasing the number of their employees in the region.

Many representatives of foreign companies see the situation in the labour market of highly qualified people in the Czech Republic in a different light. Some of them said that it was much easier to find a qualified technician with a university

degree in the Czech Republic than in most developed economies "west of" the Czech Republic. One in four of the interviewed companies stated that it had no problem finding suitable personnel for its (in many cases strong) expansion. The companies differ in size, from very small to large ones. A common feature of these companies is a high innovation and growth aspiration. It was also found that these companies devoted much more effort to a systematic cultivation of human resources development. For example, these companies have sophisticated competency models interconnected with the wage policy, seek talented people not only in the Czech Republic, and have targeted internal programmes to promote self-fulfilment. As part of a special survey among HR managers of selected companies, the importance of the "success attracts talent" principle was stressed. It was repeatedly stated that the practical implementation of many standard procedures in the area of HR management was "...easier if the company expands globally and thus offers very attractive job opportunities which others cannot offer".

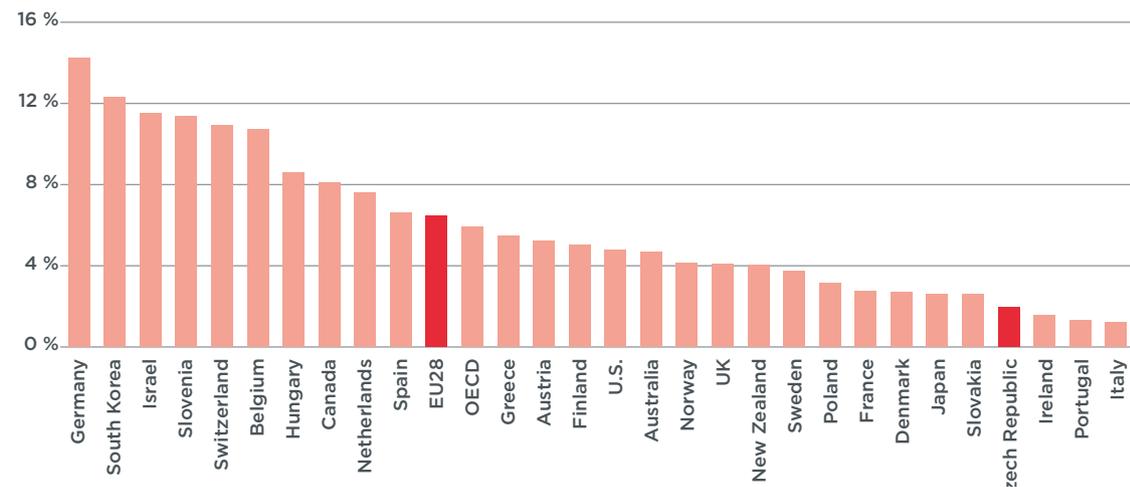
3.8 COOPERATION AND KNOWLEDGE TRANSFER BETWEEN COMPANIES AND RESEARCH ORGANISATIONS

The area of cooperation between companies and public research organisations draws great attention of experts in innovation support. Such public research organisations include universities, the institutes of the Czech Academy of Sciences, and other research institutions. In countries which are among the innovation leaders, the “soft infrastructure” supporting new ideas, the sharing and distribution of knowledge and the concentration of talent is a major asset. Some global companies deliberately place their research, development and other strategic capacities in regions with such developed infrastructures. These capacities then further stimulate (not only) the economic development of these regions and countries.

Some statistics suggest that the cooperation between companies and ROs is not sufficiently developed

An example is the share of R&D expenditure at universities which is funded by enterprises (see Chart 14). However, the data showing who finances and who actually implements R&D activities are impeded by differences in the institutional structure of the research sector in individual countries. The organisational structures, the systems of funding and the focus of support programmes vary and affect these statistics. Major cooperation also takes place through various unofficial channels that are not captured in the statistics. The less ROs are prepared for cooperation, the greater is the scope of the unrecorded cooperation. Finally, the informative value of data is negatively affected by the fragmented approach to the collection and reporting of data on cooperation at the level of ROs.

Chart 14: Share of R&D expenditure in the higher education sector (HERD) funded by enterprises 2013

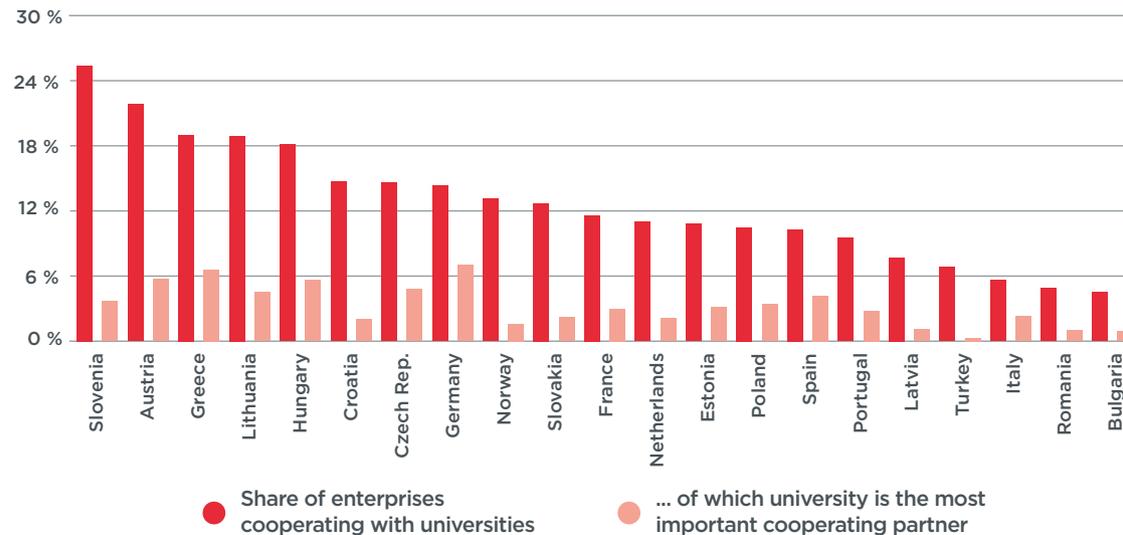


Source: OECD STI Database

Other statistics show that cooperation is quite abundant

According to the data from the Community Innovation Survey, the Czech Republic is one of the leading European countries according to the proportion of companies for whom universities represent the most important cooperating partners in innovation (see Chart 15).

Chart 15: Share of enterprises cooperating with universities (UNI) according to the Community Innovation Survey



Source: Community Innovation Survey 2010-2012 (the latest version of the regular EU-wide survey)

The information obtained through interviews in companies and public research organisations shows that:

- There is a growing demand of companies for the cooperation with public research organisations (PROs).
- For most companies, the main motivation is the access to talented graduates; however, there is also an increasing number of companies looking for “out of box” ideas for solutions to their needs.
- There are long-known barriers on the part of PROs as well as companies (see audit-vav.reformy-msmt.cz, <https://tacr.cz/link/studie1>, <https://tacr.cz/link/studie2>). Despite their existence at the level of faculties, institutes or individual teams, there are large differences in the motivation as well

as the volume of cooperation. Despite the existence of strongly restrictive barriers, personal motivation and the aims of research teams play an important role.

- Contractual research is the easiest form of cooperation for companies as well as application-oriented researchers. Due to the metrics of the OP RDI projects and changes in the research evaluation, there is a growing interest in a more systematic monitoring and specification of conditions for contractual research.
- Many researchers see contractual research as the least suitable form of cooperation, as it involves a cheap sale of know-how and no or little stimulation of research as such (see the studies of TA CR).
- On the other hand, other researchers argue that a long-term relationship with a company develops gradually and contractual research can be a good opportunity to develop research cooperation that will gradually bring incentives for the researchers as well.
- Simplistic conclusions concerning the barriers and non-functioning cooperation and their medialisation contribute to maintaining the barriers between the business sector and the research sphere. These spheres operate on the basis of different principles in individual countries, which inevitably makes communication and cooperation difficult.

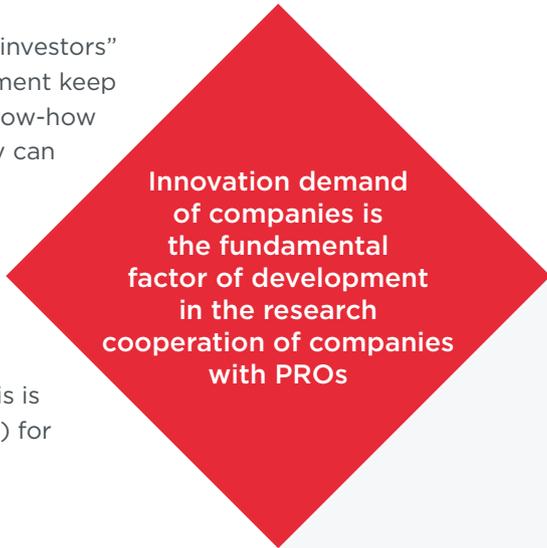
Scope and content of corporate demand for research collaboration

The development of research cooperation of companies with academic institutions also depends on the structure of the economy, in addition to the interest and readiness of research organisations and legislative and other general conditions. The number of large companies with great innovation and thus technological ambitions is particularly important. In this respect, the local economy considerably differs from the most advanced economies.

No Czech company is among the thousand largest companies in the world according to their R&D expenditure²

On the other hand, several companies in the top hundred have growing R&D centres in the Czech Republic. Their primary need in the area of cooperation with local PROs lies in qualified graduates or services related to the use of the research infrastructure. Parent corporations have their own capacities of external cooperation in the area of strategic research and development that are available to the local companies if needed. The establishment of a long-term research cooperation with these companies is therefore not easy for the local ROs, even though the relative proximity is good for the development of cooperation.

These global corporate “investors” in research and development keep searching for relevant know-how and locations where they can effectively develop R&D capacities. Gradually, more and more such companies are expanding their R&D capacities outside their home countries. This is an opportunity (not only) for the Czech Republic.



Innovation demand of companies is the fundamental factor of development in the research cooperation of companies with PROs

About 600 companies invest 10+ million Czech crowns in R&D every year; of these companies, nearly 60 companies invest 100+ million Czech crowns and only a few of them invest more than 1 billion Czech crowns

Although the precise measurement of the scope of corporate R&D capacities is problematic, the available data show that corporate R&D capacities are small compared to innovation leaders (such as SRN, SWE, SUI). For example in Switzerland, which is smaller in terms of population, there are 62 companies which invest over 400 million Czech crowns in R&D annually. In the Czech Republic, there are not even 10 such companies and most of them belong in global groups with access to their networks of research cooperation.

The evolution of the local economy is a crucial factor in the development of research cooperation

Well-set public programmes to support applied research and the support of commercialisation of research outcomes may significantly contribute to the development of research cooperation. Nevertheless, the driving force will be the growth in the number of companies that have high innovation aspirations and a critical mass of resources for their implementation. In this regard, **when evaluating the effectiveness of state aid, emphasis must be placed on whether private investment in R&D is complemented and not displacing.**

² See <http://iri.jrc.ec.europa.eu/scoreboard15.html>

How to approach the measurement and evaluation of cooperation and technology transfer?³

The development of mutual ties between companies and research and educational organisations may, with a certain degree of simplification, be considered an indicator of development of the innovation ecosystem. On the other hand, this is not the goal. Compared to Germany or Switzerland, the local economy contains far fewer companies which need and have the capacity to build external research capacities. The conducted analyses show that to obtain a relevant picture of this very complex issue, the following should be taken into account:

Not only the scope but especially the content of cooperation

In terms of the actual benefit of PROs for the innovation processes in companies and their competitiveness, the content of cooperation is crucial, not the scope. This leads to the question of how relevant the existing data (e.g. concerning contractual research) and quantitative methods in general are.

Distinguish between various forms of cooperation and commercialisation

Different companies prefer different forms of cooperation, just as researchers prefer different forms of research outcomes commercialisation. Given the fundamental differences, for example in relation to the objects of intellectual property of the individual forms of cooperation and commercialisation, these forms must be carefully distinguished. The fact that one of the forms does not work does not imply that the cooperation as such does not work.

Avoid excessive generalisations

One of the main findings in the area of cooperation of companies and PROs is the lack of relevant data and a very limited informative value of the aggregated data. Differences between individual PROs and companies are so extensive that any aggregation of findings can be misleading.

³ See the studies by TA CR – <https://tacr.cz/link/studie1> and <https://tacr.cz/link/studie2>

3.9 DRIVING FORCES OF AND BARRIERS TO THE INNOVATION CAPACITY IN THE CZECH REPUBLIC

Main driving forces of the innovation capacity in the Czech Republic

1. **Growth in the number of globally successful autonomous companies** that invest in ambitious innovation projects.
2. Expansion of (not only) **the R&D activities of multinational companies** which are global technology leaders.
3. Growing number of entrepreneurs who have personal **experience with the failure of a strategy based primarily on cost optimisation.**

These three forces are real processes which take place in the Czech economy and have a major influence on the development of its innovation capacity. These processes are interconnected and their effects are multiplied through supplier-customer ties to the entire economy. If the Czech Republic wants to effectively develop its own innovation ecosystem, it should facilitate the natural course of the forces and eliminate the effects of the below-listed barriers to innovation as much as possible.

Main barriers to the innovation capacity in the Czech Republic

1. **Lack of highly motivated people** with the necessary technical, trade and other experience.
2. **An education system insufficiently responding** to long-term social and technological changes and thus new needs of individuals and companies.
3. **The market competencies of most companies are not as well-developed** as their technical competencies.
4. **A minimum of companies of a crucial size that are able to be among the global leaders in the development of new generic technologies.**
5. **A minimum of companies which did not exist 10 years ago and today belong among the global market players.**
6. **A stable, predictable and motivating business environment.**

4. LIST OF TERMS AND ABBREVIATIONS AND GLOSSARY

LIST OF TERMS AND ABBREVIATIONS

CAS	Czech Academy of Sciences
CR	Czech Republic
BERD	Business expenditure on research and development
CIS	Community Innovation Survey
CZSO	Czech Statistical Office
EU 28	European Union (28 Member States)
Eurostat	Statistical Office of the European Union
FTE	Full Time Equivalent
GDP	Gross domestic product
GVA	Gross value added
ICT	Information and Communication Technologies
IT	Information Technology
SMEs	Small and medium-sized enterprises
MSTI	OECD Indicator Database (Main Science and Technology Indicators)
NACE	Classification of economic activities (Nomenclature statistique des activités économiques dans la Communauté européenne)
NIS	National Innovation System
MNC	Multinational company
OECD	Organisation for Economic Co-operation and Development
VA	Value added
PPS	Purchasing power standard
FDI	Foreign direct investment
R&D	Research and development
SW	Software
TiVA	Trade in value added
R&D	Research and development
RO	Research organisation
PRO	Public research organisation
UNI	University
SWS	Selective Workforce Survey
MI	Manufacturing industry

GLOSSARY OF SELECTED TERMS IN THE PUBLICATION

Centres of Excellence

Units or organisational structures involved in world-class research and development of state-of-the-art technology. Public Centres of Excellence in the field of natural, social and economic sciences combine theoretical and applied research and (to the maximum extent possible) use multidisciplinary approaches. Centres of Excellence in companies represent the highest level of group R&D hierarchy.

Customisation

The possibility and ability of companies to adapt their products or components to specific wishes of customers, whenever possible.

Disruptive innovation

An innovation that enables the creation of an entirely new market or value chain, and possibly disrupts an existing technology (over several years or decades) or replaces a previously used technology.

Dualisation of the economy

The designation for the different behaviour of domestic and foreign companies in the economy. The degree of dualisation represents the share of foreign companies in the economy as well as in individual sectors. In terms of innovation and innovation processes, the position of foreign companies is different compared to domestic companies, and the innovative behaviour of foreign companies thus also differs.

Endogenous company

Companies that are formed and managed in the Czech Republic. Numerous endogenous companies move their registered offices outside the Czech Republic because of tax optimisation and for other reasons; consequently, these companies may be included among companies under foreign control in aggregate statistics.

Evolutionary development of the economy

A process in which historically individual economies undergo evolutionary development from competitiveness based on the availability or price of production inputs, or both, and competitiveness based on the effectiveness of the implemented activities to the development phase, in which the main source of the competitive advantage consists in the innovation capabilities based on unique knowledge. The significance of the sources of the competitive advantage in a lower stage of the economy development remains unchanged with the transition to a higher development stage. However, it is no longer crucial for retaining or expanding the competitive advantage.

Gazelles (gazelle companies)

Companies (groups of companies) which show a very dynamic growth in their economic performance – their performance grows annually by at least 20 % over four consecutive years (for the specific needs of certain analyses, this definition was modified to a period of three years, 2009–2012; for details see the Methodology).

Global triad

A designation comprising three traditional economically and socially advanced areas – Western Europe, North America and Japan.

High-tech / low-tech sectors

High-tech sectors are sectors which generally achieve a high knowledge intensity (the share of R&D expenditure in the created production). Companies in high-tech fields mostly use the outcomes of primary or applied research as drivers of innovation. Activities of some companies statistically belonging in the high-tech sector do not necessarily have to show a high knowledge intensity; this is influenced by the position of such companies in the value

chains. The internationally recognised methodology (classification of the NACE groups according to the knowledge intensity, see the Annex to the Methodology) is used to classify sectors into high-, medium-high-, medium-low- and low-tech.

Driving and driven sectors

Driving sectors are major and strong sectors of the domestic economy which significantly contribute to the economic performance of selected (driven) sectors through a demand for the inputs from such selected (driven) sectors.

Value chain

Almost all final products in the world are created through the cooperation of many companies, using a variety of inputs (know-how, capital, raw materials, labour) in various locations around the world. The value chain encompasses all these companies that successively participate in the creation of the final product's added value. Leading companies that manage and organise entire chains or networks of subcontractors play the key role in the value chain. The term of (global) production network (a broader concept including the environment surrounding companies – see the explanation below) is sometimes used for the concept of (global) value chain. The positions of companies in the value chains can be distinguished by the distance from the final market or demand, and shifting companies to higher positions is referred to as upgrade or upgrading.

Incremental innovation (sometimes called “sustaining innovation”)

It is based on existing technology or knowledge and their new combinations or use in a new context. It provides an incremental (partial) improvement of the existing products, services or processes, or changes them so that they can serve other purposes as well. Incremental innovation, although it is new to the institution in which it is implemented, can also be used in other institutions.

Innovation policy

A policy which focuses on supporting the components of the economy whose competitiveness is based primarily on the use of new knowledge (in-house knowledge or knowledge gained from elsewhere). Innovation policy, as part of the economic policy, aims to contribute to strengthening the competitiveness of the national economy, to contribute to the economic growth of the country and, in a broader sense, also to lead to the genesis of (qualified) jobs and thus contribute to retaining or increasing the employment.

Innovation / innovative companies, enterprises

Companies or enterprises which base the development and sustainment of their competitive advantage on a continuous introduction of innovations. These companies are generally characterised by an intensive creation of new (own) knowledge which they use for their own innovations. Nevertheless, innovations are also implemented through the adoption of other entities' knowledge. In such cases, companies may be considered innovative if they adopt others' knowledge in a new (so far unused) manner.

Cluster

A geographically concentrated group of companies and institutions interconnected through vertical relations (supplier-customer) or horizontal relations (shared customers, technologies, sales channels, key skills, knowledge bases etc.) or both, operating in a particular field or fields of the same value chain. A cluster may be institutionalised and thus have legal personality.

Comparative advantage in export

Represents the importance of export in a certain sector of the country from the global perspective. A country has a comparative advantage in the export of a certain product if the share of the sector in the country's export is higher than the share of the export of the same sector in world exports.

Composite indicators

Indicators composed of a number of sub-indicators and metrics (sometimes several dozen). Typical examples include indicators comparing the innovativeness or competitiveness of economies (the Global Competitiveness Index WEF or the Summary Innovation Index of IUS).

Convergence countries

Countries which are approaching the level of economic development of advanced countries.

Market intelligence

Specialised services focused on the collection, analytical processing and distribution of strategic information on the situation and development in the markets (the possibility of a geographic and/or professional orientation). In combination with the services of technology foresight, they are used as a valued tool to support innovation in some regions (especially in the segment of small and medium-sized enterprises). This type of activity is the purpose of many clusters (abroad).

Multinational companies (MNCs)

Companies which own or otherwise control the production or marketing capacities in multiple countries.

Non-technological innovation

A collective term for marketing innovation (the method of product selling or offering) and organisational innovation (for example in the corporate structure and the employee competences).

NACE sections

The statistical classification of economic activities at the NACE 2-digit level classifies economic activities into the so-called sections, which are denominated by two-digit numerical codes. The sector names are used in some cases as they are comparable with the generally respected industrial or service sectors.

Open innovation

A concept which assumes an ever greater openness of corporate innovation processes and an interactive cooperation of an increasing number of various entities. The reason is the growing complexity of the mix of necessary knowledge combined with the risk of stagnation which is associated with an excessive focus on the knowledge base within the company. This approach to innovation processes in companies has been developing over the past 20 years.

Production networks

No final product is made in one company, i.e. "under one roof". If the final product represents a certain added value, it should be noted that this added value has been created by many companies in many places regardless of the state borders. A production network (sometimes called the value chain) means the network of companies whose added value is included in the final product. Compared to the value chain, production networks as an analytical approach also include other entities and their relationships (not only companies but also countries, the social and cultural environment etc.). For a more detailed explanation of the concept see Chapter 3.3 in the Methodology concerning step 1B.

Radical innovation

Innovation which brings a high degree of novelty. The company thus usually disrupts the established rules, processes, market expectations etc.

Economy segment

Denotes a certain section (part) of the economy in which the economic activities show some common characteristics or features (for example the segment of companies under foreign control, the segment of small and medium-sized enterprises etc.).

Spin-off [company]

There is no consensus in specialised literature as to a clear definition of this concept; in general terms, the expression is used to describe a company which was formed for the purpose of commercial use of the intellectual property created at a university or other public research institution. In a narrower, according to some people more precise, sense, these are merely companies with ownership interests in research organisations that are the originators or owners of commercialised know-how. The term is sometimes used for selected companies in the private sector.

Technological innovation

This is the collective term for the innovation of products and production and technological procedures and processes.

Technological boundary

The technological boundary of a field is the current maximum achieved level of knowledge that is determined by the existing parameters and characteristics of products and production technologies. Some innovations (especially radical ones) contribute to shifting the technological boundary.

Technology platforms

Associations of enterprises, research and financial institutions, national public administration authorities, users and consumers involved in research, development and innovation in strategically important technological fields, at the national as well as all-European level.

Technology transfer

A process which conveys the “movement” of the outcomes of research and development and in which technology, knowledge and information are created in one organisation, in one field, or applied for one purpose or used in another organisation, in another field or for another purpose.

Traditional sectors

A set of sectors with a relatively low technological level (mostly belonging in the low- and medium-low-tech sectors) which form a crucial part of the national economy in all (even the most innovative) economies. These include for example the food industry, wood-working, the textile industry, metal-working, metallurgy etc.

Triple helix

The term is used to indicate the interaction of activities (local) of the public administration, enterprises and academic institutions aimed at improving the conditions for the development of innovation business (i.e. companies which base their competitive advantage in the global markets on innovation) in the region. The capability of an efficient triple helix collaboration significantly contributes to the successful implementation of innovation strategies in the regions. Its existence can be considered part of the so-called social capital (or “soft” infrastructure) of the region.

Vertical fragmentation

A process in which the creation of added value in the value chains is divided into an increasing number of production stages – the production of the final product requires more and more different inputs from different suppliers, while the average contribution by each supplier to the overall added value of the final product is increasingly lower.

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