European Commission

Support to Czechia on the reform of the Technology Transfer Offices sector

Background Report

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Independent Expert Report

Research and Innovation

Support to Czechia on the reform of the Technology Transfer Offices sector. Background Report

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EUROPEAN COMMISSION

Support to Czechia on the reform of the Technology Transfer Offices sector

Background Report

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2024

Directorate-General for Research and Innovation
Horizon Europe Policy Support Facility

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LIST OF ABBREVIATIONS

BERD	business expenditure on research and development
BES	Business Enterprise Sector
CAS	Czech Academy of Sciences
CIS	Community Innovation Survey
EDP	entrepreneurial discovery process
EIS	European Innovation Scoreboard
EPO	European Patent Office
ESIF	EU Structural and Investment Funds
GA CR	Czech Science Foundation
GBARD	government budget allocations for research and development
GDP	gross domestic product
GERD	gross expenditure on research and development
GOV	Government Sector
GOVERD	government expenditure on research and development
HEI	higher education institution
HERD	higher education expenditure on research and development
HES	Higher Education Sector
IOCB	Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences
IPR	intellectual property rights
KTO	knowledge transfer office
MEYS	Ministry of Education Youth and Sports
MIT	Ministry of Industry and Trade
NPOV	National Priorities of Oriented Research
OP EI	Operational Programme Enterprise and Innovation 2007-2013
OP EIC	Operational Programme Enterprise and Innovations for Competitiveness 2014-2020
OP JAC	Operational Programme Johannes Amos Comenius 2021-2027
OP PC	Operational Programme Prague – Competitiveness 2007-2013
OP PGP	Operational Programme Prague – Growth Pole of Czechia 2014-2020
OP RDE	Operational Programme Research, Development and Education 2014-2020
OP RDI	Operational Programme Research, Development for Innovation 2007-2013
OP TAC	Operational Programme Technology and Applications for Competitiveness 2021-2027
PCT	Patent Cooperation Treaty
PSF	Policy Support Facility
R&I	research and innovation
RDI Council	Research, Development and Innovation Council

S3	Research and Development Strategy for Smart Specialisation
SME	small and medium-sized enterprise
SII	summary innovation index
TA CR	Technology Agency of the Czech Republic
USPTO	United States Patent and Trademark Office
VC	venture capital

EXECUTIVE SUMMARY

The aim of this background report, prepared as part of the Horizon Europe Policy Support Facility (PSF) project entitled 'Support to Czechia on its reforms of the Technology Transfer Offices sector', is to describe the system of knowledge transfer and valorisation in Czechia. The report describes the structure and dynamics of the national research and innovation (R&I) system which provides the context for the work of the PSF panel. The focus is on the R&I governance and funding system, collaboration between public research and the business sector, and the analysis of the environment for different forms of knowledge transfer from the public research sector to actors working on innovation.

The strategic governance of the Czech R&I system is shared between the Research, Development and Innovation Council (RDI Council), the Ministry of Education Youth and Sports (MEYS), and the Ministry of Industry and Trade (MIT). The RDI Council plays a coordinating role as well as an executive role. It prepares the draft annual and medium-term budget for R&I, including the proposal of the total amount of expenditure and its distribution among individual funding providers (ministries and agencies). It also plays an important role in determining the methods for evaluating research organisations (currently according to the 'Methodology 2017+', also known as the 'Methodology 17+' or 'M17+'), which sets certain incentives in the public research system. In the past, the system for evaluating research organisations tended to incentivise researchers to maximise the number of research results (especially scientific publications). The Methodology 17+ creates a much more robust system for evaluating research organisations, but the way in which it is carried out is still considered to provide little incentive for knowledge transfer and commercialisation of research results.

MEYS plays an important role in the funding of universities and in the implementation of the EU Structural and Investment Funds (ESIF), supporting the development of public-sector research. The Ministry of Industry and Trade coordinates the implementation of the Smart Specialisation Strategy (S3) and the distribution of ESIF to support business R&I. The Technology Agency of the Czech Republic (TA CR) is the main funding provider for cooperation between research organisations and enterprises.

The R&I system in Czechia is highly fragmented. A total of 180 research organisations receive institutional support for research including 26 public universities, 2 state universities, 54 institutes of the Czech Academy of Sciences, and 22 sectoral public research institutes. The remaining 76 institutions consist of various state research institutions, private research institutions, cultural organisations (such as museums, libraries, archives), and teaching and other hospitals engaged in research and development.

Innovation centres and agencies established by regions or associations of regions, universities and cities have played an important role in the development of the innovation ecosystem at the regional level over the past 10-15 years. Each of the 14 regions has one such regional innovation centre or agency. Their development is supported by ESIF (Smart Accelerator projects) in addition to regional funds. The main activities of the regional innovation centres and agencies include formulating and implementing the regional innovation strategy, creating and implementing new support instruments for innovation (e.g. innovation vouchers), advising innovative enterprises in the startup and scale-up phase, operating innovation infrastructure (business incubators and/or science and technology parks), facilitating cooperation in the regional innovation ecosystem (in particular between enterprises and public research) or brokering and seeking financial resources for innovative business projects. In this respect, regional innovation centres and agencies can play an

important role in connecting research organisations with businesses, using their regional expertise and strong communication with the public and business sectors to foster mutual trust within innovation ecosystems.

The quality of research conducted in Czechia remains below the EU average when assessed against international standards, particularly in terms of citation rates. However, there has been a gradual improvement in both the quantity and quality of research outcomes in recent years. This has been facilitated, among other factors, by substantial public investment in the modernisation of research infrastructures and facilities, which has attracted high-quality researchers from both within and outside Czechia. In certain fields, such as computer science, physical sciences, molecular biology and genetics, chemistry and biochemistry, and some medical fields, Czech research is of a world-class standard. However, the exploitation of research results in practice is to some extent hampered by a limited entrepreneurial culture and low motivation for knowledge transfer and commercialisation in public research.

The effective transfer of knowledge from public research to business is also impeded by the limited capacity of Czech companies to absorb the results of cutting-edge research into their business activities. This is to some extent related to the position of Czech companies at the lower end of global value chains and their role as suppliers to multinational companies that carry out research and development activities and have access to final markets. Thus, while multinationals drive business investment in research and knowledge intensity in the Czech economy, their integration into the national R&I ecosystem is limited. On the other hand, a dynamic segment of technology startups has emerged in recent years, founded with global ambitions and bringing new dynamism to the Czech R&I ecosystem.

The Czech government has long been striving to strengthen the links between the public and private sectors and to establish an environment conducive to effective knowledge transfer and valorisation, as evidenced by the inclusion of this issue in numerous strategic documents. The areas with high potential for public-private cooperation in R&I identified in the S3 include digital technology and electronics, advanced machinery and technology, 21st century transport, healthcare and advanced medicine, culture and creative industries, sustainable agriculture, and the environment. Artificial intelligence, semiconductors and quantum technologies are the strategic technology areas identified by the Government's Strategic Investment Committee.

The establishment of TA CR in 2009 has contributed to the development of collaborative research, which is strongly emphasised in most its programmes supporting applied research. The Competence Centres and National Competence Centres programmes implemented by TA CR have been an important tool to support long-term cooperation between research organisations and enterprises, supporting the establishment and development of more than 30 such competence centres where collaborative research is carried out to strengthen competitiveness in areas of importance to the Czech economy. These programmes have helped to strengthen long-term public-private cooperation, to renew or create new networks of contacts and, most importantly, to increase trust between the actors involved.

On the other hand, Czechia has long lagged in its use of formal instruments to protect industrial property rights, especially patents. This is mainly related to the level of technological maturity of domestic enterprises and their position in global value chains, the high share of foreign-controlled enterprises in knowledge-intensive industries and services (patent offshoring), but also to the relatively low awareness of the importance of industrial property protection for innovative development. Interestingly, Czechia is characterised by a relatively high share of universities and public research institutes in the total number of

patent applications. On the other hand, the number of licences sold – and the income generated through these licenses by universities and public research institutes – is very low. An exception is the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, which generates 85% of all licensing income in the country, thanks to very successful research and high-quality patent protection.

As with patent activity, the number of spin-offs from universities and public research institutes is low in Czechia. The main identified barriers to spin-offs are the cultural environment in research organisations and the low recognition of scientists who work simultaneously in a research organisation and in a private company, the institutional and administrative complexity of the process of creating a spin-off, and the lack of professional staff capable of ensuring the entire process of creating a spin-off company.

In order to strengthen the capacity of professional staff for knowledge transfer and to institutionalise it in universities and public research institutions, the development of Knowledge Transfer Offices (KTOs) has been supported quite intensively since 2010. About 40 KTOs have been identified, most of which are members of the Transfera.cz platform for the promotion of knowledge transfer in Czechia. However, the quality of the services provided by KTOs varies and depends crucially on the experience and skills of their staff. Although some universities and public research institutions set performance indicators for their KTOs, such as the number of patent applications and patents granted, the number of licences sold, income from licences or contract research, there is no overall monitoring of the performance of KTOs in Czechia.

One of the main identified barriers to effective knowledge transfer from universities and public research organisations is their conservative approach to core activities, as defined by legislation or research organisation charters (usually stipulating that the research organisation is primarily engaged in education and research activities). As a result, researchers are mainly motivated to produce publication outputs without trying to commercialise their research results. A systemic obstacle to the effective implementation of knowledge transfer strategies and the valorisation of R&D results is the relatively weak position of KTOs in the management system of research organisations. In an environment of considerable decentralisation of the management structure of research organisations (especially universities) down to the level of departments and research units, commercialisation and knowledge transfer are often handled by the researchers themselves, despite the existence of a KTO at the level of the research organisation. The undervalued role of KTOs is also reflected in the limited institutional resources allocated to their operation and understaffing issues. With limited budgets, it is also difficult to attract qualified staff who know the technology, the research activities within the organisation/institution, and the needs of industry.

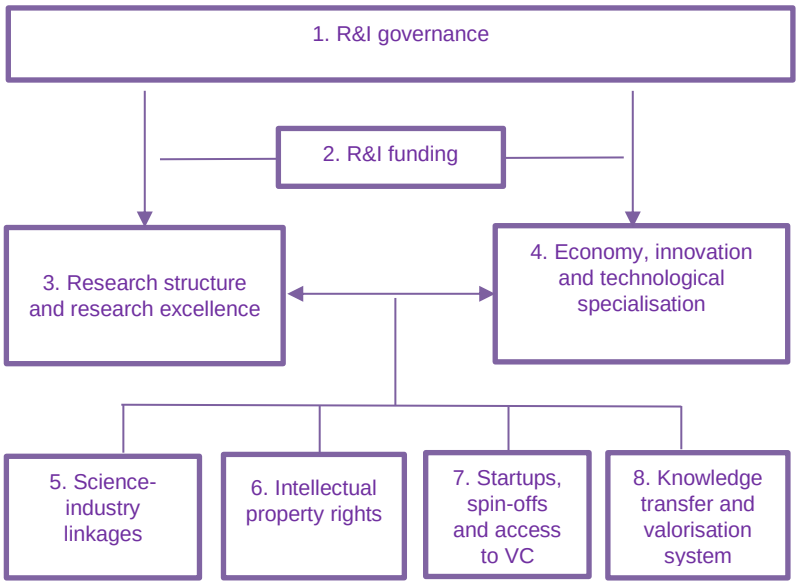
The barriers to knowledge transfer from research organisations to enterprises described above have been discussed quite intensively in the Czech R&I system in recent years. Impulses for this discussion come from companies, KTOs (represented by Transfera.cz), and public administrations. In January 2024, the Minister of Science, Research and Innovation introduced the knowledge transfer reform ‘An Economy Driven by Science’, which includes specific measures to strengthen the valorisation of scientific and research knowledge. It is not limited to narrowly defined technology transfer in the sense of commercial application of technologies on the market but focuses on different types of knowledge valorisation, including the use of results for public policymaking. The reform thus aims to streamline both Science2Business (commercial exploitation of research results) and Science2Policy (use of research results in public policymaking).

INTRODUCTION

This background report was prepared as part of the Horizon Europe Policy Support Facility (PSF) project entitled 'Support to Czechia on its reforms of the Technology Transfer Offices sector'. The objective of this report is to provide experts on knowledge transfer and valorisation a degree of contextual information on the functioning of the R&I system in Czechia. The focus is on the system and environment for knowledge transfer and valorisation, as well as for the development of long-term cooperation between research organisations and industry. The objective is to provide experts some background information enabling them to identify potential avenues for improvement in the knowledge valorisation system, taking into account the prevailing institutional and cultural conditions pertaining to research and innovation in Czechia.

The background report is structured according to a simplified logic of the functioning of the R&I system (see diagram), which consists of three basic pillars: public research (listed as 3. Research structure and research excellence), industry and innovation sector (4. Economy, innovation and technological specialisation), and the governance system (1. R&I governance). A pivotal aspect of the governance system is the manner in which R&I activities are financed (2. R&I funding). Given the thematic focus of the background report, a substantial part of the document is devoted to the links between public R&I. Here, attention is paid specifically to the science-industry ties (5. Science-industry linkages), the forms and treatment of industrial property rights (6. Intellectual property rights), the startup environment and conditions for spin-offs (7. Startups, spin-offs and access to venture capital) and, finally, the knowledge transfer and valorisation system itself (8. Knowledge transfer and valorisation system).

Diagram describing the structure of the report:



1. R&I governance

1.1. Governance structure

To describe the R&I governance system in Czechia, we will use a simple model that distinguishes three levels (see Figure 1). The first level represents the strategic governance of the national R&I system, where the general direction and priorities of the entire national innovation system are set. The second tier represents the level of organisations involved in financing R&I activities, both nationally and regionally. The third level consists of organisations that carry out R&I activities.

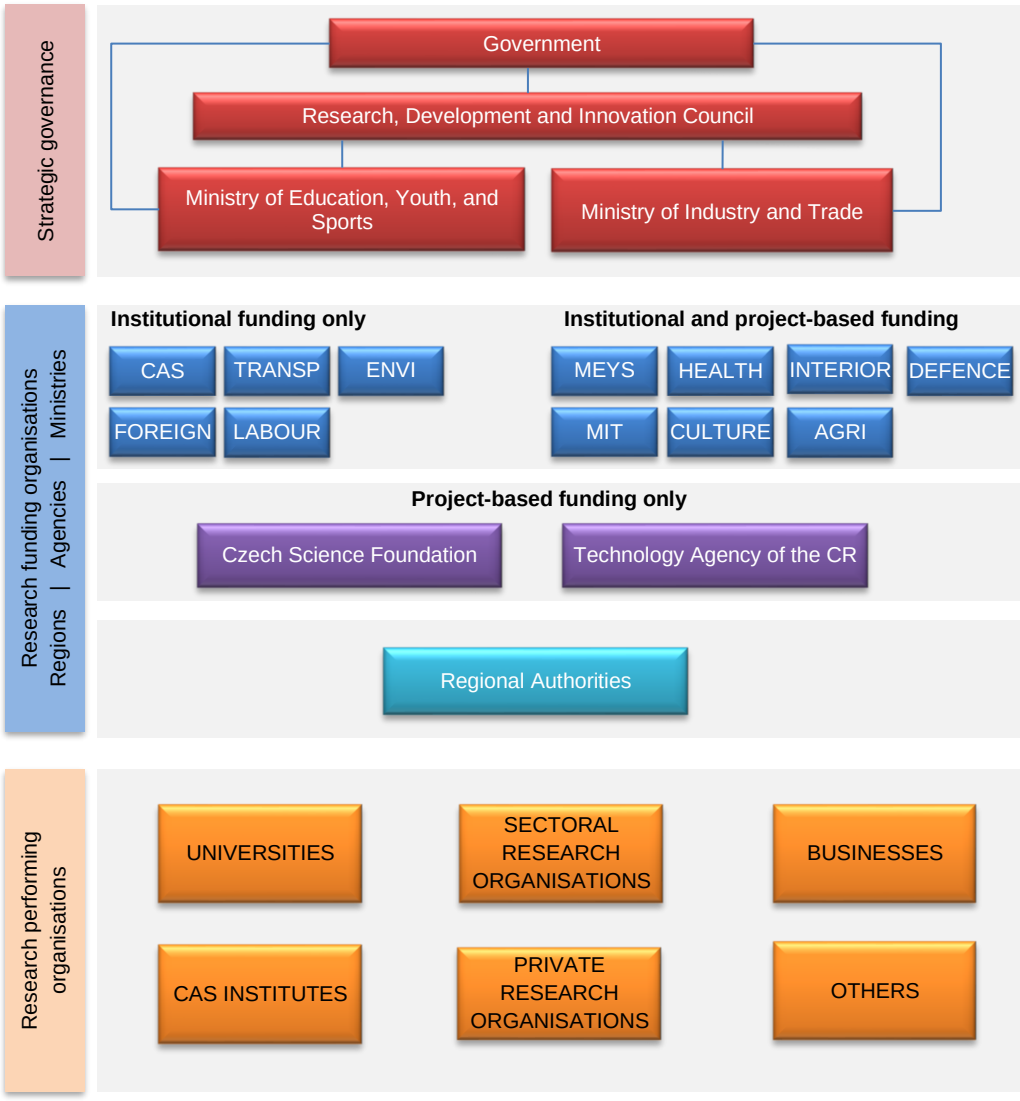


Figure 1. Structure of R&I Governance in Czechia.
Source: own illustration.

1.1.1. Strategic governance

The main organisation responsible for formulating national R&I policy is the **Research, Development and Innovation Council (RDI Council)**, an advisory body to the Government of Czechia. The Council itself consists of 17 members – the Chairperson (a member of the Government) and representatives of the Czech Academy of Sciences, universities, sectoral research organisations, and companies. The members of the RDI Council, except for its Chairperson (who is always a member of the Government), are appointed by the state based on the proposal of the RDI Council Chair, in particular to ensure representation of leading experts in basic and applied research, development, and innovation (Section 35(3) of Act No. 130/2002 Coll.). The members of the RDI Council are selected on the basis of nominations submitted by the Czech Rectors' Conference, the Association of Universities (both representing the higher education sector), the Czech Academy of Sciences (representing the institutes in the Academy), the Confederation of Industry and Transport (representing business), the Association of Research Organisations (representing private research organisations), and other associations and unions. The mandate of RDI Council members is four years (renewable once). They are remunerated and may resign, or the Government may withdraw their mandate, either individually or for the whole RDI Council period. The Council meets once a month. The secretariat for RDI Council is provided by the Office of the Government – Science, Research and Innovation Section, which reports to the Minister of Science, Research and Innovation. The Section has approximately 20 staff.

It is important to note that there is no separate Ministry of Science, Research and Innovation in Czechia per se. The Minister of Science, Research and Innovation, as a member of the Government, chairs the RDI Council. The Minister receives a professional administrative support from the Science, Research and Innovation Section of the Office of the Government.

The RDI Council plays the main strategic and coordinating role in the research and innovation governance system. It is responsible for preparing the draft annual and medium-term budget for R&I, which includes proposing the total amount of expenditure and its distribution among individual funding providers (ministries and agencies). In cooperation with the Ministry of Education, Youth and Sports, the RDI Council formulates the National Policy on Research, Development and Innovation, and submits that to the Government. In addition, the RDI Council reviews the implementation of this policy by giving opinions on the conformity of R&I programmes with the national policy before their approval by the Government. The RDI Council also sets national research priorities (National Priorities of Oriented Research, NPOV). The RDI Council also formulates the methodology for evaluating research organisations and R&I programmes. In accordance with this methodology, it carries out the evaluation of R&I results at the national level (see Modules 1 and 2 of the Methodology 17+ described in Section 3.2) and meta-evaluation of R&I programme evaluations. The RDI Council regularly prepares annual analyses and evaluations of the state of research, development and innovation in Czechia, comparing them with foreign countries, and it then submits the results to the Government. In addition, the RDI Council acts as the administrator and operator of the information system for research, development and innovation. Finally, the RDI Council submits proposals for the Chairperson and Board members for the Technology Agency of the Czech Republic and the Czech Science Foundation, and for preparing opinions on all materials submitted to the Government in the field of R&I.

As some studies have pointed out (see e.g. Arnold, 2011 or RDI Council, 2020), the extensive responsibilities of the RDI Council reaching the level of a "virtual R&I ministry" are not matched by sufficient staffing capacity to carry out executive tasks in a systematic way.

They also pointed out that the RDI Council tends to centralise activities related to the governance of the R&I system and, unlike policy councils abroad which define broad principles related to R&I governance issues, the Council also takes responsibility for the implementing specific R&I policy measures (this can be interpreted as micro-management).

The **Ministry of Education, Youth and Sports (MEYS)** is a central administrative body responsible for research and development. Following the 2008 reform of the R&I system and the related amendment to Act No. 130/2002 adopted in 2009, MEYS is responsible for research and development "except for the areas falling under the RDI Council". At present, the Ministry's main responsibilities in the field of R&I are as follows:

- Institutional support for research in universities and other public research organisations, and support for specific research in universities
- Support for international cooperation in research and development through specific programmes
- Support for major research infrastructures,
- Managing Authority of the Johannes Amos Comenius Programme (OP JAC), co-funded by the EU Structural and Investment Funds (ESIF), which aims to support research and education in the programming period 2021-2027
- Fulfilling the administrative function of a central administrative body for research and development, e.g. maintaining registers of public research organisations, etc.

The **Ministry of Industry and Trade (MIT)** is the central government body for industrial research and technology development, as well as for the support of small and medium-sized enterprises (SMEs). MIT is the owner of the National Research and Development Strategy for Smart Specialisation (National S3). It is also responsible for the operation of the entrepreneurial discovery process (EDP) at national level, which is implemented through the national innovation platforms. MIT is also the managing authority for the Operational Programme Technology and Applications for Competitiveness (OP TAC), which is co-funded by ESIF. This programme supports, among other things, the development of applied research and the introduction of innovation in companies.

There are five other ministries responsible for developing and implementing their own R&I policies and programmes: Ministry of Health, Ministry of Agriculture, Ministry of Culture, Ministry of Interior, and Ministry of Defence. These ministries provide R&I support from their own budget chapters and establish and operate their sectoral research institutes.

1.1.2. Key research funding organisations

There are two main types of R&I funding: institutional (basic) funding, and project-based (competitive) funding. Institutional support is provided to research organisations by MEYS (funding of universities), the Czech Academy of Sciences (funding of its institutes) and 10 other ministries. Most of the project-based funding is provided by two agencies, namely the Czech Science Foundation, and the Technology Agency of the Czech Republic.

The **Czech Science Foundation (GA CR)**, established in 1992, provides funding for *basic research*. It funds basic research mainly in public universities and institutes of the Czech Academy of Sciences; grant competitions are in principle open to applicants from all sectors. The management of the GA CR is entrusted to a Board appointed by the

Government on the proposal of the RDI Council. It is composed of five members representing the five basic scientific disciplines: technical sciences, life sciences, medical and biological sciences, social sciences and humanities, and agricultural and bio-environmental sciences. The Board approves the launch of public competitions and decides on the award of grants to scientific projects based on the evaluation of the GA CR's evaluation committees and panels. The GA CR supports all disciplines of basic research. In addition to standard basic research projects, which account for most of the funding provided by the GA CR, it also supports the development of young researchers, international cooperation in basic research, and the international mobility of early-stage researchers. The main criteria for the evaluation of project proposals are the quality and originality of the project proposal, the professional capacity of the proposer to achieve the stated objectives, and the reasonableness of the costs. Impact, valorisation of knowledge or commercialisation of results are not stated objectives of the supported projects.

The **Technology Agency of the Czech Republic (TA CR)**, established in 2009, provides funding for *applied research, development and innovation projects*. TA CR was established to simplify and rationalise the system of R&I funding in Czechia. TA CR implements funding programmes for applied research on behalf of the RDI Council, ministries (in particular the Ministry of Transport and the Ministry of the Environment) and other central authorities. The Board of TA CR is the executive body and consists of five members, including the Chairperson. The members of the Board and the Chairperson are appointed and dismissed by the Government on the proposal of the RDI Council. The Board approves the announcement of calls for proposals and decides on the granting of support on the basis of expert evaluation panels and commissions. TA CR announces a wide range of programmes to support applied research. One group consists of *sectoral programmes***,** where TA CR ensures the implementation of programmes prepared in cooperation with the relevant sectoral ministries, namely the Ministry of the Environment, the Ministry of Transport, MIT, and a new programme is being prepared with the Ministry of Defence. Another group consists of applied research *programmes prepared directly by TA CR*, which focus on selected thematic areas (e.g. support for research in the energy sector) or on the development of systemic aspects of R&D. These include programmes for competence centres, which concentrate research and innovation capacities for long-term research and cross-sectoral cooperation, or programmes to support the commercialisation of research results (GAMA, SIGMA, see Chapter 8). They also include programmes to support applied social science and humanities research or to support early-stage researchers in applied research. The third large group of programmes relate to *international cooperation activities in applied research*, either bilateral cooperation programmes announced in cooperation with foreign innovation agencies, or programmes implemented in the framework of European partnerships (ERA-NET co-fund).

In addition, to GA CR and TA CR, the remaining part of the project-based (competitive) funding is distributed through sectoral and cross-sectional research programmes run by the **Ministry of the Interior, Ministry of Culture, Ministry of Defence, Ministry of Agriculture, and Ministry of Health**, as well as through **MEYS** programmes supporting international research cooperation, large research infrastructures, and specific university research. The majority of competitive funding takes the form of calls for project proposals launched by funding providers. Only a minority (about 5%) is distributed through public procurements.

Figure 2 shows the structure of state budget expenditure by type of funding and individual funding bodies. As illustrated, there are *four dominant providers of R&I funding in Czechia,* namely MEYS, the Czech Academy of Sciences, TA CR, and GA CR. These four providers distribute more than 80% of the total R&I funding.

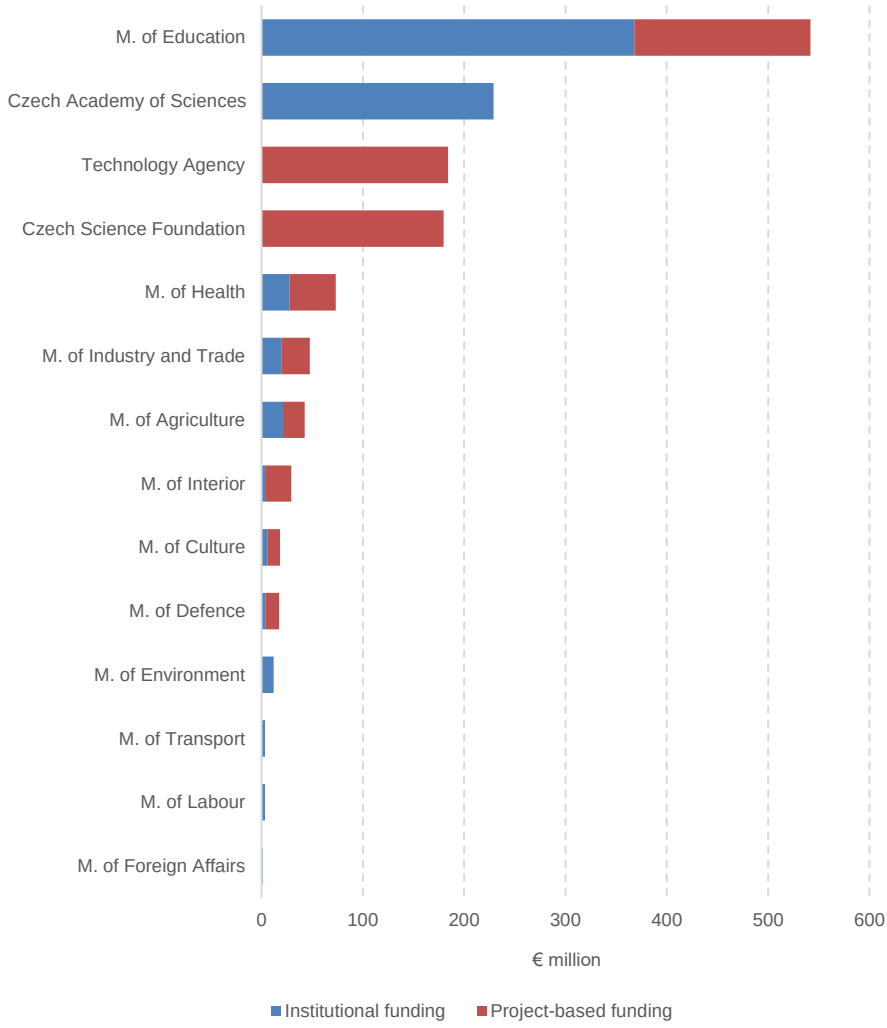


Figure 2. Structure of state budget expenditures on R&I in 2024 by type of support and funding provider.
Source: State budget on R&I, 2024

Any new research programme issued by a research funding organisation must be submitted to the Government for approval. Prior to submission, the RDI Council must be consulted to obtain an opinion on its consistency with national priorities (NPOV) and national strategy (National R&I Policy). In practice, the RDI Council's opinion is usually taken into account by the funding providers or a compromise proposal is negotiated that is acceptable to both parties – the funding providers and the RDI Council.

1.1.3. Key research performing organisations

According to data from the Czech Statistical Office, the business enterprise sector is the largest research performer in Czechia, spending 64% of gross expenditure on research and development (GERD), and its share has been growing steadily in recent years. The higher education sector comes second with almost 20%, followed by the government sector with 16%. The role of the private non-profit sector in R&D is negligible.

The government sector is defined for statistical purposes according to the OECD Frascati Manual. Thus, the government sector includes research institutions established under public law and covers institutes of the Czech Academy of Sciences, sectoral research institutions (established by ministries, other central government agencies or regions), as well as public cultural institutions (museums, libraries, archives) and public health institutions (excluding university hospitals).

Table 1. Key research performing organisations – basic overview

Sector	Research performing organisations	Focus	Number	R&D expenditures (2022) in € million
Higher Education Sector (HES)	Public and state universities	Basic and applied research in all fields of science (in particular natural sciences, engineering and technology)	28	973
	University hospitals	Medical research	12	54
	Private universities	Basic and applied research, particularly in the social sciences	22	9
Government Sector (GOV)	CAS institutes	Socially relevant basic and applied research in all fields of science (in particular natural sciences)	54	630
	Sectoral research organisations	Sector-oriented applied research	22	66
Business Enterprise Sector (BES)	Businesses	Applied research and experimental development for own needs	~ 2,900	~ 3,120
	Private research organisations	Applied research and experimental development for the needs of other enterprises	~ 60	~ 300

Source: Czech Statistical Office and own calculations

Research performing organisations in the public sector

Public research is characterised by a split between institutes of the Czech Academy of Sciences and public universities, although they are increasingly cooperating. Private universities and other research institutes play a minor role in terms of R&D expenditure.

The **Czech Academy of Sciences (CAS)** comprises 54 formally independent public research institutes. The CAS institutes employ around 5,600 full-time researchers and spend €630 million (in 2022) on research. More than 75% of the total research expenditure is financed from the state budget (€480 million). The main mission of the institutes of CAS is *to conduct high-quality scientific research at the frontiers of knowledge, taking into account the current and future needs of society* (CAS, 2022). In terms of its mission, focus and organisational structure, CAS is close to the position of the German Leibniz Association, which deals with socially relevant basic and applied research. CAS also partly fulfils a role similar to that of the Max Planck Society (basic research), the Helmholtz Association (operation of large research facilities), and to lesser extent that of the Fraunhofer Society (applied research).

The **higher education sector** consists of 26 public, 2 state and 28 private higher education institutions (HEIs). Universities used to *focus on teaching, but in the last decade they have rapidly expanded their research activities*. At present, universities employ about 14,400 full-time researchers, 93% of whom work in public and state universities. Public and state

universities spend €975 million (in 2022) on research, of which €735 billion (75%) is financed from the state budget (institutional as well as project-based funding).

In addition to CAS institutes and universities, there are 22 **sectoral research institutes** established by relevant ministries, other central state authorities or regions. Most of the sectoral research institutes were established by the Ministry of Agriculture, the Ministry of the Interior and the Ministry of the Environment. The sectoral research institutes employ about 1,000 full-time researchers and spend almost €70 million (in 2022) on research. The dominant part of the research expenditure is financed from the state budget (€57.5 million, i.e. 82%).

Research performing organisations in the private sector

Research in the private sector is carried out in manufacturing and service enterprises as well as in private research organisations whose main activity is the provision of R&D services.

There are almost 2,900 **companies conducting research** in Czechia, of which 21% are foreign affiliates and 49% are SMEs. The business enterprise sector employs about 45,000 full-time researchers and spends almost €3,450 million (2022 figure) on research. Foreign affiliates play a dominant role in the Czech business R&D, accounting for 40% of researchers and almost 64% of research expenditure. Approximately 5% of business research expenditure is financed from the state budget. Almost 90% of direct public funding for business research goes to domestic enterprises. Foreign-owned enterprises make much greater use of tax credits for R&D (for more details on this scheme, see Chapter 2.2.3). In 2021, these companies claimed a tax deduction of €60 million, which is 63% of the total indirect support for R&D in Czechia.

The main sectors in which R&D is carried out are IT and ICT services, the automotive industry, the electrotechnical and electronic industry, and the mechanical engineering sector (see Figure 3). These account for 60% of total business enterprise R&D expenditure. As can be seen from the figure below, the top three sectors in terms of R&D expenditure are dominated by foreign affiliates. In the case of the automotive industry, the dominant R&D investor is Škoda Auto of the Volkswagen Group.

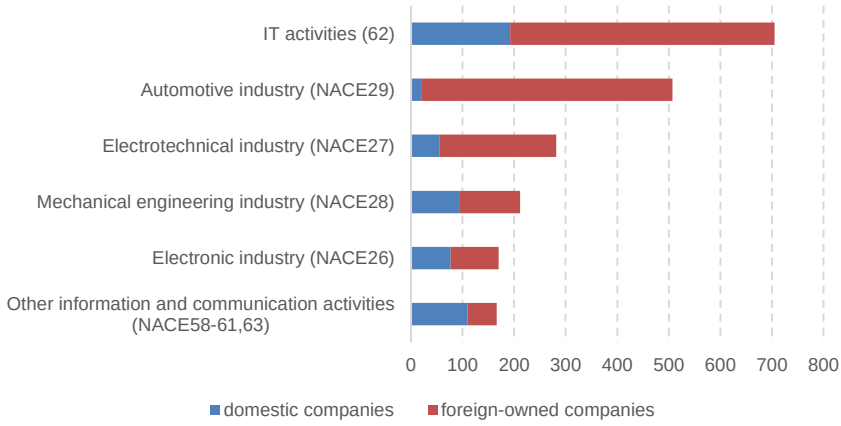


Figure 3. Business R&D expenditure in the main sectors in 2022 (€ million)
Source: Czech Statistical Office

In addition to research carried out in companies in various manufacturing or service sectors of the Czech economy, there is a group of about 60 **private research organisations** in Czechia whose main activity is the provision of research and development services to other companies. These organisations were typically created through the privatisation of state research institutes in the 1990s. Most of these organisations are grouped in the Association of Research Organisations, which represents applied business R&D and the interests of private research organisations in the R&I system. A dozen of these private research organisations receive institutional support from MIT. These are mainly private research organisations carrying out research in strategic areas for the state, such as nuclear research, aerospace research or specific materials research.

1.1.4. Historical milestones of the R&I governance development

The governance structure of the Czech research, development and innovation system underwent major changes in the early 1990s. The most important were related to new public spending measures, which resulted in the restructuring of CAS (the closure of about 25 institutes) and the *privatisation of research institutes performing industrial research*, formerly controlled by sectoral ministries. Prior to privatisation, there were about 250 industrial research institutes providing industry-oriented business research. During the 1990s some of them were incorporated into manufacturing companies, others became private research organisations or sectoral public research organisations, and the rest ceased their activities. At the same time, the business sector – consisting of public enterprises – underwent large-scale privatisation and in the process lost much of its R&I capacity in a rather short-sighted effort to cut costs quickly. The consequences of these processes are still being felt, particularly in the absence of research and technology organisations to act as partners for the business sector. In any case, the links between the supply of industrial research services and the research needs of manufacturing companies were broken, and it took several years to re-establish at least some of these links.

Since the 1990s, the system has evolved slowly without major disruptions or changes until 2008, when a *reform of the R&D system* was launched. The main reason for this reform was the increasing complexity and fragmentation of the overall system for R&I governance, which was reflected in the limited ability of the state to allocate public resources effectively to R&I. The reform significantly changed the governance of R&I policy and the responsibilities of the main bodies. Since the reform, three bodies have played a central role in the governance of the Czech R&I system – the RDI Council, MEYS, and MIT. On the implementation side of the R&I governance structure, the reform led to the establishment of TA CR, which has become the central innovation agency responsible for implementing applied and pre-competitive research programmes. At the same time, project-based support for basic research was concentrated in GA CR. The reform also reduced the number of research funding agencies from 22 to the current 14, thereby reducing the degree of fragmentation and difficulty faced in coordinating the R&I system.

More recently, the public R&I system has undergone significant structural changes since 2009. Until then, the public sector played a central role with the strong position of CAS and its institutes. The massive *inflow of ESIF investments* in research infrastructure at universities from 2009 onwards has led to a strengthened position of the higher education sector in the Czech R&I landscape – indeed since 2011 it has overtaken the government sector in terms of research expenditure and the number of research personnel.

1.2. Role of regions

R&D activities in Czechia are very *unevenly distributed across regions* (consisting of 14 self-governing regions at NUTS III level), with the highest concentration is seen in the capital city of Prague and surrounding Central Bohemia region, followed by the second largest city, Brno, and the surrounding South Moravia Region.

The Czech regions have relatively limited powers of self-government, concentrated in the areas of primary and secondary education, transport, health, tourism, and regional policy. They have no legally binding powers in the field of R&D, but at the same time the law does not prevent them from being active in this area. Several have done so in recent years, for example by launching innovation voucher schemes to stimulate cooperation between research organisations and enterprises in their regions.

The *limited resources for R&I support in regional budgets* means that regions have so far been largely passive actors in R&I policy and support, and their role has often been limited to that of catalysts for ESIF-funded R&I projects.

However, there are exceptions. One of them is undoubtedly the *South Moravia Region*, which has long paid great attention to supporting innovation activities. As early as 2003, the region, in cooperation with local universities, established a specialised (expert) institution for this purpose, called the South Moravian Innovation Centre, which was entrusted with implementing the region's innovation strategy. The 2018 evaluation of the regional innovation strategy of South Moravia, carried out for the period 2003-2016 (Kostić et al., 2018), showed that this strategy contributed to increasing the knowledge intensity of the regional economy, developing the entrepreneurial and innovative spirit, developing cooperation between the research and business sectors, retaining talent and attracting foreign university students and highly qualified workers, and lastly, strengthening the innovative image of the region. The South Moravian approach to regional R&I strategy has become a model for other Czech regions.

Coordination between national and regional R&I strategies and activities is not very strong, although it has recently started to improve due to the implementation of the national *S3 Strategy*. So-called regional appendices to the S3 have been developed in all regions to shape the innovation system at the regional level and set up regionally specific initiatives and fields of intervention that respond to local needs and conditions. The regional annexes to the national S3 are subject to approval by the regional governments and are complemented by regionally specific action plans. The implementation of regional S3 strategies is supported not only by programmes funded by regional governments (e.g. innovation/creativity vouchers etc. have long been funded at this level in many regions), but also by national and EU programmes, including ESIF and the Recovery and Resilience Facility.

ESIF also plays an important role in supporting governance and implementation structures for R&I policy in the regions. An important instrument here is the *OP JAC programme*, which supports the development of regional capacities for the design and implementation of R&I policy in the regions through specific *Smart Accelerator calls*. These projects, which are implemented in all regions by innovation centres or regional innovation agencies, fund activities aimed at developing capacities and competences for strengthening smart specialisation, developing innovation ecosystems and cooperation between actors across sectors in the so-called triple/quadruple helix. Similarly focused projects were already

supported in the previous operational programme (2014-2020). The total support for developing regional innovation systems has reached almost €80 million since 2015. Smart Accelerator projects supported by OP JAC are currently being implemented in all 14 regions (2023-2026), as shown in Table 2.

Table 2. Support from the OP JAC programme for the Smart Accelerator projects in the regions

Region	Smart Accelerator projects support 2023-2026 (€ million)
Prague	3.9
Central Bohemian Region	3.5
South Bohemian Region	2.3
Hradec Králové Region	2.3
Liberec Region	2.5
Karlovy Vary Region	3.0
South Moravian Region	3.8
Olomouc Region	2.6
Ústí Region	3.2
Zlín Region	2.5
Pardubice Region	2.3
Plzeň Region	2.4
Vysočina Region	0.8
Moravian-Silesian Region	3.0

Source: MEYS, OP JAC programme

The funds in these projects are spent on several types of activities. The main activity is the funding of *human capacity and key competences to coordinate and implement regional S3 strategies*. In addition, the Smart Accelerator projects support *training and education* to develop the competences of innovation system actors involved in the development of the innovation ecosystem in the region and in the preparation of strategic interventions implementing the regional S3. An integral part of the supported activities in all regions is the *monitoring, analysis and evaluation* of changes in the development of the regional innovation ecosystem, identification of its needs and potential, and evaluation of the effects and impacts of the implementation of the regional S3. In addition to these activities, support is also provided for *consultancy services* (assistance vouchers) aimed at developing strategic projects funded under regional, national or international programmes. Another supported activity is *twinning with foreign institutions* aimed at exchanging experience in the implementation of regional innovation support instruments, pilot testing of new instruments to support the development of the innovation ecosystem, and marketing activities aimed at promoting the innovation potential of the region.

Smart Accelerator projects supporting the development of a regional innovation ecosystem are usually implemented by *regional innovation centres or agencies*. These centres have been set up by the regional authority or as an association of the region, the city and the universities located in the region. All regional innovation centres or agencies are fully or partially funded by the regional budget. Currently, the following 14 institutions act as centres or agencies for the development of regional innovation ecosystems (see Table 3). These centres and agencies are key partners of MIT in coordinating the implementation of the national S3 strategy with the regional S3 strategies.

Table 3. Regional innovation centres or agencies for the development of regional innovation ecosystems

Source of the map: CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=912955

	Region	Regional innovation centre/agency	Links
A	Prague	Prague Innovation Institute	https://www.prazskyinovacniinstitut.cz/en/
S	Central Bohemian Region	Central Bohemian Innovation Centre	https://s-ic.cz/en/
L	Liberec Region	Regional Development Agency of Liberec Region	https://arr-nisa.cz/en; https://1012plus.cz/en
U	Ústí Region	Innovation Centre of the Ústí Region	https://icuk.cz/en/region-image/
K	Karlovy Vary Region	Business Development Agency of Karlovy Vary Region	https://www.karp-kv.cz/en
P	Plzeň Region	Regional Development Agency of Pilsen Region	https://www.rra-pk.cz/; https://www.inovujtevpk.cz/en
C	South Bohemian Region	South Bohemian Science and Technology Park	https://www.jvtp.cz/en.html
J	Vysočina Region	Department of Regional Development of the Regional Office of the Vysočina Region	https://www.kr-vysocina.cz/veda-vyzkum-inovace/ms-123029/p1=123029
B	South Moravian Region	South Moravian Innovation Centre	https://www.jic.cz/en/; https://brnoregion.com/en/
Z	Zlín Region	Technology Innovation Centre Zlín	https://www.liveinzlin.cz/en/homepage/
T	Moravian-Silesian Region	Moravian-Silesian Innovation Centre	https://ms-ic.cz/en/; https://hrajemskrajem.msk.cz/dokumenty/#:~:text=Development
M	Olomouc Region	Innovation Centre of the Olomouc Region	https://www.inovaceok.cz/en/about-us; https://www.ris3ok.cz/en/
E	Pardubice Region	Regional Development Agency of the Pardubice Region	https://rrapk.cz/about-agency; https://paradnikraj.cz/en/
H	Hradec Králové Region	Centre for Investment, Development and Innovation	https://cirihk.cz/; https://www.proinovace.cz/en

In terms of focus and scope of activities, among the 14 regional innovation centres and agencies there are those whose main or only mission is the development of the regional innovation ecosystem (e.g. the South Moravian Innovation Centre or the Central Bohemian Innovation Centre). However, there are also innovation centres and agencies that focus on other regional development activities, such as the more general economic transformation of the region (e.g. the Moravian-Silesian Innovation Centre) or on supporting spatial planning, transport, environmental or cultural development (e.g. the Regional Development Agency of the Pilsen Region). *Typical services provided by innovation centres* and agencies for the development of regional innovation systems include (see Klimova, 2016):

- Formulation and implementation of the regional innovation strategy (or S3 strategy)
- Assessing the innovation potential and performance of the region
- Preparation of projects to support innovation (e.g. projects eligible for ESIF)
- Identifying opportunities to increase the innovation capacity of the region
- Creating and implementing new support instruments for innovation (e.g. innovation vouchers)
- Advising innovation companies in the startup and scale-up phases
- Operating innovation infrastructure (business incubators and/or science and technology parks)
- Facilitating cooperation in the regional innovation ecosystem (among businesses and between businesses and the public research)
- Brokering and seeking financial resources for innovative business projects (e.g. micro-credit funds or patent and licensing funds)
- Marketing and promotion of innovation activities in the region

Innovation centres and agencies established by regions, cities or universities in Czechia and Slovakia are brought together by the *Ynovate network*, which was launched in 2018. This network aims to connect the services provided by individual innovation centres and agencies in the regions and, in particular, to share a common network of experts who support the development of innovative enterprises. Representatives of the innovation centres also share experience, know-how and information to improve services for startups and growing companies. The Ynovate network currently includes 10 innovation centres in Czechia and two in Slovakia.

1.3. R&I policy development

1.3.1. Regulatory framework

The national regulatory framework for R&I policy is primarily determined by *Act No. 130/2002 Coll. on the Support of Research, Experimental Development and Innovation*. This Act regulates the responsibilities for the governance of the R&I system, the formulation of R&I strategies and the preparation of the R&I budget, the rules for the provision of support for research, development and innovation, the conditions for reporting the results of

publicly supported research, and other conditions related to the financing of R&I from public funds.

In 2022, the preparation of a *new Act on Research, Development, Innovation and Knowledge Transfer* was initiated, which was tabled to replace the existing Act No. 130/2002 Coll. The new Act aims to create a more effective and supportive environment for R&D and knowledge transfer, as summarised in an accompanying Explanatory Report to the Act. This report emphasises that the current regulatory system faces significant challenges due to a lack of instruments to support innovation and a lack of coherence between policy documents on R&I. There is also no clear breakdown of expenditure on R&I activities, resulting in inadequate allocation and subsequent evaluation of project-based support. Furthermore, there is poor project transferability and administrative complexity is exacerbated by the absence of a single methodological framework for implementing project-based support. The system also suffers from insufficient promotion and 'popularisation' of R&D and knowledge transfer.

The proposed new law also emphasises the need for a coordinated approach to international cooperation in R&I and knowledge transfer, and for clarification of the current relationship between GA CR, TA CR and state administrative bodies. Furthermore, legislation on ethical principles in research, human potential development and the career development of scientists is inadequate, further hampering progress in the sector.

Legislation on open science and access to research data is also deemed as insufficient, as is the regulation of state security interests in R&D and knowledge transfer. A stronger legal framework for knowledge transfer is needed to facilitate better outcomes. Addressing these issues will require comprehensive policy reform and continued legislative improvements to create a more effective and supportive environment for R&I and knowledge transfer.

As can be seen from the above areas, the new legislation should place *much more emphasis on the promotion of innovation, knowledge transfer, the principles of open science, and the popularisation of research and innovation activities in society*. This emphasis is also reflected in the proposed change in the title of the Act, which will now be called the Act on Research, Development, Innovation and Knowledge Transfer. The main objectives are articulated in the Submission Report on the new Act.

- In the area of the *research, development, innovation, and knowledge transfer system*, the new Act sets out to simplify the administration processes and reduce administrative burden, particularly for applicants and beneficiaries. Support for researchers' career development and the reconciliation of professional and family life should be prioritised. Additionally, it is important to strengthen respect for ethical principles and scientific integrity. The security interests of the State must be protected by ensuring the institutional resilience of research organisations against adverse influences.

- In the area of *funding*, it is crucial to facilitate and encourage knowledge transfer. There should be greater flexibility in providing project-based support, including multi-provider programmes and those addressing emerging risks as well as project transferability. New instruments to support innovation need to be enabled. A systematic evaluation of project-based funding programmes, including impact assessment, should be introduced in line with the Methodology 17+. Additionally, the possibility of increasing the participation of private sources in the funding of research, development, innovation, and knowledge transfer should be considered. The provision of project-based funding should be moved to a public law regime, and the breakdown of expenditure on research, development, innovation, and knowledge transfer must be clarified.

- In the area of *open science*, it is important to link the research, development, and innovation information system with other public administration information systems. An integrated environment for managing project-based support should be established. Ensuring open access to scientific information and data in accordance with European directives is crucial. Additionally, supporting the popularisation of research, development, innovation, and knowledge transfer is essential.

The new draft law redefines the term 'knowledge transfer' to mean: *"[The] process of creating social and economic value from knowledge by linking different fields and sectors and transforming data, know-how and research results into sustainable knowledge-based products, services, solutions and policies for the benefit of society, with the aim of generating, pooling and sharing knowledge, including skills and competences, in economic and non-economic activities such as collaborative research, consultancy, licensing, transfer of intellectual property rights, spin-offs, publications and mobility of researchers and others involved in these activities.*"

The draft of the new law was circulated for inter-ministerial comments in November 2023, when all ministries, agencies and other stakeholders of the R&I system were able to comment. The revision of the draft based on the comments received (more than 1,400) is currently (May 2024) being finalised, after which the new Act should be submitted to the Government and then to Parliament. The government aims to adopt the law before the parliamentary elections in autumn 2025.

1.3.2. Policy framework

The basic vision and strategic direction for the development of the research and innovation system is set out in the *Innovation Strategy of Czechia 2019-2030*, which was approved by the government in 2019 (Resolution No. 104 of 4 February 2019). It is a strategic framework plan that sets out the government's policy in the field of research, development and innovation and aims to help Czechia become one of the most innovative countries in Europe within 12 years. The Innovation Strategy consists of nine interrelated pillars, which contain the basic strategic objectives and indicate the instruments leading to their fulfilment. They are: (i) R&D funding and evaluation, (ii) Innovation and research centres, (iii) National startup and spin-off environment, (iv) Polytechnic education, (v) Digitisation, (vi) Mobility and construction environment, (vii) Intellectual property protection, (viii) Smart investments, and (ix) Smart marketing. Although the importance of this document in government strategies has declined somewhat with the change of government in 2022, the core directions continue to be implemented through the other policy documents listed below.

The *National R&I Policy* is the main strategic document at national level for the development of all components of research, development and innovation in Czechia. The latest version is valid at least for the seven-year period of the EU Multiannual Financial Framework (i.e. from 2021 to 2027). The National R&I Policy sets out the main strategic directions, defines objectives and measures for the development of the R&I system and aims at the efficient functioning of this system. The National R&I Policy sets strategic goals for achieving progress in the management and financing of the R&I system, motivation of people to pursue research careers and development of human resources, quality and international excellence in R&D, cooperation between research and industry, and development of the Czech innovation potential.

The National R&I Policy is complemented by the *National Priorities for Oriented Research, Development and Innovation (NPOV)*, which outline long-term strategic directions and objectives for the focus of R&I activities. The priorities are based on important societal needs determined by top-down analyses and consultation. The NPOV are reflected in

related strategic documents and policies, and in turn implemented through R&I policy instruments and actions by funding agencies. The NPOV provide the basic orientation for targeting public and private R&I investments to address important societal needs and, by their very nature, stimulate the implementation of an interdisciplinary, collaborative and coordinated approach by different actors of the R&I system to support R&I with high societal relevance.

The *National Research and Innovation Strategy for Smart Specialisation of Czechia 2021 – 2027 (S3 Strategy)* is an important instrument for the implementation of R&I policy, through which the objectives of the National R&I Policy are expected to be achieved. The S3 Strategy sets medium-term goals and topics for research, development and innovation in areas that have a high potential for creating a long-term competitive advantage for Czechia thanks to knowledge and innovation. Priority R&I themes are based on identified market opportunities, build on the strengths of Czechia and individual regions, and are determined in a bottom-up manner through consultations within the entrepreneurial discovery process. The S3 Strategy ensures the matching of European, national and regional resources to support R&I, with a focus on the knowledge economy and transformations seen as helping to boost innovation-based competitiveness.

The R&I *strategies of each research funding organisations* are also important policy documents that set the objectives for institutional and project-based R&I funding. The R&I strategies complement the National R&I Policy, NPOV and S3, and together they form a coherent strategic framework for the governance and implementation of R&I policy in Czechia.

In addition to the above-mentioned strategic documents, the *National Reform Programme of Czechia,* which regulates reforms in the area of public investment and sustainable development goals – and related investments from the National Recovery and Resilience Plan (NRRP) – are also important for the strategic direction of the country in a broader framework. The current National Reform Programme (NRP) was adopted by the government in April 2024. In the area of R&I, it focuses on strengthening the innovation capacity of domestic enterprises, boosting business links with the public research sector, and improving access to finance for SMEs. Among the main reform measures mentioned here are the knowledge transfer reform (see the chapter on knowledge transfer and valorisation for a more detailed description), the preparation of a new law on research, development, innovation and knowledge transfer, and the implementation of the NRRP, component 5.3 ‘A strategically managed and internationally competitive R&I ecosystem’. The objective of which is to increase the competitiveness and socio-economic benefits and impact of research, development and innovation by promoting excellence, strengthening international cooperation and strategic development of human resources for R&I.

In order to strengthen the competitiveness of the Czech economy, there is a new focus on supporting strategic technologies such as artificial intelligence, semiconductors, and quantum technologies. These technologies will play a crucial role in future technological development in the context of digital and technological transformation. At the same time, they strengthen the strategic resilience and autonomy of Czechia and the EU. The *National Strategy for Artificial Intelligence* (updated in 2024), the *National Semiconductor Strategy* (in preparation) and the *National Quantum Strategy* (in preparation) all set out strategic directions for developing research and innovation activities in these technology areas. They seek to strengthen and expand existing capacities and in research, development and innovation, as well as to support the creation of startups and technology companies, education, and international cooperation.

2. R&I expenditure and funding

2.1. R&I expenditure

Czechia has experienced steady growth in R&D expenditure over the last 15 years. Government expenditure on research and development (GERD) more than doubled in nominal terms between 2010 and 2022, and R&D intensity increased from 1.33% of gross domestic product (GDP) in 2010 to 1.96% in 2022. The dynamic growth of R&D expenditure in Czechia has been driven mainly by the business enterprise sector, but the public sector is also keeping pace with the rapid development. Thanks to ESIF, the public sector (universities and institutes of CAS) has invested heavily in building new R&D capacities since 2007. The decline in this type of funding between the two programming periods is also behind a drop in GERD reported in 2016.

As mentioned in the chapter on R&I governance, the Czech R&I system comprises three performance sectors: the business enterprise sector (BES), the higher education sector (HES), and the government sector (GOV). Figure 4 shows the development of R&D expenditure in these sectors.

R&D expenditure in the *BES* is concentrated on foreign affiliates, which account for around 65% of total business expenditure on R&D (BERD). This is highly correlated with the structure of knowledge-intensive industries in the Czech economy (see also the chapter on knowledge intensity). The majority of BERD is spent in the manufacturing sector (54%), as well as a visible pattern of growth in the ICT sector (20%).

In *HES,* R&D capacity began to build in the mid-1990s with a first wave of dynamic R&D growth in this sector. Before that, the majority of higher education institutions in Czechia (as in many Central and Eastern European countries) were mainly teaching universities. A second wave of dynamic R&D growth in HES started in 2007 with investments from ESIF. In 2014, it became the second largest sector of R&D performance in Czechia for the first time, overtaking the government sector.

In *GOV*, R&D performance orientates mainly around institutes in CAS and sectoral research organisations. While HES has become more important in terms of R&D performance over the last decade, CAS has seen an inverse growth pattern since the early 1990s. CAS-related R&D expenditure stabilised in the 2000s and has even shown signs growing again in more recent years.

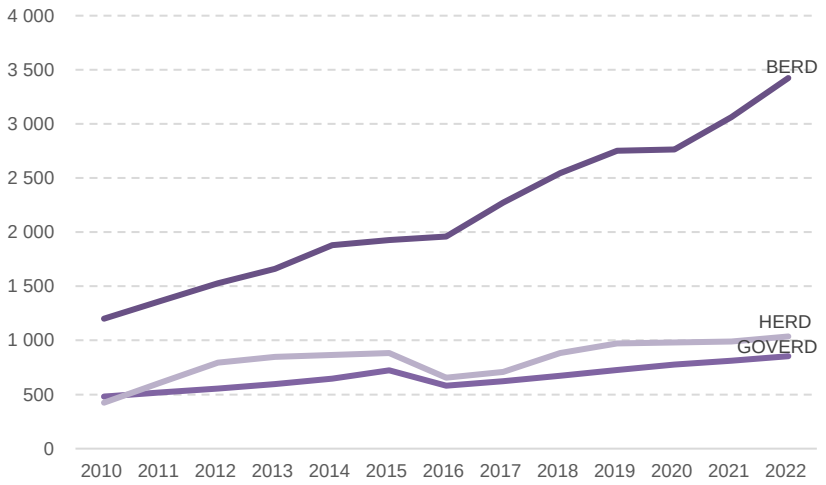


Figure 4. R&D expenditure in business (BERD), higher education (HERD), and government sector (GOVERD) in € million.
Source: Czech Statistical Office

To varying degrees, all three performance sectors (i.e. higher education, government, and business) are subsidised by public sources. In the higher education sector 75% of R&D activities, in the government sector 78%, and in the business enterprise sector 5% of R&D activities are backed or supported in part through national funding. The *government budget allocations for R&D (GBARD)* have been growing steadily over the past decade with the accelerating pace between 2017-2020 (reaching around 0.6% of GDP) and comprises nearly 1.3% of total government spending. This is slightly below the EU average, but still relatively higher than most other European countries (see Figure 5).

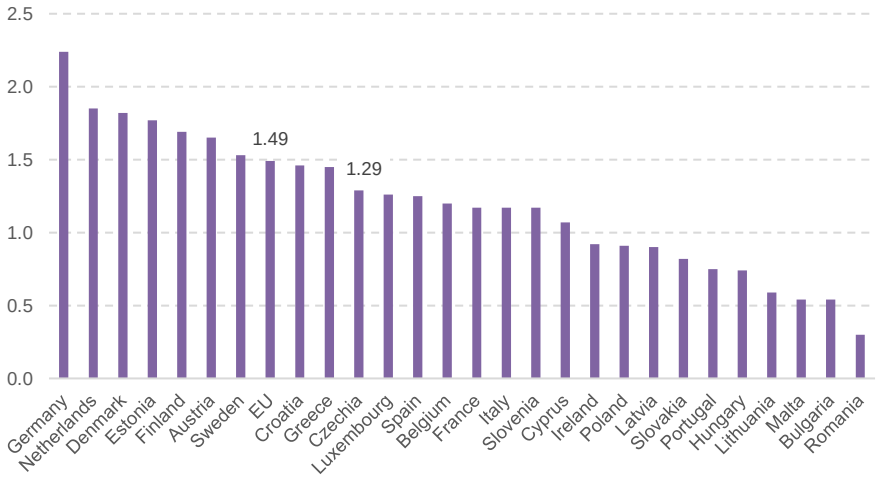


Figure 5. Share of GBARD in total general government expenditure.
Source: Eurostat

In the context of increasing R&D capacity in the higher education sector, the structure of GBARD in terms of sectors of expenditure has changed accordingly over the last decade.

Whereas in 2010 the bulk of GBARD was spent in the government sector, in 2022 the majority went towards the higher education sector. The share of GBARD spent in the business sector has decreased over time from 18% to 10% in 2022 (see Figure 6).

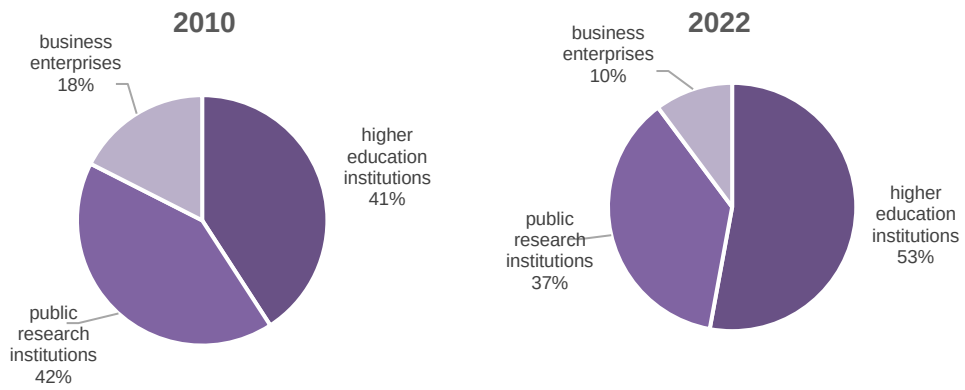


Figure 6. Share of GBARD spent in higher education institutions, public research institutions, and business enterprises.
Source: Czech Statistical Office

2.2. R&I funding system

Support for research, development and innovation is regulated by Act No. 130/2002 Coll. on Support for Research, Development and Innovation from Public Sources. This Act regulates the responsibilities for supporting basic and applied research and innovation, establishes the conditions under which support for R&I from public sources can be provided, and defines the basic rights and obligations of the providers and recipients of support for R&I from public sources. With regard to the framework conditions for knowledge transfer, the regulation of rights to the results of publicly funded R&I is of particular importance.

State budget support for R&I activities takes three forms: institutional support, project-based support, and R&D tax credits. The first two forms are regulated by Act No. 130/2002 Coll., while tax credits are regulated by Act No. 586/1992 Coll. on income tax.

2.2.1. Institutional R&I funding

Public R&D funding has traditionally been dominated by institutional funding. However, the reform of the R&I system from 2009 has changed this, with the share of institutional funding falling from 56% in 2009 to 49% in 2014. This change is mainly due to political and partly economic factors (austerity policy after the economic downturn of 2009-2010). The main political factor is anchored in the 2009 reform of the R&I system, which set the goal of achieving a 60:40 ratio of project-based and institutional funding by 2015. Since then, however, the policy approach has changed again in favour of the need for stability in the R&I system and a consequent emphasis on increasing the share of institutional funding compared to competitive funding (see Figure 7).

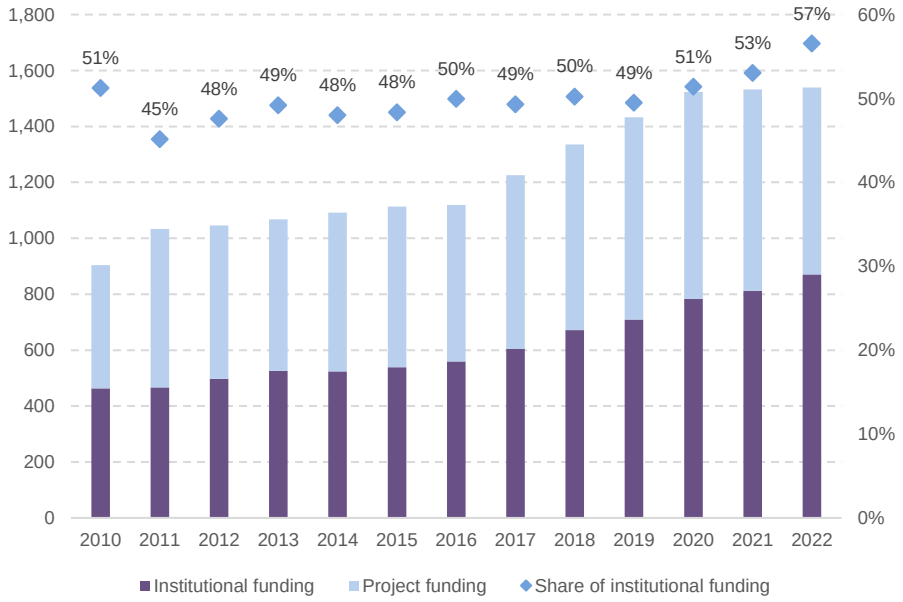


Figure 7. GBARD by type of funding in € million (left axis) and share of institutional funding in total GBARD (right axis). Source: Czech Statistical Office

The Czech system of institutional support has undergone significant changes over the last 25 years. The first *model of institutional support*, used until 1999, was based on the *index method* – i.e. funding established from the level of expenditure in previous years with some minor changes. In 1998, this model was replaced by the system of *research plans* – i.e. broad, general research projects designed for a period of five and later seven years. Research organisations had considerable freedom in the design of research plans. The 2009 reform introduced a *performance-based research funding model*. This model used a metrics-based quantitative assessment of research outcomes (mainly publications, but also outputs in the form of various types of industrial property such as patents, utility models, or new varieties and breeds). Institutional support was allocated largely on the basis of the quantity (and partly the quality) of outputs produced by a given research organisation over the previous five years. For the strictly metrics-based approach, the allocation of institutional support was called the "coffee grinder" (see the chapter on research assessment for more details). Since 2013, this model has been replaced by a kind of *index-based model*, where a significant part (80%) of the institutional support is allocated at the same level as in the previous year, and the remaining part is allocated according to the results achieved or (since 2017) based on the more robust research assessment (Methodology 17+, see Chapter 3.2).

Institutional support is mainly provided to universities by MEYS, and to CAS institutes through its own budget (see Figure 8). Another nine ministries, namely the Ministry of Agriculture, Ministry of the Interior, Ministry of the Environment, MIT, Ministry of Foreign Affairs, Ministry of Labour and Social Affairs, Ministry of Transport, Ministry of Defence, and Ministry of Culture, provide institutional support to sectoral research organisations under their responsibility.

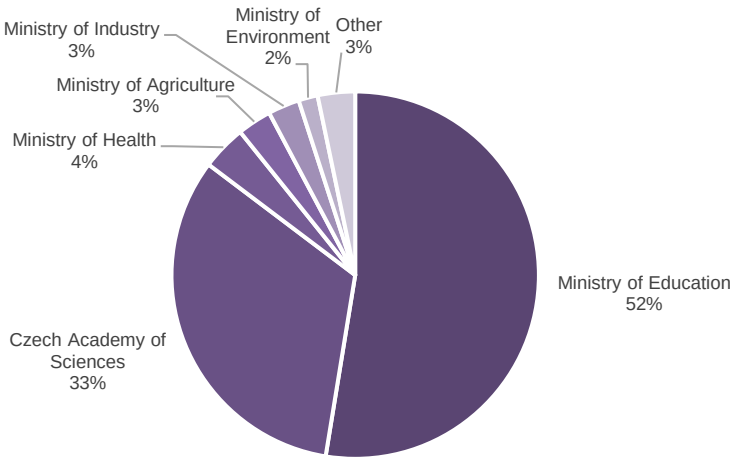


Figure 8. Institutional funding providers in 2024.
Source: State budget on R&I

2.2.2. Project-based R&I funding

There are *two major agencies allocating the project-based funding* in Czechia, namely *GA CR* for basic research and *TA CR* for applied research. Before establishing TA CR in 2009, MIT played the role as key research funding organisation for industrial research. Since 2009, the funding of industrial research has been gradually transferred to TA CR, and MIT mainly funds industrial R&D in companies. MEYS is an important provider of project-based support for the development of research infrastructures, research of master and doctoral students at universities, and international cooperation (see Figure 9).

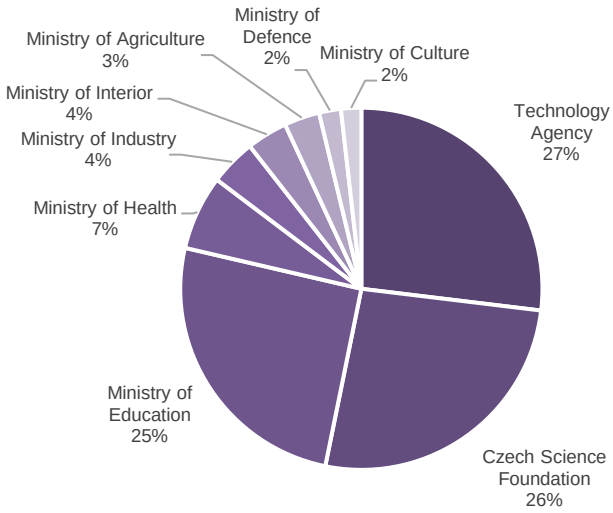


Figure 9. Project-based funding providers in 2024.
Source: State budget on R&I

In general, there are *two ways of allocating project-based R&D support*. Firstly, the allocation is based on *project calls* and the selection of the most appropriate R&D projects. The results of these projects and related intellectual property rights belong to the research performing organisations. The second type is *R&D procurement*, where research funding organisations purchase R&D services from research performing organisations together with the rights to use the results. R&D procurement accounts for only 3% of total project-based R&D funding.

2.2.3. Tax credits for R&I

In addition to direct support in the form of institutional and project-based support, research in Czechia is also stimulated by *indirect support* in the form of R&D tax deductions. This instrument was introduced by an amendment to the Income Tax Act (No. 586/1992 Coll.) in 2005 for the deduction of companies' own R&D costs and, from 2015, also for R&D purchased from research organisations. According to this Act, companies can deduct up to 100% of R&D costs from the tax base.

About 750 companies in Czechia (i.e. a quarter of companies with research activities) benefited from indirect support in 2022, a number that has been gradually decreasing (by more than 40%) since 2015 (see Figure 10). The reason for the *declining interest of business enterprises in using indirect support* is mainly due to the unpredictability of the tax deduction system, with the tax administration questioning applications, issuing additional tax assessments on enterprises, including penalties, as well as disputes arising between the enterprises concerned and the tax administration on the assessment of the nature of costs (whether they were research or not). Other factors that discourage SMEs, in particular, from using tax credits include the administrative complexity of the process of claiming them (see Czech Confederation of Industry, 2024a). The attractiveness of tax credits declines for both domestic and foreign-controlled enterprises.

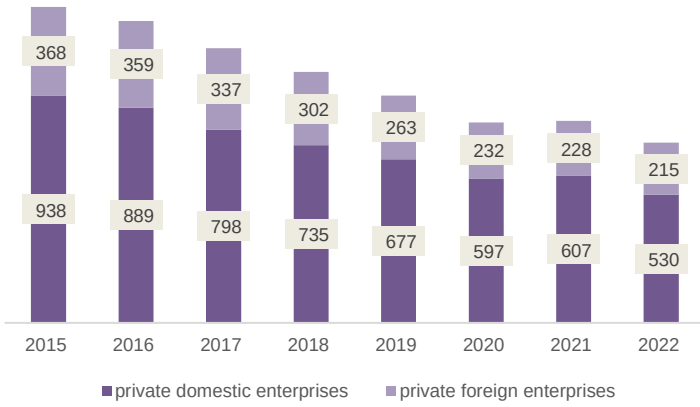


Figure 10. Number of business enterprises claiming R&D tax credit.
Source: Czech Statistical Office

The volume of tax support (i.e. reduced tax payments due to the application of the R&D deduction) has fluctuated by around €100 million over time. In 2022, it increased to €125 million. More than 70% of this support went to the manufacturing industry, and 80% of the total tax support was used by large companies.

Business associations consider tax deductions to be an important tool for supporting business research, which can help the Czech economy achieve higher positions in global value chains. Therefore, they actively propose *further adjustments of the tax deduction system in Czechia towards greater predictability, simplicity and variability* of the parameters covering the whole system, such as extending it to a discount on social and health insurance payments, introducing cash back, and other (Czech Confederation of Industry, 2024b).

2.3. Role of the EU Structural Funds in the Czech R&I funding system

Since 2007, ESIF has played an important role in strengthening R&D capacities in both the public and private sectors. The EU programme has been the largest source of funding for the construction and initial development of R&D centres and R&D infrastructure in both the public and private sectors.

R&D support from ESIF was managed by MEYS, MIT and the City of Prague. *MEYS supported R&D capacities in the public sector* through the Operational Programme Research, Development for Innovation 2007-2013 (OP RDI), the Operational Programme Research, Development and Education 2014-2020 (OP RDE), and the Operational Programme Johannes Amos Comenius 2021-2027 (OP JAC), *MIT supported research and innovation capacities in the private sector* through the Operational Programme Enterprise and Innovation 2007-2013 (OP EI), the Operational Programme Enterprise and Innovations for Competitiveness 2014-2020 (OP EIC), and the Operational Programme Technology and Applications for Competitiveness 2021-2027 (OP TAC). *Prague* has its own support programmes as the capital city is the only "more developed" region in Czechia; namely, the Operational Programme Prague – Competitiveness 2007-2013 (OP PC) and the Operational Programme Prague – Growth Pole of Czechia 2014-2020 (OP PGP).

The following table provides an overview of the financial resources allocated to research organisations and enterprises for research and innovation-related activities in three programming periods from 2007 to 2027.

Table 4. Support from ESIF and corresponding national/regional public co-funding on R&I activities in period 2007-2013, 2014-2020, and 2021-2027 (plan)

Operational Programme (abbreviation)	Specific objectives	Support (in € millions)
	Programming period 2007-2013	
OP RDI	European Centres of Excellence	810
OP RDI	Regional R&D Centres	815
OP EI	Business R&D Capacities	310
	Business development and innovation	850
OP PC	Research Centres in Prague	55
	Programming period 2014-2020	
OP RDE	Strengthening capacity for high-quality research	1,400
OP EIC	Business R&D centres and industrial R&D	890

OP EIC	Business development and innovation	2,060
OP PGP	R&D capacities in businesses	105
Programming period 2021-2027 (plan)		
OP JAC	Developing and enhancing research and innovation capacities and the uptake of advanced technologies	1,640
OP JAC	Developing skills for smart specialisation, industrial transition and entrepreneurship	
OP TAC	Developing and strengthening research and innovation capacities and introducing advanced technologies	970

Source: Programme documents and statistics of MEYS, MIT, and City of Prague

Support from ESIF has contributed significantly to the *modernisation of research infrastructures and the development of research capacities* in both public and private spheres. In the public research sector, a total of eight centres of excellence and 40 regional research centres were established at universities and public research institutes with the support of ESIF in the period 2007-2013, providing an important stimulus for the development of high-quality science and cooperation with industrial partners. The ex-post evaluation of OP RDI, carried out in 2018, showed that the centres of excellence (and some regional research centres) accelerated the development of international research cooperation and the internationalisation of the research system in Czechia, where state-of-the-art infrastructure facilities attracted a number of foreign researchers (EACE, 2018). The role of ESIF in increasing the share of foreign researchers in universities and R&D in Czechia in general has also been demonstrated by the thematic evaluation of the Partnership Agreement prepared in 2023 (EY, 2023).

The development of *cooperation with enterprises* has been mainly driven by regional research centres, which should ensure the interaction of public research with the regional innovation system. Cooperation between these centres and enterprises is mainly based on collaborative and contract research. The 2023 evaluation found that support from ESIF has demonstrably helped to strengthen the focus of research on the practical application of results and their benefits for competitiveness. This support also strengthens cooperation between research organisations and enterprises. The main contribution of ESIF in this area is to create the conditions and quality services for liaison between research organisations and enterprises, on the basis of which specific cooperation projects are developed. The evaluation confirmed the positive impact of the support on universities' income from contract research, and on the *development of knowledge transfer systems at universities and public research institutes*, in particular the development of human capacity for knowledge transfer, the institutionalisation of knowledge transfer (setting up knowledge transfer centres), and the increased awareness of the importance of knowledge transfer and cooperation between public research and industry. A limiting factor for the development of knowledge transfer, according to the evaluation results, is the fact that the research assessment in research organisations does not sufficiently take into account the results in the field of knowledge transfer – researchers may not be adequately motivated to engage in applied research and/or knowledge transfer activities.

An important conclusion of the evaluations is also the question of the *financial sustainability of the newly created research capacities and knowledge transfer offices*. The interventions have contributed to greater fragmentation and a large number of research centres in Czechia, leading to increased demands on public funding for the entire research system. At

the same time, the evaluations underline the need to maintain public support for the activities of knowledge transfer infrastructures.

3. Research profile and assessment

3.1. Research profile

As discussed in the chapter on R&I governance above, the dominant part of public research is carried out in universities and CAS institutes. Together, these organisations employ 82% of all public researchers and spend 85% of total R&D public expenditure. The remaining percentage is made up of sectoral research institutions, representing 3% of the total number of public-sector researchers, and 4% of total government R&D spending.

An insight into the *disciplinary structure of public research* is important to assess the potential for collaboration between research organisations and industry, and for knowledge transfer from public research to innovation. While the universities have traditionally been dominated by the natural sciences (especially biology and mathematics), engineering and technology, and medical sciences, the government sector (i.e. CAS and sectoral research institutes) is more geared towards physics and chemistry (see Figure 11). The disciplinary structure of public research has remained stable over time.

Given the structure of the Czech economy, which is dominated by the automotive, electrical and mechanical engineering sectors, the *potential for cooperation* between Czech industry and universities is more significant. In the case of the institutes of CAS, this potential can be found mainly in the field of biotechnology and the pharmaceutical industry.

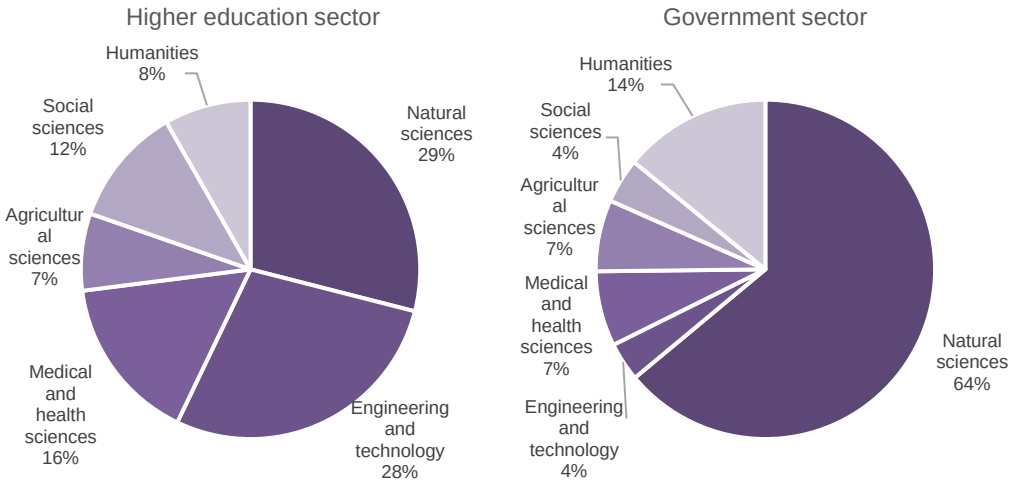


Figure 11. Structure of researchers in public research by scientific discipline.
Source: Czech Statistical Office

The international importance and impact of research in individual disciplines can be monitored by the number and citation rate of publications. This information is summarised by the Government Office/RDI Council in the National R&I Assessment (RDI Council, 2024a).

In Czechia, most publications are produced in the *natural sciences* (physical, chemical and biological sciences), *engineering* (especially materials engineering) and *medical sciences* (clinical and basic medicine). In some fields, the share of publications in the total publication output is (significantly) higher in Czechia than in the EU-15. For international comparison, there is a high proportion of publications especially in natural sciences (chemistry, physics, biology, mathematics), some engineering sciences (especially materials science), and some agricultural sciences (agriculture, forestry, fisheries). Publication activity is increasing in the vast majority of disciplines. The highest increases are in the engineering sciences, especially environmental engineering, industrial biotechnology, and nanotechnology (RDI Council, 2024b).

The *citation rate of publications* produced by Czech research organisations is below the world average in most fields. Publications in the physical sciences reach the world average citation rate. Among the more narrowly defined fields of science, only physical sciences and agricultural sciences are significantly above average. In some fields, however, the actual impact of Czech publications on the development of science is above the world average. These include promising fields such as computer science, physical sciences, molecular biology and genetics, chemistry and biochemistry, and some medical fields. Citation rates are increasing in most fields, as too the proportion of publications produced in collaboration with the business sector and those produced in international collaboration (RDI Council, 2024b, Kučera et al., 2020).

3.2. Research assessment

3.2.1. Context and history of research assessment

Research assessment is an important policy tool that provides strategic information for the direction of the research system and also creates certain incentives for the management of research institutions and for researchers themselves.

The organisation and approach to the evaluation of research organisations has been discussed quite intensively in Czechia for more than 20 years. In its original form, introduced in 2004, it was a uniform national assessment of research and development results according to a system of points awarded for individual types of results achieved by research organisations. These points were mechanically (according to an established algorithm) converted into sums that were allocated by funders to individual organisations as 'institutional support'. Because of its mechanical nature, the term *"kafemlejnek" (coffee grinder)* was coined for this system. An international audit of the R&I system carried out in 2011 summarised its shortcomings as follows (Arnold et al. 2011):

"The evaluation methodology (EM) is not fit for purpose. Its reliance on quantitative indicators is driven by a desire to depoliticise and depersonalise the funding process. By relying only on (proven) past performance, it aims to combat cronyism, corruption and lobbying. It sends a clear signal: no results, no institutional funding. However, the evaluation methodology suffers from important weaknesses, including reductionism, failure to take into account differences between inputs and outputs, or to take into account policy requirements, such as national thematic priorities, which treat all institutions equally, regardless of their missions, by using output indicators that are in practice arbitrary. (...) EM leads to opportunistic behaviour ('gaming the system') by researchers and makes institutional funding unpredictable. It leads in some cases to large swings in funding and encourages a short-term focus by penalising investment in the development of new fields and capacities that have few short-term outputs. It has been refined year by year, but without a change introducing elements of foresight and judgement, it will continue to

perform poorly, fragmenting research efforts, discouraging collaboration, distorting the innovation-oriented activities of researchers, and hampering the development of research strategy and investment and the creation of links between science and industry."

As the results of the international audit show, the evaluation methodology (*kafemlejnek*) significantly distorted the research system in Czechia and created undesirable motivations and cultures among research organisations and researchers themselves. These findings have therefore contributed significantly to the initiation of a political debate on a radical change in the approach to research evaluation in Czechia.

An important professional contribution to this discussion was the *IPn Methodology project*, initiated by MEYS and funded by ESIF in 2012-2015. The main objective of the project was to develop a proposal for a new system of research assessment and public funding that would replace the *kafemlejnek* and become a source of information for the strategic management of the R&I system at the level of the state administration, funding agencies, research programmes, and research organisations. A consortium led by Technopolis was commissioned to develop a new methodology for research assessment. The resulting proposal was based on proven standards of international research assessment through informed peer review, primarily inspired by the UK Research Excellence Framework. The proposed methodology was tested on a selected sample of universities, institutes of the Academy of Sciences, and sectoral and private research organisations, and was submitted to the RDI Council as a basis for the development of a new national research assessment methodology. After further discussion between the RDI Council, funding agencies and other stakeholders in the R&I system, and related (quite significant) modifications to the draft resulting from the IPn Methodology project, a *new methodology for the assessment of research organisations and the evaluation of research programmes (Methodology 17+)* was approved in 2017 and is currently in force.

3.2.2. Methodology 17+

The obligation to carry out research evaluation is enshrined in Act No. 130/2002 Coll. on Support for Research, Experimental Development and Innovation. The RDI Council is responsible for ensuring that this legal obligation is fulfilled at the national level, whereby research is linked to assessment at the level of funding bodies nationally. The *assessment covers all research organisations that received institutional funding* in the preceding year.

The *main objectives* of research assessment according to the Methodology 17+ are to:

- Provide information for R&I management at all levels (formative aspect)
- Increase the efficiency of public expenditure (summative aspect)
- Promote the quality and international competitiveness of Czech R&I
- Increase the responsibility of individual actors in the R&I system
- Provide information for the allocation of institutional support to research organisations

Research evaluation according to the Methodology 17+ takes into account the diversity of tasks of research organisations in the whole system, evaluates their outputs, impacts and overall development perspectives, takes into account the specifics of the field, and *uses informed independent peer review* in the evaluation process.

The Methodology 17+ offers a common framework for research assessment, with the detailed parameters defined by each funding agency. The framework is divided into the following five modules: M1 – Quality of selected research outputs, M2 – Research performance, M3 – Societal relevance, M4 – Viability, and M5 – Strategy. Modules M1 and M2 are evaluated annually by the RDI Council. The assessment of modules M3-M5 is usually carried out every five years by the funding agencies. Below is a brief summary of the main parameters assessed in each module.

M1 – Quality of selected outputs

This module evaluates a *limited number of research outputs* selected by research organisations. These results are assessed by a panel of experts in terms of their quality, originality and international relevance from two different perspectives. In the first category, the main evaluation criterion is the *contribution to scientific knowledge*. In the second, the main criterion is *societal relevance*, i.e. the importance of the research result for society, which is understood both in the sense of 'usefulness' (typically industrial research generating economic benefits) and 'necessity' (typically sectoral research arising from societal needs).

M2 – Research performance

Research performance is assessed as a multidimensional category and includes *research productivity and quality*. The assessment generally uses bibliometric data for scientific articles and information on research results recorded in the Research, Development and Innovation Information System managed by the RDI Council.

M3 – Social relevance

This module is based on the assessment of parameters that monitor, in particular, the *application of research results in practice*, *cooperation with industry*, impact of research activities on the quality of life, economic benefits of research activities, benefits of research for society, contribution of research to the formation of national and cultural identity, involvement of students in research activities, quality of training of doctoral students and their employment, prestigious awards for scientific contribution, *intersectoral mobility of researchers*, and the impact of research organisations on regional development or popularisation activities. The consideration and weighting of each parameter is determined by the individual funders (ministries) in relation to the characteristics and mission of the research organisations to which they provide institutional support.

M4 – Viability

This module assesses parameters such as the management of research and human resources, research infrastructure, international research collaboration, international mobility of students and young researchers, national research collaboration, research funding from national and international projects, *contract research*, *income from licensing or sale of intellectual property rights*, and *income from spin-offs*. Again, the specific parameters and their weighting in the evaluation are determined by the individual funding agencies (ministries).

M5 – Strategy and concepts

This module usually assesses the *appropriateness and quality of research strategies* formulated by research organisations in relation to their mission, the implementation of

these strategies and the link to the fulfilment of strategic objectives set at the level of the funder or nationally. In this module, too, the assessment is specific to the criteria set by the funding agencies.

From the above description, the main emphasis on the assessment of the transfer of research results into practice is placed in M4, where individual forms of knowledge transfer and its valorisation are assessed. The actual impact of research results in practice is then assessed in M3 and partly in M1.

One of the purposes of the evaluation carried out according to the Methodology 17+ is to provide information to funders for the allocation of institutional support to research organisations. A study by Daniel and Čadil (2023), which looked at allocation or funding dispersal issues, showed that the *use of research assessment results for the allocation of institutional support varied considerably between funding providers*. To allocate institutional support between universities, MEYS established an algorithm for scaling universities based on research assessment results. The results of M1 and M2, which focus on the assessment of research outputs, were given the most weight in the scaling of universities.

In the case of CAS, which covers 54 institutes, this support is distributed on the basis of bilateral negotiations between the management of the CAS and the directors of the institutes themselves. The results of the research assessment organised by the CAS can be taken into account here.

In the case of sectoral research organisations, the use of the information from the research assessment is very different, with some funding bodies having an algorithm for the distribution of institutional support directly embedded in the research assessment methodology (e.g. the Ministry of Health), while others use the scaling of research organisations according to their assessment results and the related adjustment of institutional support for the next period (e.g. Ministry of Agriculture).

Although the Methodology 17+ takes into account other aspects of the functioning of research organisations besides research results, including cooperation with industry and knowledge valorisation, to a much greater extent than the *kafemlejnek*, *the way research organisations are evaluated is still considered to provide little incentive for knowledge transfer and commercialisation of research results* (RDI Council, 2022).

4. Economy, innovation and technological specialisation

4.1. Economy, innovation and competitiveness

4.1.1. Sources of productivity and competitiveness

Czechia is a small open economy with a high export ratio. It is globally recognised for its strong manufacturing sector, skilled workforce and high degree of openness to foreign investment. Competitive advantages include a favourable geographical location in Europe, well-developed infrastructure, sound legal and institutional framework, and competitive wages. Unemployment and public debt remain among the lowest in Europe.

Czechia has traditionally been a *highly industrialised country*. As in other developed countries, the share of services in value added and employment is gradually increasing, but the primary importance of manufacturing in the Czech economy is still very clear by international standards (data from Eurostat, OECD and the Czech Statistical Office have

been used for comparison). Manufacturing in Czechia has long contributed around 30% of value added and around 28% of employment. The most important sectors of the Czech economy are the *automotive industry*, *mechanical engineering*, *electronics, and electrical engineering*. These sectors also contribute significantly to the export performance of the Czech economy and are characterised by a high level of foreign investment. Among services, the ICT sector has the strongest position in the Czech economy.

The economic performance of Czechia is mainly due to its high employment rate and the participation of the population in the creation of economic output. Employment in Czechia is one of the highest in the EU and contributes positively to GDP, but this has contributed to a serious *shortage of workers* (see European Commission, 2024b). In addition, Czechia lags behind many EU countries in terms of *labour productivity*. Total labour productivity in Czechia is around 85% of the EU average per person and hour worked (see Figure 12). This is to some extent related to the localisation of production capacity of foreign investors and downstream suppliers (Czech or foreign), whose position tends to be at the *lower levels of global value chains*. On the one hand, these firms have limited information about end markets, and they are often forced by their customers to reduce production costs. The value added generated by these firms tends to be lower, which affects their innovation activities and lowers the Czech economy's productivity.

In recent years, there has been a slight decline in productivity due to measures and the market strains brought on by the COVID-19 pandemic. The impact of the Russian invasion of Ukraine was also a significant external shock to the cost competitiveness of the Czech economy. Rapidly rising commodity and input prices pushed consumer price inflation up to almost 15% in 2022. As a result of higher commodity prices and unit labour costs, Czechia's cost competitiveness is pushed down, posing a significant threat to the sustainability of the existing economic model.

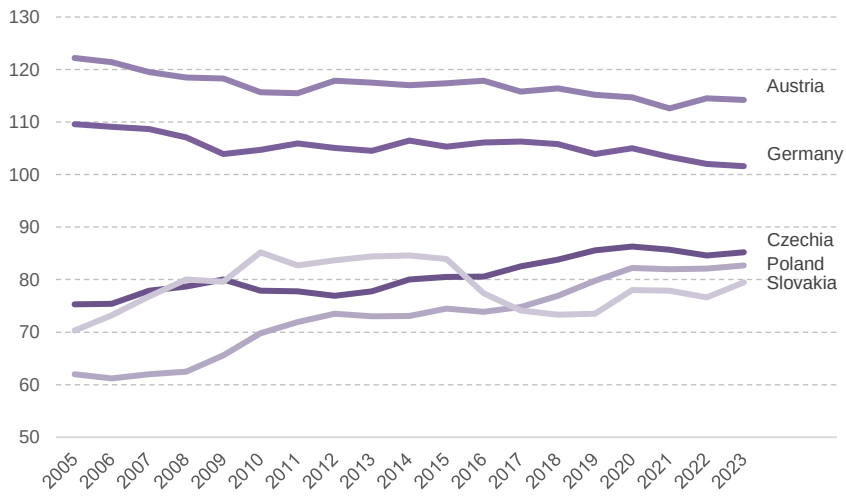


Figure 12. Labour productivity per person employed and hour worked (EU27_2020=100).
Source: Eurostat

4.1.2. Role of foreign investment

The competitiveness and performance of the Czech economy during the transition period (1990-2010) were significantly supported by *high inflows of foreign direct investment*. This

inflow was initially stimulated mainly by relatively low labour costs, which was reflected in the nature of foreign investment in lower value-added segments of production. However, a qualitative shift has gradually taken place and foreign investment in manufacturing has been followed by foreign investment in development and technology centres. As the surveys of innovative companies organised by TA CR show (2023a), there is an increasing number of examples of the *qualitative transformation of foreign companies' activities in the Czech economy towards higher value added*. In contrast, the number of globally successful endogenous firms has tended to stagnate over time, which only confirms the importance of foreign-owned firms for future innovation potential in key sectors of the economy. Foreign investment inflows and their transformation affect the specialisation of the Czech economy in many ways and also have an impact on the country's knowledge intensity (see below).

4.2. Knowledge intensity

The knowledge intensity of Czechia, measured as the share of R&D expenditure in GDP, is slightly below the EU average. Although it reached the 2% of R&D expenditure in GDP threshold in 2021, a slight decline to 1.96% was recorded in 2022. Nevertheless, it can be concluded that Czechia has recorded a *solid increase in knowledge intensity over the last 10 years*. The share of R&D workers in total employment is also gradually increasing.

Businesses spend the most on R&D. The share of the business sector in total R&D spending was already 64% in 2022, which brings it closer to the share reported in most European countries (the EU27 average is around 66%). *Foreign-controlled companies in Czechia spend the most on business R&D*. Their share of BERD spending has long been above 60%, and in 2022 recorded more than 64%. The amount of R&D spending in foreign-controlled companies has increased more than threefold in nominal terms since 2010. In 2010, foreign-controlled companies spent a total of €600 million on R&D, which accounted for 28% of total R&D expenditure; in 2022, these enterprises already accounted for 41% of total R&D expenditure (nearly €2,200 million) in Czechia. This opens a gap between the knowledge intensity of the domestic business enterprise sector and that of foreign-owned companies (see Figure 13).

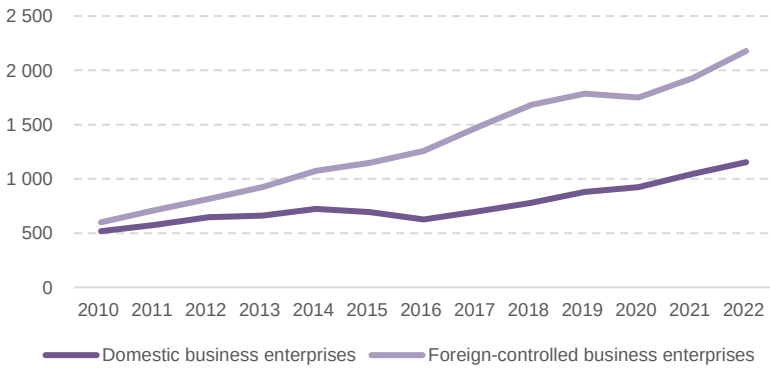


Figure 13. R&D expenditures in business enterprise sector (in € million).
Source: Czech Statistical Office

According to the summary innovation index (SII) monitored in the European Innovation Scoreboard – EIS (European Commission, 2024a), Czechia has long been ranked in the *group of moderate innovators*. In 2024, Czechia's EIS ranking is being adversely affected by indicators monitored in the areas of intellectual assets and human resources. On the

other hand, the country is well above average in areas related to digitalisation, firm investments, innovators and linkages (innovative SMEs collaborating with others and public-private co-publications). Czechia is also above EU average in the area of employment impacts, which is linked to the relatively high share of employment in the high-tech manufacturing sector in the Czech economy.

This makes the Czech economy an integral part of multinational value chains in high-tech and medium-tech industries. Here, the involvement of firms in production, assembly and related logistics (mainly through branches of foreign-owned firms) is prevalent. At the same time, the more innovative segment of domestic firms within the high-tech sector can also be observed to be increasingly important for their own product innovation, but with a mostly local or national reach. Overall, Czechia can be regarded as an *innovative economy with a weak representation of radical product innovation*.

One of the significant constraints on the advancement of the innovation capabilities and knowledge intensity of Czechia is the *limited availability of highly skilled professionals* (see also the weak position in the EIS human resources indicators described above). The European Commission report highlights that this presents challenges for economic growth, with firms emphasising the scarcity of skilled personnel as a major investment barrier (European Commission, 2024b).

4.3. Entrepreneurial culture

Skilled people with entrepreneurial aspirations and skills are a prerequisite for the development of innovative entrepreneurship and the effective transfer of knowledge into practice. As both TA CR (2023a) and OECD (2020) studies point out, a *lack of entrepreneurial culture is a key factor hindering the diffusion of innovation, development of innovative entrepreneurship, and the growth of higher value-added firms*. In this context, historical reasons are often cited that negatively affect risk attitudes and the willingness to create new technology-oriented firms. One is the legacy of the pre-1989 Soviet-dominated period, when Czechia had a centrally planned economy and the development of private entrepreneurship was suppressed. The second is the period of fast privatisation in the 1990s, when, on the contrary, there was a boom in the development of private enterprise in conditions where standard regulatory mechanisms were not established, which subsequently led to a certain cultural discrediting of private enterprise.

Another reason for the relatively underdeveloped entrepreneurial culture is people's own perception that they lack sufficient skills to start their own business. This is linked to relatively low levels of ambition and risk-taking. The ambition deficit among entrepreneurs is confirmed by the TA CR survey, where most entrepreneurs are reluctant to adopt innovations, either radical or incremental, as long as the business continues to be profitable.

The *lack of an entrepreneurial culture in public administration* is highlighted by the OECD study. This is reflected in support programmes with cumbersome and time-consuming application procedures and limited willingness to guide entrepreneurs and small business owners through the R&I policy environment in a language they can easily understand.

Last but not least, the limited business culture makes interaction between higher education institutions and enterprises difficult. *Collaborating with business and commercialising research is not in the DNA of many universities and public research institutes*, and knowledge transfer activities are not an integral part of their mission. This weakens the

entrepreneurial culture in public research, hinders efforts to build partnerships between academia and industry, and curbs effective knowledge transfer between these sectors.

4.4. Technological specialisation

The thematic areas of Czechia's technological specialisation are defined in the *National S3 Strategy*. They include:

- Digital technology and electronics
- Advanced machinery and technology
- Transport for the 21st century
- Healthcare and advanced medicine
- Culture and creative industries
- Sustainable agriculture and environment

These sectors form the *backbone of the Czech economy* and have a *high potential for the creation and absorption of new knowledge and R&D results* and for the *use of key enabling technologies*. In the background analysis for the formulation of the National S3 Strategy (Kučera et al., 2020), the technological readiness and ability of enterprises in various sectors of the Czech economy to absorb new knowledge and R&D results was analysed in detail. This analysis confirmed that the key share in the dynamic development of R&D activities in the business sector is held by large foreign-controlled enterprises, and that the share of domestic SMEs in research activities is decreasing over time.

At the same time, *foreign-controlled enterprises dominate most of the sectors with significant R&D activities*. In the automotive industry, for example, the concentration of R&D in foreign-controlled enterprises is almost 100%. There is also a high concentration of research activities in foreign-controlled enterprises in high-tech industries (electronics, pharmaceuticals), electrical engineering, computer activities and some other knowledge-intensive service industries, such as architectural and engineering activities, financial intermediation, and telecommunications. In these sectors, there is also a significant concentration of R&D activities in a small number of enterprises and thus a lack of a broader and more dispersed R&D base in the business sector.

The sectors in which domestic enterprises perform a higher proportion of R&D than foreign-controlled enterprises are the manufacture of other transport equipment, both metal and chemical industries, the repair and installation of machinery and equipment, and knowledge-intensive services, including R&D and information activities.

- In terms of key sectors of economic specialisation in Czechia, business R&D activities are most extensive in the field of *digital technologies and electronics*, which is also one of the most dynamically developing sectors. A significant part of this dynamism is accounted for by foreign-controlled enterprises, where most of the BERD in this sector is concentrated. Despite the significant concentration of R&D expenditure in a small number of large enterprises, a relatively high number of research-active enterprises are active in digital technologies and electronics. This, together with the dynamic research activities in this field, indicates promising potential for absorbing R&D results and new

knowledge into innovation processes. This is further confirmed by the relatively high and growing number of patent applications filed by enterprises active in digital technologies and electronics. However, a significant number of patent applications of Czech origin are filed by companies based abroad (see the chapter on patent offshoring below), which indicates a certain risk of "knowledge leakage" from Czechia. The increasing potential of R&D in digital technologies and electronics is also reflected in the relatively high and growing support for research activities from public sources. The fact that around two-thirds of the projects supported are carried out in cooperation between enterprises and research organisations suggests that the links between universities and enterprises for the transfer of new knowledge in this area are relatively well developed.

- *Advanced machinery and technology* is characterised by a higher share of domestic enterprises in R&D activities (around 55% of business R&D expenditure is performed by domestic enterprises), with a relatively high share of R&D performed by SMEs, except in the energy and metallurgy sector. This is also reflected in the very high number of enterprises with R&D activities, which confirms that there is a broad research base for further R&I development in this area. Advanced machinery and technology is characterised by its high potential for absorbing R&D results and new knowledge into innovation processes, as evidenced by the relatively strong number of patent applications filed by domestic SMEs. About half of these applications naming Czech employees are filed by companies based abroad (usually parent companies of branches operating in Czechia). There is therefore some knowledge leakage abroad, but not to the same extent as in the electrical engineering and automotive sectors. A relatively high share of public support for R&D is directed to the field of advanced machinery and technology, which is also reflected in the strong links between academic and business research (about 80% of publicly supported R&D projects are carried out in cooperation between the two sectors), given the emphasis on promoting cooperation between research organisations and enterprises. These existing links provide a good basis for effective knowledge transfer between research organisations and enterprises, especially in the field of engineering and mechatronics.

- *Transport for the 21st century* is the theme with the lowest share of domestic enterprises in R&D expenditure. The lowest share of domestic expenditure in the automotive industry is a logical consequence of the ownership structure of the main companies in this sector. An exception is the railway and rolling stock sector, where the share of domestic enterprises is the highest (almost 92%). In transport for the 21st century, R&D is mainly carried out by large enterprises (especially large foreign-controlled enterprises), while the share of domestic SMEs is very low. This is observed in the narrow base of business R&D and the high concentration of R&D activities in a small number of enterprises. Given the privileged position of transport-related production in the economic structure of the Czech economy, support for business research activities in this sector is relatively high. Public support is mainly directed to the automotive and aerospace sectors. Most projects are carried out in cooperation between research organisations and enterprises, which is a prerequisite for using the knowledge potential of public research in business innovation. On the other hand, although the area of transport for the 21st century includes sectors that are the engine of the Czech economy, patent activity in this area is low compared to other thematic areas and is also on a downward trend. This, together with the high share of R&D performed in foreign-controlled enterprises, largely reflects the position of enterprises in global value chains, where production activities in these sectors tend to be concentrated in low-end activities.

- In the field of *healthcare and advanced medicine*, the capacity of the business enterprise sector to absorb new knowledge and R&D results lags behind the research

capacity of the public sector. This is also expressed in the relatively low level of BERD compared with other fields. More than half of R&D expenditure is carried out by foreign-controlled enterprises, and the share of domestic enterprises in R&D performance is gradually decreasing. Research in health and advanced medicine is a priority for the government, which is reflected in the high level of public support for medical and pharmaceutical research (support is particularly high in clinical and basic medicine, and in life sciences). Public support, which has been increasing over time in these fields (especially in clinical medicine), is mainly directed to research organisations, where the majority of research in health and advanced medicine is carried out. In contrast, support for business research activities is relatively low. The dominance of public research in health and advanced medicine also translates into patenting activity, which is mainly carried out by academic (research) institutions. Patent applicants from the business enterprise sector are dominated by domestic players, especially medium and large enterprises. In general, the relatively low BES R&D expenditure, the limited participation of enterprises in publicly funded R&D projects and the low number of enterprises with their own patenting activities all indicate a rather limited absorptive capacity among business enterprises (expressed in lower levels of new knowledge and R&D results being applied in this field).

- In the *culture and creative industries*, which includes both traditional craft industries and industries associated with new activities and business models, R&D activities are not as extensive as in other manufacturing and knowledge-intensive service sectors. Nevertheless, there is a broad base of R&D activity in the business economy, as evidenced by the relatively high number of enterprises reporting R&D expenditure. On the other hand, a small number of large enterprises in this sector account for the dominant volume of R&D investment. The lower level of R&D activity in the culture and creative industries also contributes to the lower number of new technical solutions with patent protection – indeed patent applications in the culture and creative industries has been declining over recent years. Nevertheless, the importance of R&D carried out in the culture and creative industries in the R&D support system is demonstrated by the relatively high volume of support for R&D projects in this sector. Compared to other sectors, the culture and creative industries are specific in that the dominant share of support for R&D activities goes to small domestic enterprises. This indicates the relatively high potential of the endogenous sector for the creation and absorption of new knowledge. This potential is reinforced by the fact that the vast majority of supported projects are carried out in cooperation between enterprises and research institutions.

- *Sustainable agriculture and environment* are among the sectors with the least R&D activity, which is confirmed by their lower BERD numbers. Although business R&D expenditure in this area is increasing, the growth rate is lower than the average BERD rate. In contrast to most other thematic areas, R&D activities in sustainable agriculture and environment are mainly performed by domestic enterprises, and the share of domestic enterprises in R&D performance is relatively stable. This reflects the strong position of local players in the business research base, and the high proportion of SMEs. Business R&D in this area is strongly dependent on public support. Yet more than 90% of publicly-funded research projects carried out by companies are conducted in collaboration with universities or public research institutes, demonstrating the well-established links between companies and universities. Research organisations are also heavily involved in patenting R&D results. This bodes well for intersectoral knowledge transfer and the application of joint R&D results in innovation.

5. Science-industry linkages

5.1. Funding of public research by businesses

One way to assess the links between research organisations and enterprises in the national innovation system is to look at the financial flows between the different sectors (see Table 5). These intersectoral financial flows take into account contract research and the sale of rights to R&D results carried out by research organisations. However, they do not take into account joint research and innovation activities between enterprises and research organisations.

Table 5. Sources of R&D funding by sector of performance in 2022

		Sector of R&D performance									
		BERD		HERD		GOVERD		Private non-profit		**TOTAL**	
		€ million	%	€ million	%	€ million	%	€ million	%	€ million	%
Source of funds	Business enterprise funds – domestic	3,125	*91*	40	*4*	23	*3*	7	*35*	3,269	***61***
	Business enterprise funds – abroad			3	*0*	71	*8*				
	Public funds – national	168	*5*	775	*75*	666	*78*	6	*34*	1,616	***30***
	Public funds – abroad	129	*4*	156	*15*	90	*10*	5	*27*	380	***7***
	Other funds – national	1	*0*	61	*6*	4	*0*	1	*4*	67	***1***
	TOTAL	**3,424**	***100%***	**1,036**	***100***	**854**	***100%***	**18**	***100%***	**5,332**	***100%***

Source: Czech Statistical Office

In the government sector, business resources totalled €94 million in 2022 and accounted for 11% of total government R&D expenditure. Some €71 million came from foreign companies, while €23 million of research in the government sector was funded by domestic companies. Business resources in the government R&D sector consist mainly of income from the sale of R&D services (i.e. contract research) and income from royalties and licence fees amounting to €64 million (i.e. almost 70% of the business resources used for R&D in the government sector). This was dominated by licence income from Gilead Sciences to the CAS Institute of Organic Chemistry and Biochemistry. A total of 75 institutes (36%) in the government sector had revenues from the sale of R&D services to enterprises in 2022, of which 19 institutes (9%) had revenues exceeding €400,000. In the majority of EU27 countries, less than 1% of R&D in the government sector is financed from business enterprise funds.

Business funding of university research has been around €40 million per year for the last eight years (€43 million in 2022), which represents some 4% of R&D expenditure in the higher education sector. Total business funding of university research is dominated by domestic business funding (93%). Business resources available to higher education institutions consist mainly of income from the sale of R&D services. A total of 27 higher education institutions (44%) carried out research for enterprises in 2022, of which 13 institutions (21%) received more than €400,000. Technical universities (especially the

Czech Technical University in Prague and the Brno University of Technology) received the most funding. In almost all EU27 countries, less than 10% of R&D expenditure in the higher education sector is financed by business enterprises.

It is interesting to compare the structure of business funding of research activities in the higher education and government sectors by field of science (see Figure 14). While in the higher education sector, business sources are mainly involved in the financing of research in engineering and technology, in the government sector, the share of business sources in research funding is mostly in the fields of natural and agriculture sciences.

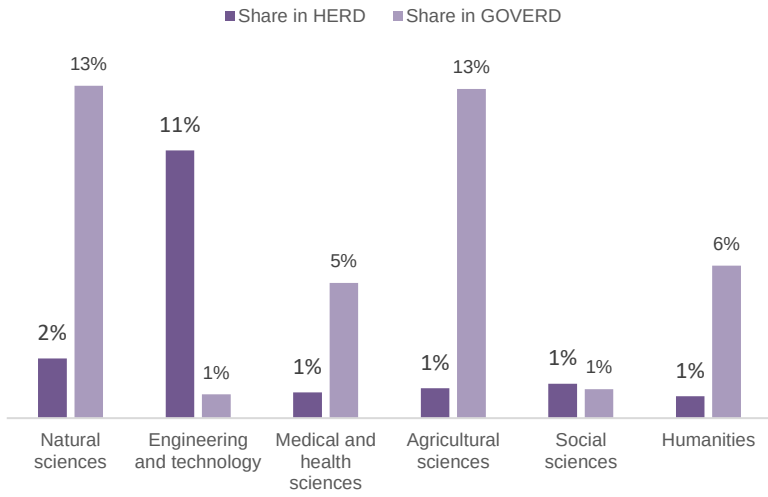


Figure 14. Share of business enterprise funds in total expenditures on R&D by sector and field of science in 2022.
Source: Czech Statistical Office

5.2. Cooperation between businesses and research organisations on innovation activities

Data from the Community Innovation Survey (CIS) provide an international comparison of how enterprises collaborate with research organisations on innovation activities. The CIS2020 shows that the share of innovative enterprises collaborating with universities in Czechia is close to the EU average, while the share of enterprises collaborating with public and private research institutes is below the EU average (see Figure 15). This contrasts to some extent with the data on financial flows between sectors presented above. While the share of business resources in the government R&D sector is significantly higher than in HES; innovative enterprises report more frequent collaboration with HES than with public and private research institutions. This may suggest that, *in addition to contract research and the sale of rights to R&D results, cooperation between enterprises and universities may be based on other forms of knowledge transfer* (consultancy, training).

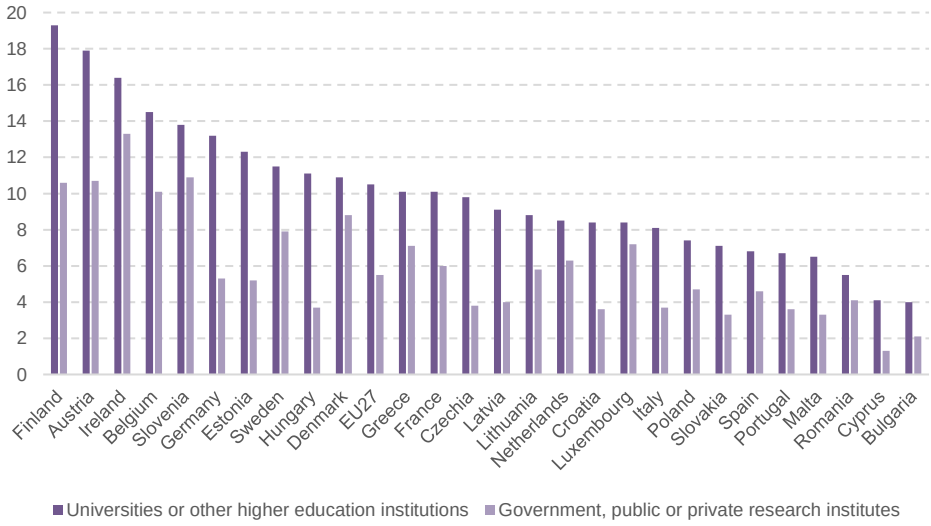


Figure 15. Share of innovative enterprises that co-operated on R&D and other innovation activities with universities or research institutes (%).
Source: Eurostat, CIS 2020

With regard to the industrial orientation of Czechia, data on the cooperation between innovative enterprises in the manufacturing sector and universities/research institutes are also interesting. The sectors with the highest share of *innovative enterprises cooperating with universities* are in the petrochemical and chemical industry, building materials industry, the electronics industry – manufacture of electronic and optical equipment – and the manufacture of other vehicles and equipment. The sector with the highest proportion of *innovating enterprises collaborating with public and private research institutes* is pharmaceuticals. This reflects the sectoral focus of public research institutions on life sciences as well as the traditionally high intensity of science-industry collaboration in the pharmaceutical industry (see comparison with selected countries in Table 6).

Table 6. Share of innovative enterprises in manufacturing that co-operated on R&D and other innovation activities with universities or research institutes in Czechia (CZ), Denmark (DK), Germany (DE) and Finland (FI), in %

	Universities or other higher education institutions				Government, public or private research institutes			
	CZ	DK	DE	FI	CZ	DK	DE	FI
Manufacturing total	**11.8**	***10.9***	***16.2***	***26.1***	**4.1**	***6.4***	***6.4***	***15.8***
Food, beverage and tobacco industry /10-12/	**6.8**	*6.9*	*5.0*	*13.7*	**1.6**	*4.4*	*2.6*	*14.0*
Textile, clothing, leather and footwear industry /13-15/	**8.3**	*11.8*	*27.1*	*28.3*	**1.2**	*3.9*	*4.9*	*11.8*
Wood and paper industry /16-18/	**5.3**	*0.0*	*2.5*	*21.8*	**4.3**	*1.0*	*0.8*	*13.6*
Petrochemical and chemical industry /19-20/	**24.9**	*39.4*	*30.6*	*n.a.*	**10.3**	*22.7*	*15.8*	*n.a.*
Pharmaceutical industry /21/	**18.1**	*45.8*	*23.4*	*n.a.*	**30.1**	*37.5*	*16.8*	*n.a.*
Rubber and plastics industry /22/	**10.0**	*6.5*	*17.9*	*29.0*	**4.0**	*0.9*	*5.3*	*25.6*
Glass, ceramics, porcelain and building	**24.3**	*14.0*	*15.8*	*33.1*	**5.6**	*6.0*	*8.6*	*12.2*

materials industry /23/								
Manufacture of metals, metallurgical and metalworking products /24-25/	**6.9**	*2.2*	*15.6*	*20.9*	**2.5**	*0.6*	*5.3*	*8.4*
Electronic industry – production of electronics and optical equipment /26/	**24.0**	*24.8*	*33.6*	*38.9*	**8.7**	*12.4*	*18.4*	*31.2*
Electrotechnical industry – manufacture of electrical equipment /27/	**17.8**	*9.4*	*19.3*	*30.6*	**6.2**	*5.7*	*8.6*	*23.3*
Engineering industry – manufacture of machinery and equipment /28/	**20.7**	*10.1*	*23.4*	*39.8*	**5.5**	*6.9*	*8.5*	*18.2*
Automotive industry – manufacture of motor vehicles /29/	**9.3**	*5.0*	*13.7*	*33.3*	**4.3**	*0.0*	*5.8*	*14.2*
Manufacture of other vehicles and equipment /30/	**36.7**	*22.2*	*37.4*	*20.5*	**18.6**	*5.6*	*16.6*	*20.5*
Other manufacturing /31-33/	**8.8**	*11.4*	*12.6*	*14.7*	**1.6**	*8.1*	*3.6*	*7.5*

Source: Czech Statistical Office, CIS 2020

5.3. Contract research

Contract research is one of the knowledge transfer patterns from public research to innovation in the private or public sector. Data from the Czech Statistical Office show that *income generated in the government and university sector from the sale of R&D services* reached almost €72 million in 2022, representing less than 4% of total R&D expenditure in public research (see Table 7). R&D services provided to domestic enterprises (77%) accounted for the largest share of these revenues, followed by R&D services provided to foreign enterprises (10%). Revenue from the sale of R&D services to government institutions amounted to almost €4.8 million (i.e. 7% of the total). As mentioned above (see Section 3.2), the volume of contract research is one of the indicators monitored in the assessment of research organisations according to Methodology 17+ (Module 4). However, it is usually a complementary indicator in the overall assessment of the performance of research organisations. Similarly, the amount of contract research funding received by research organisations tends to be a complementary source of income.

Table 7. Income from sales of R&D services in the government and higher education sector by type of entity to which the R&D service was sold, 2022

	€ million	Share in %
Government and university total	**72**	**100**
Entity from Czechia	**62**	**87**
Businesses	55	77
Government institutions	5	7
Universities and higher education institutions, university hospitals	2	2
Private non-profit institutions	1	1
Entity from abroad	**10**	**13**
Businesses	7	10
Other foreign entities	2	3

Source: Czech Statistical Office

As mentioned above and confirmed by Růžička et al. (2023), *contract research activities in the public sector are mainly driven by technical universities* (especially the Czech Technical University in Prague and the Technical University in Brno). In technical fields, the supply of research services by these universities meets the demand of innovative firms, which are predominantly active in sectors such as mechanical, electrical and automotive engineering. In terms of the overall structure of universities' knowledge transfer income, contract research is clearly dominant, accounting for 88% of the total. A further 10% comes from consultancy and commercial training, and less than 2% from licensing.

5.4. Collaborative research

Collaborative research, i.e. research carried out by research organisations and companies to exchange knowledge or technology or achieve a common objective (see Community Framework for State Aid for Research and Development and Innovation, 2022/C 414/01), is an important tool for mutual knowledge transfer between research organisations and businesses. Czechia has long been striving to strengthen the links between the public and private sectors, as evidenced by the inclusion of this issue in numerous strategic documents. This is also reflected in the recommendations included in the National Reform Programmes, as shown in the European Commissions' country reports (European Commission, 2023, European Commission, 2024b). Support for collaboration between businesses and research organisations is also emphasised in Component 5.2 of the National Recovery Plan, which is funded by the Recovery and Resilience Fund. The focus here is on developing long-term cross-sector collaboration in national competence centres (see below).

The establishment of TA CR in 2009 has contributed to the development of collaborative research, which is strongly emphasised in most programmes of the agency supporting applied research (see also the Annex I).

For example, the *Alfa programme* implemented by TA CR for the period 2011-2019 supported almost 900 collaborative research projects (93% of all projects supported in this programme) with a total cost of more than €530 million. As shown in the evaluation of the impact of the Alfa programme (TA CR, 2023b), more than 2,000 results achieved in the supported projects have been brought to the market, and it is estimated that the commercialisation of these results has contributed to an increase in companies' revenues of more than €90 million per year.

A new dimension in the development of collaborative research has been brought about by the creation of competence centres, supported since 2012 by the TA CR. The *Competence Centres programme*, inspired by the Austrian COMET programme and implemented from 2012 to 2019, has supported the creation of 34 competence centres, involving almost 300 research organisations and companies, with a total cost of €360 million for collaborative research projects. An ex-post evaluation of the Competence Centres (Berman Group, 2022a) showed that the programme helped to strengthen long-term public-private cooperation, (re)new networks of contacts and, above all, increase trust between the actors involved. At the same time, this evaluation has shown that the long-term nature of the competence centres projects has enabled research organisations to build up teams of young researchers who have worked with companies over a long period of time, adding know-how in both research organisations and companies. They then often moved to the companies, strengthening mutual trust and informal cooperation through personal ties.

The Competence Centres programme was followed by the *National Competence Centres programme* (2018-2028), which supported 31 such centres, most of which built on previous

projects of already established centres of competence. The total cost of the 31 national competence centres projects exceeds €500 million. The projects require joint research between research organisations and enterprises, emphasise applications and their practical use in business innovation, and require co-decision between the two parties on the strategic development of the joint research. However, the interim evaluation of the national competence centres has shown (Berman Group, 2022b) that the programme's success in commercialisation has so far been limited, not least because even sophisticated research activities still tend to focus on partial improvements; incremental innovations that help companies maintain their competitive advantage rather than establish themselves in new markets. On the other hand, competence centres build trust and long-term stability in relationships between companies and research organisations.

Operational programmes also facilitate research collaboration between the private and public sectors. In the 2021-2027 programming period, MEYS launched calls in the *OP JAC programme* to support cross-sectoral cooperation. The calls facilitate the establishment or deepening of cooperation between research organisations and enterprises with the aim of generating and subsequently using research and development results in practice. In particular, it supports collaborative research projects carried out by a research organisation in cooperation with industry. This may be complemented by the involvement of experts from industry in teaching activities. Projects must be thematically in line with the S3 Strategy. To date, two calls have been launched with a total budget of €170 million. These calls received 116 project proposals with a total requested support of more than €400 million – the calls were still being evaluated at the time of writing this background report.

It is also evident that regions play an important role in initiating cooperation between research organisations and enterprises in the implementation of R&I activities. In particular, the *innovation voucher scheme*, which offers companies financial support for services provided to them by research organisations, has proved to be an effective tool. This tool has been successfully used by the South Moravian Innovation Centre to promote the regional innovation system and has subsequently been extended to other regions.

Other instruments and initiatives that can indirectly stimulate public-private cooperation in research and innovation include *support for clusters and technology platforms*. The establishment and development of these collaborative initiatives has been facilitated by MIT for about two decades. However, there has been no significant integration of clusters and technology platforms into the Czech innovation ecosystem so far.

The *tax deductions for R&D services purchased from research organisations*, introduced in 2015 complements the direct support for projects carried out in cooperation between research organisations and companies (see Chapter 2.2.3).

6. Intellectual property rights

6.1. Patenting

Formal instruments for the protection of intellectual and, in particular, industrial property rights are relatively little used in Czechia. This is mainly related to the level of technological maturity of domestic enterprises and their position in global value chains, the high share of foreign-controlled enterprises in knowledge-intensive industries and services, but also to the relatively low awareness of the importance of industrial property protection for innovative development. This is illustrated by a comparison of the number of patent applications per thousand researchers, where Czechia lags far behind the technologically

and industrially advanced EU countries (see Figure 16). In particular, the *number of patent applications filed with the European Patent Office (EPO) and the United States Patent and Trademark Office (USPTO) is very low*, which, taking into account the size of the research system, is one fifth of the EU average and 10 times lower than in, for example, Germany, Denmark, the Netherlands, Sweden or Finland.

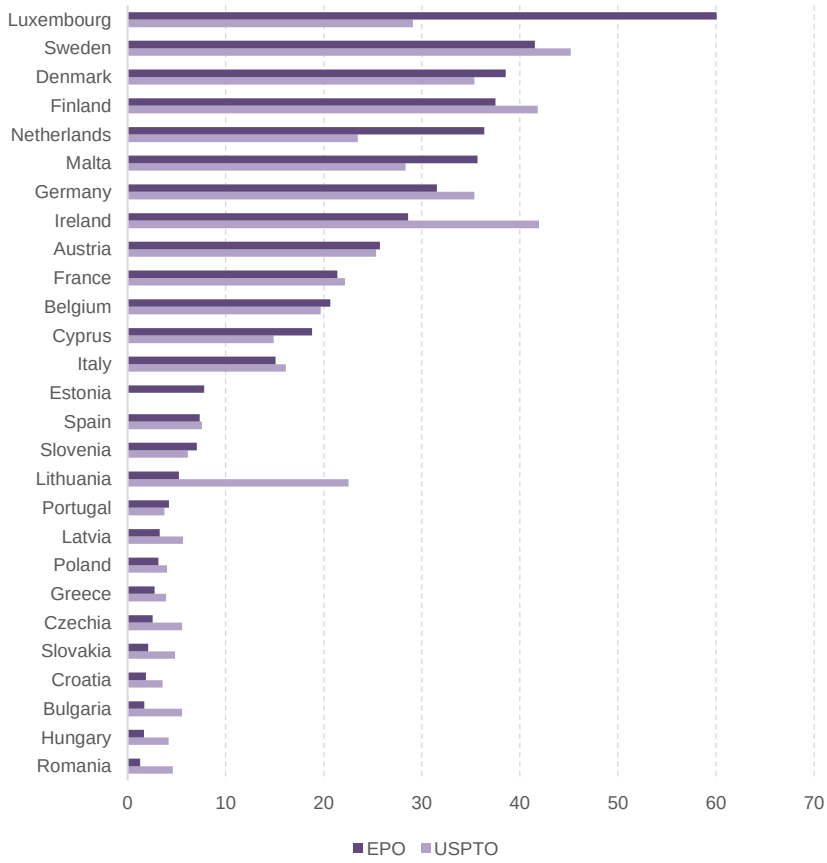


Figure 16. Patent applications at the EPO by country of applicant in 2022 – number per thousand persons employed in R&D. Source: WIPO

With regard to the development of patent activity in Czechia, it is worth noting that the absolute *number of patent applications filed with the Czech Industrial Property Office has been declining in recent years*. In 2023, for example, less than half as many patent applications were filed as in 2013 (see Figure 17). There are several factors behind this decline. The first, and perhaps most important, is related to the change in the methodology for assessing and funding research organisations in 2015. Before 2015, when the methodology called *kafemlejnek* (see Section 3.2) was in place, the number of patents granted was one of the relatively generously rewarded research outcomes. Thus, a higher number of granted patents contributed to the higher amount of institutional support a research organisation received in the following years. In this way, research organisations were incentivised to file patent applications regardless of their real economic value and potential for further commercialisation. The second factor relates to the business sector, where the number of patent applications filed with the Czech Industrial Property Office by

foreign affiliates decreased significantly after 2019. This may reflect a change in the patenting strategy of these companies and a more extensive use of the European patent as an instrument of industrial property protection.

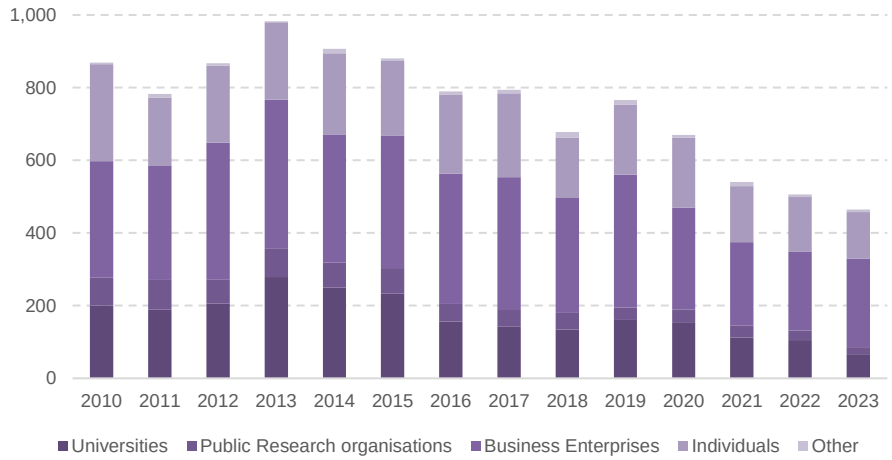


Figure 17. Patent applications at the Czech Industrial Property Office filed by Czech applicants by year of filing.
Source: Czech Statistical Office

6.1.1. Patent activity in the public research sector

In an international comparison, Czechia is characterised by a relatively high share of universities and public research institutions involved patent applications. In the period up to 2015, *kafemlejnek* was the main reason for the relatively high patenting activity of universities and research institutes. Since then, patenting activity in public research has declined and the main reason for the relatively high share of universities and research institutes in the total number of patent applications is the low patenting activity of enterprises.

In the *university sector*, the largest number of patent applications are filed in the fields of (i) measurement and testing, (ii) medicine and hygiene, (iii) organic chemistry, and (iv) basic electrical components.

The largest number of patent applications is traditionally filed by *technical universities*, namely the Czech Technical University in Prague (19%), the University of West Bohemia (14%), and Brno Technical University (12%). In the past, universities with a higher number of patent applications also included the Technical University of Liberec, the Technical University of Ostrava, and the University of Chemistry and Technology in Prague. However, the number of patent applications for these universities has decreased significantly over the last five years, with only 2-4 patent applications each in 2023.

In the segment of *public research institutes*, most patent applications are filed in the fields of (i) organic chemistry, (ii) biochemistry, microbiology, enzymology and genetic engineering, (iii) measuring and testing, and (iv) physical or chemical methods and apparatus.

Most patent applications are filed by CAS institutes, namely the *Institute of Organic Chemistry and Biochemistry*, *J. Heyrovský Institute of Physical Chemistry, Institute of Molecular Genetics, and Institute of Physics.*

As regards the regional distribution of patenting activity in public research (see Figure 18), most patent applications are filed by research organisations in Prague, which corresponds to the concentration of universities and public research institutes in the capital. The next regions with high patenting activity in public research are the Liberec region, the Pilsen region and the Moravia-Silesia region, where technical universities are located. On the other hand, the patenting activity of research institutions in Brno and South Moravia does not correspond to the amount of research capacity located there.

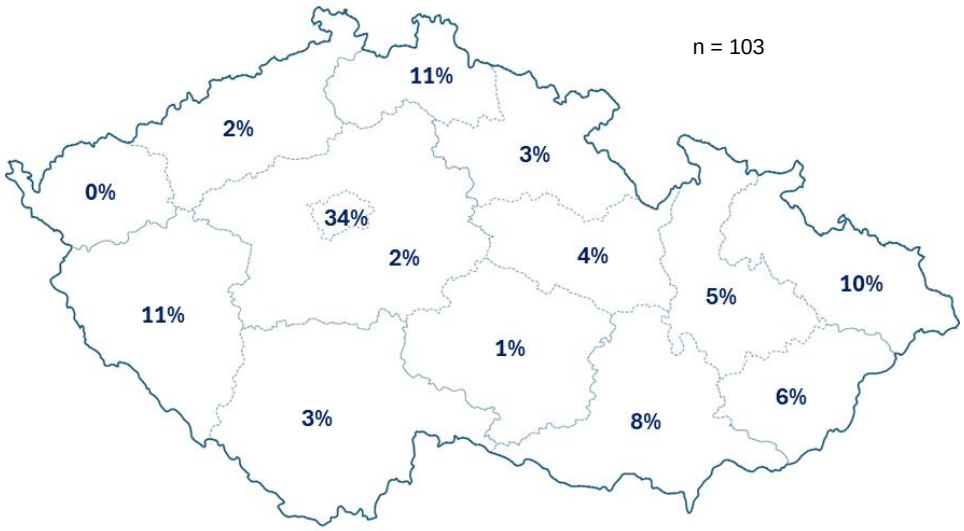


Figure 18. Regional distribution of patent applications to the Czech Industrial Property Office filed by universities and public research institutes (5-year average of 2019-2023, n=103).
Source. Czech Statistical Office

6.1.2. Patent activity in the business sector

In Czechia, patent activity in the business sector is relatively low. The number of international patent applications filed under the Patent Cooperation Treaty (PCT) or patent applications filed by companies at EPO is significantly lower in Czechia, not only compared to countries with high innovation performance, such as Denmark, Germany or the Netherlands, but also to countries with a similar level of innovation performance.

While foreign companies are much more likely to file inventions under the PCT or at the EPO, Czech companies are much more likely to file first (priority) patent applications at the Czech Industrial Property Office and only a small segment continue with a follow-up application filed at another patent office.

The *low representation of Czech companies among patent applicants* suggests that domestic companies do not consider patenting to be the most appropriate intellectual property rights (IPR) strategy or that they do not base their international competitiveness on new knowledge (inventions that are protected by patents), but on other factors, such as

lower production costs. Low patent activity combined with a relatively high number of utility model applications filed by Czech companies suggests that R&D activities result mostly in incremental innovations.

In the business sector, most patent applications are filed in the fields of (i) vehicles, (ii) medicine and hygiene, (iii) transport, packaging and storage, and (iv) measurement and testing.

In terms of the regional distribution of patent activity in the business sector (see Figure 19), most patent applications are filed by companies in the Central Bohemia Region, where a significant part of the Czech (especially automotive) industry is concentrated. A more significant share of patent applications was also filed by enterprises from Prague, the South Moravia Region, and the Moravia-Silesia Region.

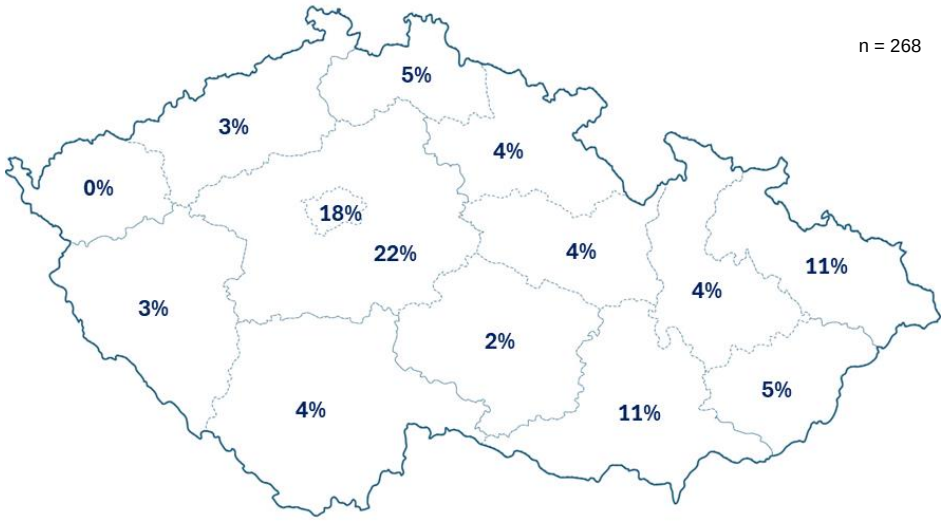


Figure 19. Regional distribution of patent applications to the Czech IPO filed by Czech businesses (5-year average of 2019-2023, n=268).
Source: Czech Statistical Office

6.1.3. Patent offshoring

As described above, in recent years Czechia has become an attractive country for multinational and foreign companies to build up their research capacities. In addition to the positive effects of increasing R&D spending, there is also the protection of the ideas of Czech researchers in the countries of their parent companies, known as “patent offshoring”. This is a relatively common strategy of industrial property protection used by multinational companies.

As shown in the UNICO.AI, 2020 study, *about 20% of the active patent portfolio of Czech inventors is registered outside Czechia,* and this share has been growing in recent years. Similar patterns in patent activity by inventors can also be observed in structurally similar countries (Hungary, Poland, Slovakia). These countries have experienced dynamic growth in the number of patents in recent years, as well as an increasing number and share of outsourced intellectual property. Germany, on the other hand, has an offshoring rate of only 7%.

The main technological fields associated with patent offshoring are computer technology; electrical machinery, apparatus and power equipment; and digital communication and measurement equipment, where 30-40% of all patents are offshored. In contrast, patent offshoring in the pharmaceutical field is insignificant. The following graph shows the territorial structure of patent offshoring. US and German companies are involved in patent offshoring mainly in areas such as the electronics industry, IT, software, Industry 4.0 technologies, automotive component manufacturing, semiconductor and integrated circuit manufacturing, and various segments of the engineering sector (see Figure 20).

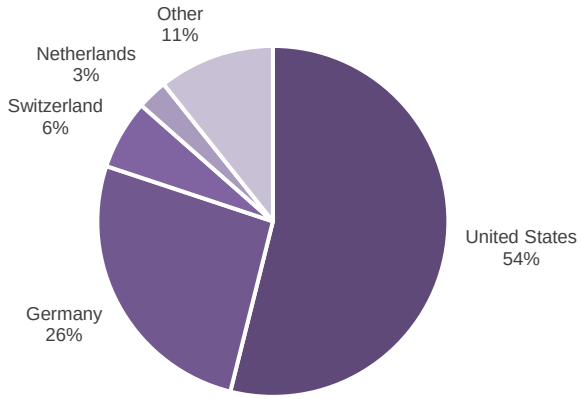


Figure 20. Structure of offshored patents of Czech inventors by country of patent owners (%).
Source: Adapted from UNICO.AI, 2020

A follow-up study from 2023 shows that the maintenance period of patents held by Czech owners is significantly shorter than that of offshored patents. For example, among patents granted in 2012, 6% of Czech patents were still active in 2023, compared to 60% of offshored patents. This suggests that the technological relevance (and thus the economic value) of offshored patents is significantly higher than that of patents owned by Czech owners.

6.2. Licensing

Licensing is one of the forms of commercialisation of industrial property and one of the means of generating financial income from research activities. A licence agreement is used to implement this commercialisation of industrial rights and intellectual property. A licence agreement grants the licensee the right to use an industrial right (patent, utility model or trademark).

Although licensing by Czech companies has gained in popularity overall, the *number of new licences sold annually has been decreasing over the last five years*. While almost 180 new licences were sold in 2018, only 107 were reported in 2022. This decrease correlates to the number of new patent licences, which almost halved between 2018 and 2022. The most significant decrease was in the number of new licences sold by universities and public research institutes (down from 83 in 2018 to 45 in 2022).

Total licence income varies over time (see Figure 21). The main driver of this volatility is the fluctuating royalty income of the dominant entity, the *Institute of Organic Chemistry and Biochemistry of the CAS (IOCB)*. This institute realises more than 85% of the total royalty

income in Czechia thanks to the highly successful sale of licences to Gilead Sciences for a patented new class of acyclic nucleoside phosphonate compounds used in the production of antivirals. This success has been followed by further research and follow-on licences to other pharmaceutical companies. This also explains the dramatic difference in licensing income between universities and public research organisations.

Figure 21. Revenues from licences (€ thousand) – logarithmic scale.
Source: Czech Statistical Office

Excluding the IOCB royalties, the remaining revenues are a negligible part of the total income from commercialisation realised by universities and public research organisations in Czechia (see Figure 22). In the case of universities, these revenues amounted to less than €520,000 in 2022. For public research organisations (with the exception of the IOCB) it was less than €720,000. These figures show that income from licensing is rather marginal for public research organisations.

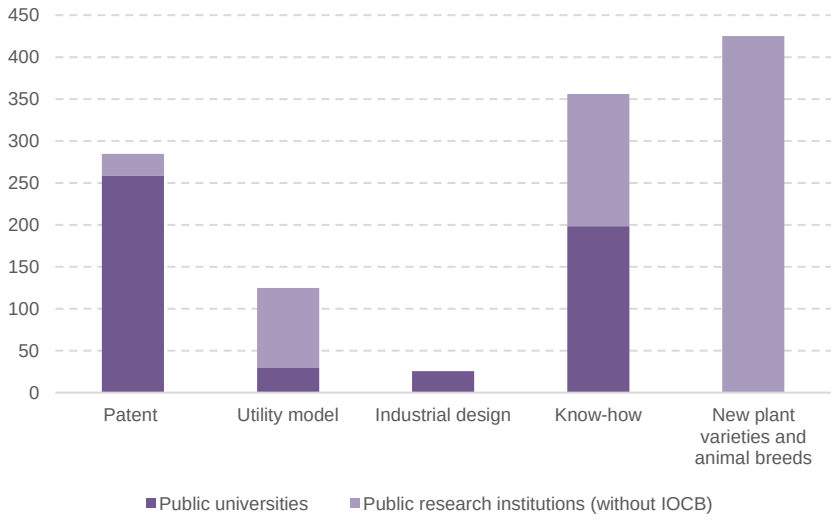


Figure 22. Revenues from licences by the type of the license agreement in 2022 (€ thousand).
Source: Czech Statistical Office

7. Startups, spin-offs and access to venture capital

7.1. Startup scene

The startup environment in Czechia has developed quite dynamically in recent years in terms of number, structure and funding. According to the StartupJobs 2024 study, the *number of startups grew by a third between 2018 and 2022*, to approximately 3,700 companies. Total employment in startups followed a similar trajectory, with startups employing approximately 150,000 people in 2022 (i.e. about 4% of all employees in Czechia). In terms of structure, half of all startups in the country have no more than five employees. On the contrary, 6% of the startups employ 100-500 people and are therefore medium-sized companies. As noted in the StartupJobs report, the total amount of documented investments in startups reached approximately €1.5 billion in 2022. Startups are therefore not a marginal part of the economy.

In terms of the regional distribution, *Prague is the dominant location for startups*, where almost two-thirds operate, followed by slightly less than 20% which are active in South Moravia (mainly in Brno). Thus, it appears that the regional distribution of startups corresponds to the regional distribution of economic activity in Czechia, but also that startups are mainly created in large cities with a high concentration of universities and public research institutes.

An interesting insight into the Czech startup environment was also provided by a Deloitte 2022 survey, which focused on the conditions for startups in Czechia. This survey showed that *Czech startups most often face problems related to initial financing, lack of human resources, complex bureaucracy in the early stages of the company's development and not always cooperative administrative authorities*.

The portal *czechstartups.org*, operated by the state agency CzechInvest, provides a closer look at *technology startups* in Czechia. It tracks 680 startups with a total publicly known funding volume of almost €3.9 billion. The startups with the highest investment volume include the startups Rohlik.cz (online supermarket, €680 million), Cera (digital-first home healthcare, €329 million), ShipMonk (logistics, €326 million), Productboard (product management software tools, €231 million) and Mews (hospitality management system, €213 million). Czechstartups.org also tracks successful exits of startups, where it records a total of 123 exits for a total of €13.2 billion. These include the sale of Avast (cybersecurity, €7.5bn), AVG (cybersecurity, €1.1bn) and Mall (wholesale, €0.9bn) The top venture capital investors in startups by number of companies invested in include StartupYard (45 startups), Credo Ventures (36), N1 (35), Lighthouse Ventures (33) and Reflex Capital (33).

The *CzechInvest agency* plays an important role in supporting startups at the national level, while regional innovation centres play an important role at the regional level. The CzechInvest agency provides several types of support for startups at the national level. The main instrument is the Technology Incubation Programme, where selected technology startups can receive direct support of €45,000 - 180,000 and indirect support in the form of workshops, seminars, support from incubation managers, consultations with business and technology experts for up to 2 years, all without losing their stake in the company. In addition, CzechInvest provides advice to startups on recruiting researchers from abroad and managing the visa process, or information on funding opportunities for startups, including possible contacts with investors.

Similar advisory services and assistance in finding suitable partners, advisors, mentors or investors for startups are also provided by *regional innovation centres or agencies*. However, the scope and quality of services for startups varies considerably between innovation centres and agencies.

7.2. Spin-off landscape

7.2.1. Spin-offs

A spin-off company is not defined in Czech law, leaving it for research organisations to outline a spin-off company in their own internal regulations. Lawyers (e.g. Smolka, 2020) generally define a spin-off as: "*[A] business designed to commercialise new knowledge from research/academia. It is basically a startup company established to develop an invention or other intellectual property. The risks and commercial activities are thus transferred from the research domain to the commercial sphere, and the newly created company operates using technical solutions, patents or utility models derived from the research activities. Often the research organisation (university, research institute, etc.) has a stake in the company, with an additional stake held by a private sector investor, who most often provides the funding, while the university provides the unique idea and the human capital.*"

Since the creation of spin-offs is not one of the key performance indicators for the assessment of universities and public research institutions, *data on the creation and existence of spin-off companies are not systematically collected in Czechia.* A partial source of information is the annual reports on university activities submitted by universities to MEYS. According to these annual reports, 68 spin-off companies were founded by universities in the period 2018-2021. Data for other research organisations are not available from publicly accessible sources. According to an analysis conducted by Transfera.cz in 2022, there were 84 spin-off companies in Czechia, mainly founded by universities and institutes of CAS, most of them in the ICT sector (Transfera, 2022).

The mapping of the spin-off environment in Czechia was also done in a report on commercialisation produced in 2023 (Růžička et al., 2023). Due to the lack of publicly available data on the number of spin-offs, a questionnaire survey among universities, institutes of CAS and sectoral research institutes was used to collect this data. Information on the number of spin-offs was obtained from nine universities (out of 26) and 23 CAS institutes (out of 54). In the higher education sector, the questionnaire revealed that the existence of spin-offs without university capital equity is more significant. For the CAS institutes, the survey identified only three existing spin-offs, two of them with capital equity coming from the research institutes (see Figure 23).

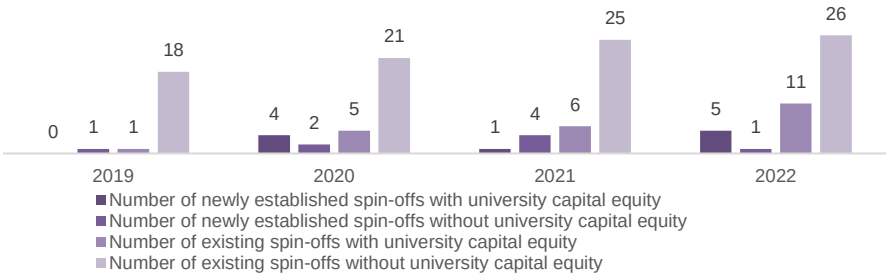


Figure 23. Number of spin-offs from 9 Czech universities.
Source: Adapted from Růžička et al., 2023

7.2.2. Environment for the creation of spin-offs

The low number of spin-offs may be due to the necessary conditions for their creation, i.e. (i) the existence of suitable R&D results, (ii) the existence of a functioning system of intellectual property protection for R&D results with a high potential for commercial exploitation, and (iii) the existence of experts capable of setting up a spin-off and launching it on the market.

One of the identified barriers to the creation of spin-offs in Czechia is the *lack of interest of basic researchers in considering the possible use of research results*. This is to some extent reinforced by the cultural environment in research organisations and the low recognition of scientists who work simultaneously in a research organisation and in a private company (Fusek, 2022). Furthermore, the low number of academic spin-offs is due to the *institutional and administrative complexity of the process of creating them* with the capital equity of a research organisation. While the legal framework in Czechia allows research organisations to create legal entities, due to the administrative complexity most spin-offs are created by research organisations without investing their capital equity or they are companies created and fully owned by researchers.

In Czechia, there is also a demonstrable lack of professional staff capable of managing the entire process of commercialising R&D results through spin-offs. There is still a *low level of personal involvement in R&D entrepreneurship and a strong fear of entrepreneurial risk*. Research organisations are also staffed by professionals for whom research activity is in itself prestigious and internally rewarding. For these workers, there is a persistent fear of losing 'status' by entering academic entrepreneurship (Žížalová et al. 2011).

Concerns about the complexity of the process of establishing a spin-off company and the associated risks for the research organisations were the impetus for the preparation of a government *document* (Resolution No. 872 of 9 December 2019), which contains a description of 'how to' guide (FAQs) to help research organisations. The purpose of the guide is, therefore, *to help research organisations better manage the setting up of legal entities* for the purpose of commercialising the results of scientific work produced by the same organisation. It is supported by a legal analysis which concludes that there are no significant legal barriers to the establishment of spin-off companies and that "no legislative changes are necessary for the use of spin-off companies as an instrument of knowledge transfer in Czechia".

On the other hand, a survey of stakeholders in the Czech innovation system conducted by the OECD in 2020 confirmed that *the institutional environment for setting up spin-offs from universities and public research institutions is not well developed*. In general, the perceived shortcomings are mainly the low motivation of research organisations and individual researchers to create spin-offs, poor awareness among researchers of procedures for effective industrial property protection and company creation, as well as concerns about the time-consuming and risky nature of such a step (OECD, 2020).

7.3. Access to venture capital

Easy access to finance is vital when increasing the absorption of R&D results by the business sector and for strengthening the innovative activity of the business sector. While debt financing instruments (loans and credits) are generally appropriate for backing enterprises at an advanced stage of development (i.e. enterprises with sufficient capital), private equity investment is an important source of finance for innovative startups, helping

to create a capital base for developing their projects at a stage when these enterprises are too risky for mainstream financial institutions (especially banks).

Venture capital (VC) is an alternative source of financing for innovative projects and companies with the potential for rapid growth. In addition to the equity investment, the company usually receives strategic assistance from the investor in setting up or developing the company. *The venture capital market in Czechia is rather underdeveloped* and VC is clearly not a standard or commonly used instrument for financing innovative projects of startup companies in the country. As confirmed by the OECD (2020) study, the role of business angels in the development and diffusion of innovation is also limited and there is a lack of a functional, formal and structured association to coordinate and promote business angel activities at national and regional level.

Therefore, since the beginning of the millennium, MIT has been trying to create a *fund of funds that would pool public and private resources to finance innovative projects at the earliest stage*. After several unsuccessful attempts, this fund was finally established in 2017 in cooperation with the European Investment Fund using European Structural funds. ESIF, together with private co-financing, can be invested in startups by the private VC funds Lighthouse Seed Fund and Nation 1. By 2019, these VC funds had invested a total of €35 million in 72 innovative projects. By June 2023, 39 companies had been 'accelerated', of which 33 received additional seed funding. Equity investments are linked to acceleration programmes that provide mentoring to startups.

Equity investment in the development of innovative projects is also supported by some regional innovation agencies. They either match startups with investors or operate their own small VC fund. One example is *JIC Ventures*, operated by the South Moravian Innovation Centre, which invests relatively small amounts exclusively in the pre-seed and seed phases.

A pioneer in investing in biotechnology spin-offs and startups is *i&i Prague*, a subsidiary of CAS' Institute of Organic Chemistry and Biochemistry, which is part of the institute's well-developed ecosystem for commercialising R&D results. In 2021, i&i Prague, together with the EIF, established the *i&i Biotech Fund*, which focuses on investing in innovative early-stage life science startups. Three years after its establishment, it has 11 biotech startups in its investment portfolio.

8. Knowledge transfer and valorisation system

8.1. Knowledge transfer infrastructure

The concept of technology and knowledge transfer has existed in the minds of the management and staff of universities and research institutions for many decades. At several CAS technical universities and institutes, processes associated with inventing, patenting and cooperating with industry, especially in the form of contract research, were cultivated even before 1989. However, the real development of knowledge transfer activities did not take place until the 1990s and the new millennium.

The first knowledge transfer office at a university in Czechia was established in the 1990s at the Czech Technical University in Prague. This centre, designed as a Technology Innovation Centre, was established as a pilot project under the Phare pre-accession assistance programme. Other knowledge transfer offices were established with a

considerable time lag – only after Czechia joined the European Union in 2004. Operational Programmes financed by ESIF proved to be an important stimulus for their establishment.

The creation of knowledge transfer offices or the modernisation of the few existing centres was supported by the *OP RDI programme through the call 'Technology Transfer Centres'* published in 2010, and later by the *OP RDE programme through the call 'Building Expert Capacity – Technology Transfer'* published in 2018.

A total of 19 technology transfer and commercialisation centres have been established with support from OP RDI. The total spent on the establishment of the centres reached €41 million. Some 22 organisations were supported by OP RDE and the total amount spent under this call was €20 million.

The position of knowledge transfer offices (KTO) in the university structure can take *two main forms*. These centres are either *separate parts of universities* or they are *specific departments within the rectorate or faculty management*. Both forms have their advantages and disadvantages. The main advantage of being separate from the university is the availability of its own budget and generally simpler (less bureaucratic) decision-making procedures. However, the university management may have less control over its functioning. Setting up a transfer centre as a department within the rectorate or faculty management may be easier, but may affect the speed of decision-making. The following table gives an overview of knowledge transfer offices established in research organisations.

Table 8. Knowledge transfer offices set up in Czech research organisations

Research organisation	Name of KTO	Type of KTO
Public universities		
Czech Technical University in Prague	Technology Transfer Centre	University KTO
Czech Technical University in Prague	Prague Advanced Technology and Research Innovation Centre (PATRIC - CTU and 2 partners)	Subsidiary for technology transfer
Czech Technical University in Prague	CTU Tech s.r.o	Subsidiary for technology transfer
Czech University of Life Sciences	Centre for Projects, Innovation and Technology Transfer	University KTO
University of South Bohemia	South Bohemia University and Academic Centre for Technology Transfer	University KTO
Mendel University in Brno	Department of Technology Transfer	University KTO
Masaryk University in Brno	Centre for Technology Transfer	University KTO
Ostrava University	Knowledge and Technology Transfer Centre of the OU in Ostrava	University KTO
Technical University of Liberec	Centre for Technology Transfer Support	University KTO
University of Hradec Kralove	Office of Technology Transfer	University KTO
Jan Evangelista Purkyně University in Ústí nad Labem	Technology and Knowledge Transfer Centre	University KTO
Charles University	Centre for Knowledge and Technology Transfer	University KTO

Research organisation	Name of KTO	Type of KTO
Charles University	Charles University Innovations Prague s.r.o.	Subsidiary for technology transfer
Palacky University in Olomouc	Science and Technology Park	University KTO
University of Pardubice	Technology and Knowledge Transfer Centre	University KTO
Tomas Bata University in Zlin	Technology Transfer Centre	University KTO
University of Veterinary Sciences Brno	Project and Technology Transfer Centre	University KTO
Technical University of Ostrava	Technology Transfer Centre	University KTO
University of Chemistry and Technology Prague	Research and Technology Transfer Unit	University KTO
Brno University of Technology	Department of Technology Transfer	University KTO
University of West Bohemia	Transfer and intellectual property	University KTO
University Hospital Hradec Kralove	Centre for Biomedical Technology Transfer	University hospital KTO
Faculty of Pharmacy, Charles University	Technology and knowledge transfer	Faculty KTO
Third Faculty of Medicine, Charles University	Technology transfer	Faculty KTO
Faculty of Management, Prague University of Economics and Business	Centre for Education and Knowledge Transfer	Faculty KTO
Faculty of Informatics and Statistics, Prague University of Economics and Business	Knowledge transfer through specialised courses and programmes	Faculty KTO
Public research institutes		
Biology Centre CAS	Technology Transfer Section	Research institute KTO
Institute of Physics CAS	Department of Technology Transfer – CITT	Research institute KTO
Centre of Administration and Operations CAS	Technology Transfer Centre of the CAS	Research institute KTO
Institute of Analytical Chemistry CAS	Technology transfer	Research institute KTO
Institute of Experimental Medicine CAS	Project Support and Technology Transfer Unit	Research institute KTO
J. Heyrovský Institute of Physical Chemistry CAS	Heyrovsky Centre for Technology Transfer	Research institute KTO
Institute of Computer Science CAS	Department of Technology and Knowledge Transfer	Research institute KTO
Institute of Macromolecular Chemistry CAS	License	Research institute KTO
Institute of Organic Chemistry and Biochemistry CAS	IOCB Tech Technology Transfer Office	Research institute KTO
Institute of Organic Chemistry and Biochemistry CAS	I&I Prague s.r.o.	Subsidiary for technology transfer

Research organisation	Name of KTO	Type of KTO
Transport Research Centre	Technology Transfer Centre	Research institute KTO
Food Research Institute Prague	Technology Transfer Centre	Research institute KTO
Private research institutes		
SVUM	Centre for Technology Transfer Support	Research institute KTO
Research Institute of Textile Machines	Transfer of results	Research institute KTO

Source: Own compilation based on Růžička (2023), Transfera.cz database and CzechInvest database

In many cases, the key role in setting up KTOs and preparing the projects from which they were initially funded was played by individual managers, who often had experience and information about the operation of similar centres in innovative foreign universities and had a clear vision of how to implement knowledge transfer as well as the necessary actions to commercialise intellectual/industrial property. The development of KTOs at universities has also been significantly supported by educational activities carried out within various projects focusing on technology transfer and intellectual property protection.

As the OECD (2020) study points out, the *quality of the services provided by transfer offices depends crucially on the experience and skills of their staff*. Although some universities and public research institutions set performance indicators for the functioning of their transfer offices, such as the number of patent applications and patents granted, the number of licences sold, income from licences or income from contract research, there is no overall monitoring of the performance of transfer offices for Czechia.

An important impulse for strengthening the system of knowledge transfer in research organisations was the EF-TRANS project implemented by MEYS in cooperation with other actors of the R&I system in Czechia.

EF-TRANS project

The large-scale ESIF-funded project 'Effective Transfer of Knowledge from Research and Development into Practice' (EF-TRANS), which took place between 2009 and 2013, sought *to establish and support the implementation of an effective knowledge transfer system for the commercialisation of R&D results*. The project was divided into several analytical and methodological parts. Analysis was needed to summarise existing knowledge in this field in Czechia and abroad, and informed the approach taken. The development of the methodology was followed by an educational component, which enabled the training of students, researchers, managers and administrative staff of research organisations. Another important activity of the project was the popularisation of knowledge transfer among research institutions, universities, and the public. Lastly, a network of technology transfer professionals was established.

The main outputs of the EF-TRANS project were (i) a comprehensive analytical background report focusing on the legal aspects of knowledge transfer from public research and inspiration from abroad, and (ii) detailed methodological procedures for research organisations as a guide for establishing and developing internal systems for knowledge transfer and commercialisation of R&D results.

The analytical background reports included:

- Analysis of the impact of changes in the legal environment and the reform of the research, development and innovation system on the internal regulations of public universities and public research institutions, as well as on their activities.

- Analysis of the system of commercialisation of R&D results in selected EU countries (Finland, Germany, Sweden, The Netherlands, etc.), the United States, Australia and Czechia, including an overview of good practices and systems for evaluating the impact of R&D results in practice.

- Analysis of industrial relations in public universities and public research organisations in relation to research, development and innovation, and the subsequent use of R&D results in practice.

In addition, a *handbook with the following seven methodologies on the commercialisation of R&D results* was produced.

- Commercialisation system

- Protection of intellectual property

- Cooperation with industry

- Use of licences

- Setting up companies

- Evaluation of results and impact

- Education for entrepreneurship

The handbook provides guidance from basic principles to detailed descriptions of concrete steps aimed at setting up a comprehensive, high-quality and efficient system for the exploitation of R&D results. The methodologies have been tested in pilot projects in 14 selected research organisations.

In addition to the analyses and methodological documents, *educational workshops and training sessions* were conducted, primarily for PhD students and other young researchers from universities and public research organisations interested in the exploitation of R&D results. The thematic focus of the training workshops was on various knowledge transfer issues, such as intellectual property protection, patents and inventions, business startups, financing of entrepreneurial activities and spin-offs, use of innovation infrastructure, etc.

The EF-TRANS project helped to *raising awareness about knowledge transfer in research organisations* and led to the *systematic development of knowledge transfer offices established with the support of ESIF*. It also helped to create informal links and networks between KTO staff, which were subsequently formalised in the national platform Transfera.cz.

Transfera.cz

The national platform Transfera.cz is an *independent, non-profit professional organisation defending the interests of the transfer community in Czechia* with the aim of strengthening and developing activities in the field of technology and knowledge transfer. It was founded in 2014 and has gradually grown to 33 members.

Transfera.cz offers (i) consultancy in the field of technology and knowledge transfer, intellectual property, proof-of-concept activities, promotion of R&D results to industry, etc.; (ii) consultancy in the planning and implementation of applied research projects with an emphasis on applying project results in practice, possible protection of R&D results and cooperation with industry; (iii) recruitment of possible project evaluators in the field of technology transfer; (iv) consultancy and advisory services in European and international cooperation (through the international network of knowledge transfer offices).

Transfera.cz also compiles a database of research and development projects and results. The *Transfera technology database* presents innovative and commercially viable projects from universities and research institutions throughout Czechia. The projects are divided into seven areas: information sciences and mathematics, engineering, food sciences, social sciences and humanities, theoretical and applied physics and chemistry, life and health sciences, and agriculture and plants.

Transfera.cz also aims to boost knowledge transfer in universities and public research institutions and to help KTOs share experiences and best practices. To this end, it organises an annual conference dedicated to this topic.

8.2. Financial support for knowledge transfer at national level

In addition to support from ESIF for the establishment and initial development of knowledge transfer offices, there are several follow-up support programmes in Czechia that directly target the development of the knowledge transfer and commercialisation system (see also Annex I).

The GAMA programme

The GAMA programme, implemented by TA CR in 2014-2019, was a unique support instrument that was a timely follow-up to the financial support for the establishment and development of knowledge transfer offices provided by OP RDI.

The main objective of the GAMA programme was to support and significantly streamline the transformation of R&D results achieved in research organisations (and/or in cooperation between research organisations and companies) into practical applications enabling their commercial exploitation.

The programme was divided into two sub-programmes – (i) proof of concept, and (ii) support for the commercialisation of R&D results – which differed in the way they were implemented and in the eligible beneficiaries of the project support.

The objective of the first sub-programme was to support research organisations in identifying applicable R&D results and their commercial validation in the form of a model, functional model or prototype. It also *supported the creation and improvement of knowledge transfer systems within research organisations*. Only research organisations could be beneficiaries of this sub-programme.

Meanwhile, the second sub-programme helped to *support companies in the commercialisation of R&D results from publicly funded projects*. It mainly supported projects involving the completion of a working prototype, verification of its characteristics, validation of a series of tests and assessment of the full impact of the innovative product or service. The implementation of this programme was significantly delayed and modified due to state budget constraints. In the end, only SMEs that had received the European Commission's "seal of excellence" in the SME Instrument – Phase 1 were supported.

An evaluation of the GAMA programme carried out in 2021 came to the following conclusions:

- The main benefits of the programme related to changes in the readiness of participating organisations to commercialise R&D results. The funded research organisations also benefited from the opportunity *to fund proof-of-concept activities* for which public research organisations do not normally have their own or other (e.g. private) funding sources.

- A key change to improve technology and knowledge transfer in supported research organisations was the *establishment of a functioning system for commercialising R&D results* (by strengthening the position of KTOs, establishing commercialisation councils and coordinating their activities with KTOs, and standardising procedures and creating rules for knowledge transfer in research organisations) and *professionalising the work of KTOs*.

- An important impetus for changes in internal commercialisation systems was the *creation of commercialisation boards*. These could be used in research organisations to select commercialisation projects to be supported by KTOs and as informal platforms for discussion with the research organisation's management on future knowledge transfer strategy.

- The *main barriers to successful commercialisation of results* were most often the low attractiveness of the results to companies, lack of financial resources to complete the commercialisation of the result, insufficient promotion of the results, lack of specific knowledge and experience of the KTO team, insufficient readiness of research projects for commercialisation, strict regulatory requirements or a combination of these factors.

- The rules and mechanisms for sharing the benefits from the commercialisation of R&D results in funded organisations were usually sufficiently motivating for researchers. However, for researchers, the actual application of the result or pushing the boundaries of knowledge was often seen as more satisfying than the profits from commercialisation. Equally important were the "non-institutionalised changes and benefits", which consisted mainly of increasing researchers' motivation to commercialise R&D results and improving communication and cooperation within the organisation. *Increased motivation to commercialise R&D results* (in some cases specified as increased awareness of the need to transfer R&D results into practice and of the potential benefits for the researchers and the research team) was considered to be the most important change brought about by participation in the GAMA programme.

- The GAMA programme also helped to *raise the visibility of KTOs* within research organisations, increasing researchers' confidence in their work and increasing the transparency and openness of internal commercialisation systems.

- The evaluation did not find an increase in transfer income for research organisations participating in the GAMA programme. However, it pointed out that data on knowledge transfer income are heavily influenced by fluctuations in income from licensing agreements, as well as the very short period for which data was made available.

SIGMA programme

The GAMA programme was followed by the support activities of TA CR in the SIGMA programme, which *supports activities related to the commercialisation of R&D results and their implementation in practice*. At the end of 2023, a call for support of proof-of-concept activities in research organisations was announced, which is directly related to GAMA sub-programme one. The maximum support per project was limited to €600,000, and aimed at the development of a system for the commercialisation and valorisation of R&D results that have been or are about to be produced in research organisations, which have a high potential for application in new or improved products or services. The aim of the call is to support new and streamline existing systems for the transfer and exploitation of new publicly funded R&D knowledge in research organisations.

Support for commercialisation in enterprises is the focus of a second call for support for the commercialisation of R&D results, which is a continuation of the second GAMA sub-programme. The maximum grant per project is €30,000.

OP TAC Knowledge Transfer Partnership

Another instrument to support knowledge transfer between research organisations and companies is the OP TAC programme implemented by MIT in the period 2021-2027. Specifically, the call 'Knowledge Transfer Partnerships' *supports the creation of partnerships between SMEs and research organisations for the transfer of knowledge, related technologies and skills to which SMEs do not have access*. It supports the implementation of R&D results and new knowledge generated in the research organisation in the innovation processes of the company. An important role is played by the so-called Knowledge Transfer Assistant, who is a Masters' or PhD graduate at the beginning of his/her career (within six years after graduation). His or her role is to help transfer knowledge from the research organisation to the company. Support for a knowledge transfer project ranges from €60,000 to €480,000. The call for projects was announced in April 2024 with a total budget of €10 million. Evaluation results for this call are expected by the end of 2024.

8.3. Innovation infrastructure and the role of regions

In addition to the KTOs set up by universities and other public research institutions, there has also been significant investment in the development of business innovation infrastructure over the last 10 to 15 years. This includes facilities such as *science and technology parks*, *business and innovation incubators*, *startup accelerators*, *coworking centres and open workshops* that support innovative businesses, including startups.

Regional governments and regional innovation centres have played an important role in the development of innovation infrastructure, creating the conditions for the emergence and development of different types of innovation infrastructure in the regions. Support for the innovation infrastructure was mainly provided by ESIF, which were distributed by MIT through three successive operational programmes between 2004 and 2020.

A detailed mapping of innovation infrastructure was carried out by CzechInvest in 2022 (Samek, 2022), which identified *more than 150 active elements of innovation infrastructure.* Figure 24 shows their regional distribution.

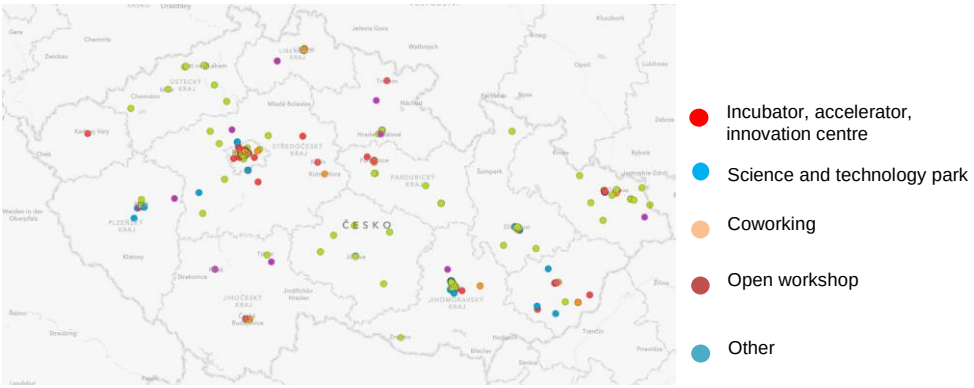


Figure 24. Map of innovation infrastructures.
Source: Samek, 2022

Although innovation infrastructures are located in all regions of Czechia, their regional distribution is not even. *The highest density of innovation infrastructure is in Prague and the South Moravian Region*, while the lowest is in the Karlovy Vary Region and Vysočina.

The study also identified the following *problematic features of the functioning of innovation infrastructure* in Czechia.

- *Lack of financial self-sufficiency*, where a large part of innovation infrastructures depends on operating subsidies from the founder or subsidies from national or international grant programmes. As a result, these infrastructures are not able to cover their operating costs by renting space and providing development services.

- *Low involvement of innovation infrastructures in regionally coordinated innovation support activities* (such as participation in the development and updating of the regional innovation strategy, smart specialisation strategy, etc.). According to the results of the study, only about ten innovation infrastructures are intensively involved in the implementation of regional innovation strategies.

- Among the management and staff of the infrastructure there are often people with experience of entrepreneurship, but much *fewer people with experience of setting up their own startup*. People with experience of investing in startups or small companies are almost completely absent, as are former or current scientists and researchers. Only a small number of infrastructures reported that their staff participate in training programmes to support innovation and entrepreneurship.

- A large part of the infrastructures have only office space, which determines the composition of their clients (ICT, e-commerce, education, marketing, etc.). *Relatively few infrastructures offer facilities for research and development or production*.

- With a few exceptions, *most infrastructures do not host spin-offs from the local university*. A large number of infrastructures report that collaboration with the local university is weak and that relatively few clients come from the local university.

Technological Incubation Programme

In 2022, the CzechInvest agency launched a large-scale *Technology Incubation Programme to support startups*. The target was to select around 250 technology startups by the end of 2025 that develop innovative products or services in key sectors. These sectors are space technologies, advanced technologies and materials, tech4life, cultural and creative industries, mobility, artificial intelligence, and eco-innovation.

The selected companies receive direct financial support to the tune of €44,000-180,000 and indirect support in the form of continuous mentoring and intensive work with the company by the incubation team, worth equivalent of €20,000.

At the time of writing, 137 startups have been supported in the three calls of the 'Technology Incubation Programme', mainly in the field of AI (31%), creative industries (26%), and technologies for ecology (19%). The supported startups are mainly located in Prague and the South Moravia region (see Figure 25).

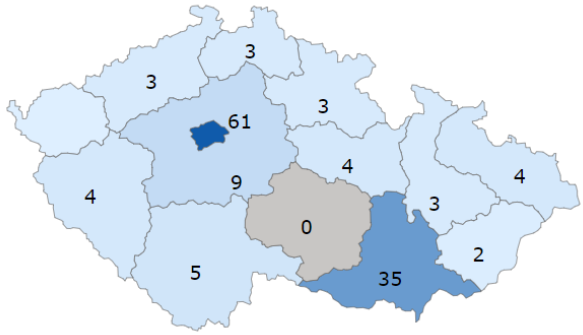


Figure 25. Number of startups supported in the three calls of the Technology Incubation Programme.
Source: Czechinvest

8.4. Institutional conditions for knowledge transfer from research organisations

8.4.1. Legal basis regulating intellectual property rights

Intellectual property rights are regulated mainly by Act No. 121/2000 Coll. on Publications and Computer Programs and Act No. 527/1990 Coll. on Inventions. Both of the latter Acts, in essentially identical terms, *grant rights to an invention to the employer, provided that the invention was created in the course of performing a task arising from the employment relationship with the employer.* In such cases, the employee is obliged to notify the employer of the invention, and if the employer does not exercise its right within three months of the notification, the right reverts to the inventor.

In order to motivate employees to engage in R&D activities, *the law grants them a reward for the invention*. However, the interpretation of the legal framework is rather general and the amount of the reward should be determined taking into account the potential profit or the importance of the invention.

8.4.2. Knowledge transfer and commercialisation of the results of publicly funded research

IPR arising from the results of research funded from public sources (i.e. institutional or project-based support) are governed by Act No. 130/2002 Coll. on Support for Research, Experimental Development and Innovation. According to this Act, *the beneficiary owns the rights to the results of research funded by institutional support or project-based support awarded through open calls for project proposals*. In this case, research organisations should regulate the treatment of research results in their internal rules. In the case of public procurement of research, the rights to the research results belong to the funder.

Public research institutions (i.e. institutes of CAS and sectoral research institutes) may acquire and dispose of property (Act No. 341/2005 Coll., on Public Research Institutions). This enables them to establish other legal entities to exploit the research results (spin-offs). On the other hand, the Act explicitly states that "a public research organisation may not guarantee the liabilities of other persons", including spin-offs.

As far as universities are concerned, Act No. 111/1998 Coll. on Higher Education Institutions does not specify or regulate commercialisation or knowledge transfer activities. According to this Act, commercialisation of intellectual property and cooperation with enterprises are not listed among the main activities of universities and belong to secondary or complementary activities.

8.4.3. Policies and strategies for knowledge transfer

Strategies for knowledge transfer at universities and public research institutions are defined in several documents approved at different hierarchical levels. *The long-term plan of the university is the mandatory strategic document of the university, which defines, among other things, the strategy for knowledge transfer and cooperation with industry*. The long-term plan is approved by the academic senate of the university. It is binding on all faculties and departments of the university, which must fulfil it through their activities. The implementation of the long-term plan is reviewed annually and an update is prepared and approved for each year.

In addition to the long-term plans, universities have their *own internal regulations on the protection of intellectual property, commercialisation and cooperation with industry*. These are mainly covered by the university statutes (e.g. defining academic freedoms affecting the motivation of researchers) and internal salary regulations (defining the method of remuneration of researchers, including extraordinary remuneration). These regulations are approved by the academic senate of the university and are binding on all faculties and all university departments.

Guidelines issued by the Rector are the most concrete and common instrument defining internal procedures related to commercialisation, IPR, and knowledge transfer. In this area, they are usually prepared by the relevant Vice-Rector or Bursar and approved by the Rector. These guidelines are binding on the entire university.

Individual faculties are free to draw up their own guidelines and regulations. These documents are binding on the faculty. They regulate in particular the remuneration of R&D results (including commercialised results), the method of staff evaluation and the conditions for appointment as associate professor or professor.

Although all documents relating to commercialisation and collaboration with industry are binding, universities do not usually enforce compliance. If a breach does occur, it is usually resolved by agreement rather than by some form of penalty or compensation.

University researchers have a relatively free hand in transferring their knowledge and collaborating with industry. If the university is not interested in the rights to an invention, researchers can commercialise it themselves without having to use the services of a knowledge transfer office. In most universities with a KTO, they only need to use the services of the KTO if the university is interested in the rights to their knowledge (Ministry of Education, Youth and Sports, 2013).

In the case of public research institutions, the law (Act No. 341/2005 Coll., on Public Research Institutions) does not require them to develop a long-term plan. However, the founder may ask the public research organisation to prepare such a plan. If a public research organisation has one, it is a binding document approved by the board of the organisation.

The board of the institution approves internal regulations, of which the internal wage regulation and the rules for the management of the public research institution's funds (e.g. patent and licensing funds) are directly related to knowledge transfer. In addition, public research organisations may have guidelines or regulations issued by the director. These documents usually concern the procedure for intellectual property protection and commercialisation. All documents are binding in public research organisations and are usually strictly adhered to. If they are violated, sanctions are applied according to the Labour Code.

8.4.4. Main barriers to implementing knowledge transfer strategies

The main barriers to an active approach by research organisations to implementing knowledge transfer strategies have been identified in several studies (e.g. Technology Centre Prague, 2010, Žížalová et al., 2011 or OECD, 2020). These studies point out that research organisations' strategies for cooperation with industry, knowledge transfer and commercialisation of R&D results are often very general documents. In most cases, they do not include the vision that the research organisation wants to achieve in terms of knowledge transfer, objectives or action plans. They are limited to a statement on open access, without identifying concrete steps that will lead to the development of collaboration, knowledge transfer and commercialisation. At the same time, these strategies do not consider an active approach to collaboration with industry, an active search for business partners or an effective mapping of the demand for the research organisation's knowledge.

The biggest likely obstacle to the development and use of strategies and guidelines for industrial cooperation, knowledge transfer and commercialisation of R&D results is the *relatively low awareness among the management of research organisations of the benefits of these activities for the further development of their institutions*. This low level of awareness is mainly due to the conservative approach of many research organisations to their core activities, as defined by legislation or research organisation charters (usually stipulating that the research organisation is primarily engaged in education and research activities). *Collaboration with industry is perceived as an unwanted interference with academic freedom or as 'extra work'*. In many cases, the management of research organisations does not accept that collaboration or knowledge transfer is an important source of funds for the organisation to improve its standing, or that it stimulates further research and attracts new researchers and students. Oversight of such 'external' activities is often limited to monitoring scientific performance through a narrow prism – the number and quality of publications, which are assessed in the national research assessment

(modules M1 and M2 of the Methodology 17+). As a result, *researchers are mainly motivated to produce publication outputs without trying to commercialise their research results*.

A systemic obstacle to the effective implementation of knowledge transfer strategies and the valorisation of R&D results is the lack of clearly defined responsibility for commercialisation processes and the relatively weak position of KTOs in the management system of research organisations. In an environment of considerable decentralisation of the governance structure of research organisations (especially universities) down to the level of departments and research units, *commercialisation and knowledge transfer are often handled by the researchers themselves, despite the existence of a knowledge transfer office at the level of the research organisation*.

The *undervalued role of KTOs is also reflected in the limited institutional resources allocated to their operation leading to chronic understaffing*. After the completion of large projects funded by ESIF, which enabled the creation and development of a number of centres, research organisations do not allocate sufficient resources to finance the activities started, either from the organisation's budget or by setting up a commercialisation fund (patenting, licensing). Instead, they continue to rely on existing projects, which are not always sufficiently focused on the needs of a knowledge transfer office. As a result, KTOs carry out other activities and *try to meet the requirements of funding programmes instead of focusing on their core mission*. With limited budgets, it is also difficult to attract qualified staff who know both the technology, the research at the research organisation and the needs of industry, and who are experienced in assessing the market value of IPR generated at universities and public research institutes.

8.4.5. Motivating knowledge transfer from public research

Researchers in universities and public research organisations can be motivated to transfer knowledge and commercialise research results by tangible (e.g. a share of the commercialisation income) or intangible (e.g. personal satisfaction, prestige, scientific development) means.

The basic and *most commonly used instrument to motivate researchers is a share of the income from the commercialisation of IPR*. In the case of inventions for which the employer has not claimed the IPR, the ownership rights are transferred to the inventor. He or she is then entitled to the full amount from the commercialisation of his/her IPR. If the employer exercises the right to protect the IPR, it may reward the inventor with a share of the profits from the sale of the IPR or the licence. The Law on Inventions (No. 527/1990) stipulates that an inventor who has created an invention in the course of his or her employment for which the employer has claimed a patent right is entitled to reasonable remuneration from the employer. The remuneration shall be determined by the technical and economic importance of the invention and the benefit derived from its possible use or other application, taking into account the employer's material contribution to the creation of the invention and the extent of the inventor's work duties.

Research organisations recognise that researchers are entitled to a share of the commercialisation of their results to which the employer has claimed a right. This entitlement is generally not included in salary scales, and in some cases the share of the profit from royalties that goes to the researcher is not specified. In such cases, it is said that the amount of the share is determined by the management of the institution on the basis of the amount of commercialisation income. So, there is no uniform policy at the national level. On the other hand, *some research organisations specify in guidelines or other binding documents the share of IPR that is due to researchers*. This share is usually graduated

according to the amount of IPR commercialisation income received by the research organisation, with the percentage decreasing as the commercialisation income increases.

8.5. Knowledge transfer reform

The barriers to knowledge transfer from research organisations to enterprises described above have been discussed quite intensively in the Czech research and innovation system over recent years. Momentum for this discussion comes from companies, knowledge transfer offices (represented by Transfera.cz), and public administration. In the case of companies, an important driving force is the declining competitiveness of Czech industry associated with the waning competitive advantage based on relatively low production (labour) costs. The aim is therefore to support the innovation potential of enterprises by establishing closer cooperation with research organisations and by making greater use of the knowledge generated by public research. Knowledge transfer centres come into the discussion mainly because of the precarious position in many research organisations where there are significant cultural barriers to increasing the emphasis on valorisation of research results through industrial property protection and the sale of licences, spin-offs or contract research. For the public administration (both the RDI Council and funding agencies), an important motive for improving the valorisation of knowledge from public research is to advocate for increased spending on research and innovation from the state budget, and therefore the need to demonstrate the positive effects of supporting research and innovation activities on the economy and society.

In 2024, the Minister of Science, Research and Innovation introduced the knowledge transfer reform *'An Economy Driven by Science'*, which includes specific measures to strengthen the valorisation of scientific and research knowledge. It is not limited to narrowly defined technology transfer in the sense of commercial application of technologies in the market, but focuses on different types of new knowledge valorisation, including the use of results for public policymaking. The reform thus aims to streamline both science2business (commercial exploitation of research results) and science2policy (use of research results in public policymaking).

One element of the reform is the preparation of a new law on research, development, innovation and knowledge transfer to replace the current one on support for research, development and innovation (see chapter on R&I governance). The ultimate goal of the reform is to fundamentally strengthen the competitiveness of the Czech economy and ensure open strategic autonomy in key areas of Czech and European economic development.

The reform consists of *30 measures divided into the following six thematic blocks*. The measures are to be implemented by mid-2025.

Orientation of the economy towards research and development

The aim in this area is *to increase legal certainty and predictability in the application of tax deductions for research and development,* so that companies (especially small and medium-sized enterprises) are motivated to increase investment in their own research and development and to purchase R&D services from research organisations. The support measures also aim to improve companies' access to the results of publicly funded research.

Transfer orientation of research organisations

The main objective of this reform area is *to strengthen the motivation of research organisations to valorise R&D results*. This will be done by revising the methodology for the evaluation of research organisations (Methodology 17+) and by placing more emphasis on knowledge transfer in the evaluation of research organisations. In addition, efforts are being made to create the conditions for the award of professional PhDs in the context of doctoral training carried out in cooperation between universities and companies (or public administrations). The inclusion of transfer and commercialisation activities in the conditions for the career development of researchers and other awareness-raising activities aimed at doctoral students and early-stage researchers should also contribute to a greater orientation of researchers towards knowledge transfer.

Strengthening the transfer ecosystem

This activity aims *to strengthen the position of KTOs and innovation centres in the research and innovation ecosystem at national and regional levels*. The reform seeks to help KTOs to use the capacities of other organisations, strengthen the transfer activities of regional innovation centres, define the role of a possible central transfer agency, create a catalogue of good practice examples, and emphasise transparency in the innovation ecosystem and the role of the different actors, e.g. incubators, science and technology parks, digital hubs, competence centres, etc. Methodological recommendations for setting up a system of KPIs for individual centres and knowledge transfer offices should also contribute to this. Measures to strengthen the transfer ecosystem include support for the establishment of policy labs at universities or CAS institutes, which should help to concentrate activities aimed at meeting the research needs of the state and public administration.

A secure and transparent regulatory environment

The legislative and methodological environment should also contribute to favourable conditions for knowledge valorisation. The main initiative here is *the formulation of a new law on research, development, innovation and knowledge transfer, which should emphasise knowledge transfer as one of the important tasks of research organisations*. At the same time, it should allow for greater flexibility of project-based support with regard to knowledge transfer needs. As part of the amendment to the Higher Education Act, the reform aims to establish knowledge transfer as one of the tasks of universities. In addition, the reform in this area seeks to strengthen the orientation of sectoral research institutions towards the research needs of their founders. In support of the law, various methodological recommendations should be prepared to assist both providers and research organisations in the implementation of activities related to commercialisation and knowledge transfer (e.g. methodology for the valuation of IPR or for the creation of spin-offs).

Targeted and effective public support

Efforts in this area aim *to strengthen support for knowledge transfer from public sources*. Specifically, the reform aims to increase funding for proof-of-concept support in the Czech TA CR's SIGMA programme, or to pool funding from several providers into a single programme to support the commercialisation of public research results. At the same time, efforts are being made to emphasise knowledge transfer in the evaluation criteria for research programmes and to strengthen the ability of ministries to contract out their research needs. The measures also aim to introduce 'patent boxes', a system of reduced taxation for corporate income from patent licensing agreements.

Encouraging private investment

The aim of this reform area is *to stimulate private investment in spin-off companies*. The reform measures seek to create a fund for transfer activities to attract private investment in the early stages of spin-offs. At the same time, the reform should increase private investors' awareness of investment opportunities linked to the results of research organisations.

It is clear that the knowledge transfer reform has the ambition to cover broader aspects of the research and innovation system in Czechia. Successful implementation of the reform measures therefore requires consensus and *active participation of a wide range of actors*, from universities, CAS or sectoral research organisations, through the business sector and private investors, to various ministries, agencies and regional actors.

CONCLUSIONS

This report has been prepared to inform the work of the PSF panel of experts who formulate recommendations for improving knowledge transfer from universities and public research institutions to innovation in the business and public sectors in Czechia. The aim of this study was to provide a broader framework of the Czech R&I system so that opportunities for improvement in the knowledge valorisation system could be identified and assessed in the context of the institutional and cultural environment for R&I in Czechia.

An important aspect to consider is the nature of the Czech economy and the position of Czech firms in global value chains. Multinational firms play an important role in this regard, contributing significantly to output, productivity growth and business investment in R&I. However, multinational firms are integrated only to a limited extent into the national R&I ecosystem. A considerable proportion of domestic firms are deemed as 'suppliers' to multinational firms (typically in the automotive industry), which constrains their R&I potential, their ambition to penetrate new markets, their capacity to absorb research results generated in universities and public research institutions, and their ability to develop long-term research collaborations. Conversely, in recent years, a dynamic segment of technology startups has emerged, founded with global ambitions and bringing new dynamics to the Czech R&I ecosystem.

The quality of research and the capacity, willingness and readiness to translate research results into practice are also of significant importance for the knowledge transfer from public research. The quality of research in Czechia is below the EU average, according to international citation standards. However, there has been a gradual improvement in both the quantity and quality of research in recent years. This has been facilitated, among other factors, by substantial public investments in modernising research infrastructures and facilities, which has attracted high-quality researchers from both within and outside Czechia. In certain fields, such as computer science, physical sciences, molecular biology and genetics, chemistry and biochemistry, and some medical fields, Czech research is of a world-class standard. However, the exploitation of research results in practice is to some extent impeded by the aforementioned limited ability of Czech companies to absorb the results of cutting-edge research in their corporate activities, as well as by a limited entrepreneurial culture and low motivation for knowledge transfer and commercialisation in public research.

The long-term objective of the Czech R&I policy is to establish an environment conducive to effective knowledge transfer and valorisation, as well as to reinforce long-term collaboration between public research and enterprises. To this end, a range of support measures have been introduced in the past, with the aim of establishing knowledge transfer centres within universities and public research institutions, developing the skills of knowledge transfer personnel, enhancing researcher mobility, and fostering long-term partnerships between research organisations and companies. Furthermore, investment has been made in the development of innovation infrastructure, with the objective of supporting the development of startups and other technology-driven innovative companies. Support has also been directed towards the development of governance and implementation structures for R&I policy in the regions.

It is the regions and specifically the regional innovation centres or agencies that can play an important role in strengthening the links between research organisations and businesses within regional innovation ecosystems. They are well placed to do so, as they have detailed knowledge of the environment and specificities in each region and are able to communicate

intensively with relevant actors from the public and business sectors, thereby facilitating the creation of mutual trust in the regional innovation ecosystem.

However, some measures to support knowledge transfer and valorisation require coordination at the national level. These include various tax incentives, legislative framework, and mechanisms for research evaluation and funding that will sufficiently motivate knowledge transfer, the commercialisation of research results, and the cooperation of research organisations with innovative enterprises. From this perspective, effective coordination between institutions responsible for strategic R&I governance (RDI Council, MEYS, and MIT), among research funding organisations, and between national and regional levels of R&I policy implementation is of great importance.

The Knowledge Transfer Reform, presented by the Czech Government in January 2024, set the strategic direction for the future development of the knowledge transfer system in Czechia. The PSF project therefore comes at a very opportune time, given the existing initiatives and strong political support, and has the potential to help drive the Czech knowledge transfer system forward.

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ANNEX I. PROGRAMMES TO PROMOTE SCIENCE-INDUSTRY LINKAGES AND KNOWLEDGE TRANSFER

TECHNOLOGY AGENCY OF THE CZECH REPUBLIC

Programme	GAMA
Focus	Knowledge Transfer System | Proof-of-concept | Commercialisation
Funding provider	Technology Agency CR
Funding period	2014-2019 (GAMA), 2020-2022 (GAMA2)
Total support	€73,387,750 (GAMA), €22,450 (GAMA2)
Link	https://www.tacr.cz/en/gama-programme/
Objectives	The main objective of the programme was to support and significantly streamline the translation of R&D results generated in R&D and/or in R&D-enterprise collaborations into practical applications enabling their commercial exploitation, thus supporting their implementation in practice. Another objective of the programme was to ensure the production of R&D results leading to innovations with a high probability of commercialisation and thus to stimulate innovation in enterprises (in particular SMEs) using R&D results generated with public support in the R&D sector. The programme was divided into two sub-programmes: (1) sub-programme Proof-of-concept, and sub-programme (2) Support for the commercialisation of R&D results, which differed in the way they were implemented and in the eligible beneficiaries of the project support. The objective of sub-programme 1 was to support research organisations in identifying applicable R&D results and their commercial validation in the form of a model, functional model or prototype. It also aimed to support the creation and improvement of knowledge transfer systems within research organisations. Only research organisations could be beneficiaries of this subprogramme. Sub-programme 2 aimed to support companies in the commercialisation of R&D results from publicly funded projects. It mainly supported projects involving the completion of a working prototype, verification of its characteristics, validation of a series of tests and assessment of the full impact of the innovative product or service. The implementation of this programme was significantly delayed and modified due to state budget constraints. In the end, only SMEs that had received the European Commission's Seal of Excellence in the SME Instrument – Phase 1 were supported.
Results	53 projects of research organisations in sub-programme 1 (Proof-of-concept) 31 projects of SMEs in sub-programme 2 (Commercialisation)

Impact	Improved readiness of participating organisations to commercialise R&D results. Opportunity to fund proof-of-concept activities for which public research organisations do not normally have their own funding sources. Establishment of a functioning system for commercialising R&D results (by strengthening the position of KTOs, establishing commercialisation councils and coordinating their activities with KTOs, and standardising procedures and creating rules for knowledge transfer in research organisations) and professionalising the work of KTOs. 'Non-institutionalised changes and benefits', which consisted mainly of increasing researchers' motivation to commercialise R&D results and improving communication and cooperation within the organisation. Increased awareness of the need to transfer R&D results into practice and of the potential benefits for researchers. Raising the visibility of KTOs within research organisations, increasing researchers' confidence in their work and increasing the transparency and openness of internal commercialisation systems.

Programme	**SIGMA – Proof-of-Concept**
Focus	Knowledge Transfer System | Proof-of-concept
Funding provider	Technology Agency CR
Funding period	2024-2028
Total support	€12,245,000
Link	https://www.tacr.cz/soutez/program-sigma/ctvrta-verejna-soutez-dilci-cil-1-podpora-aktivit-proof-of-concept-ve-vyzkumnych-organizacich/
Objectives	The SIGMA – Proof-of-concept programme is a continuation of the GAMA programme (sub-programme 1 – Proof-of-concept). The call aims to support the commercialisation system and promote the exploitation of publicly funded R&D results that have been or are being produced in research organisations and have a high potential for application in new or improved products or services. The aim is to support new and streamline existing systems for the transfer and exploitation of new publicly funded R&D knowledge in research organisations.
Results	No results yet
Impact	No impact yet

Programme	SIGMA – Commercialisation of R&D
Focus	Commercialisation of R&D results of SMEs
Funding provider	Technology Agency CR
Funding period	2024-2025
Total support	€410,000
Link	https://www.tacr.cz/en/sigma-programme-announcement-of-the-6th-call-for-proposals-sub-objective-1-support-for-commercialisation-of-rdi/
Objectives	The SIGMA – Proof-of-concept programme is a continuation of the GAMA programme (sub-programme 1 – Proof-of-concept). This call is aimed at supporting projects with the ambition to participate in the EIC Accelerator, to support the commercialisation of breakthrough innovative solutions (product, service, societal challenges etc.) and to support the growth and development of SMEs and startups based in Czechia. The public call aims to verify the outputs/results of applied research in terms of their practical application and to prepare their subsequent commercial use or use for the needs of society. The projects will result in feasibility studies. Applicants will be offered the possibility of a special screening of their successful projects for synergic purposes. Since TA CR obtained the EC certification for the SIGMA programme, successful projects could apply for the 2nd round of the EIC Accelerator – once further evaluated. Projects successful in this call for proposals will be provided with support services – coaching.
Results	No results yet
Impact	No impact yet

Programme	Centres of Competence
Focus	Long-term science-industry collaboration
Funding provider	Technology Agency CR
Funding period	2012-2019
Total support	€260,000, 000
Link	https://www.tacr.cz/program/program-centra-kompetence/
Objectives	The main objective of the programme is to increase the competitiveness of Czechia in advanced fields with a high potential for

	the application of R&D results in innovation. The sub-objectives include: strengthening long-term cooperation between research organisations and enterprises in R&I; strengthening the interdisciplinarity of R&I; creating conditions for the development of human resources in R&I, with particular emphasis on the involvement of early career researchers up to the age of 35, including students, participating in the project; creating conditions for the horizontal mobility of researchers; fulfilling the national priorities of targeted research, experimental development and innovation; sustainability of the strategic research agenda in the centres for at least five years after the end of the project.
Results	34 projects of Centres of Competence
Impact	An ex-post evaluation of the Competence Centres programme showed that the programme helped to strengthen long-term public-private cooperation, renew or create new networks of contacts and, above all, increase trust between the actors involved. At the same time, the evaluation showed that the long-term nature of the Competence Centres projects has enabled research organisations to build up teams of young researchers who have worked with companies over a long period of time, adding know-how in both research organisations and companies. They then often moved to the companies, strengthening mutual trust and informal cooperation through personal ties.

Programme	**National Centres of Competence**
Focus	Long-term science-industry collaboration
Funding provider	Technology Agency CR
Funding period	2018-2028
Total support	€570,000,000
Link	https://www.tacr.cz/program/program-narodni-centra-kompetence/
Objectives	The objective of the programme is to increase the efficiency and quality of the results of applied research and technology transfer in key areas with growth prospects, to enhance the competitiveness of enterprises and to strengthen the excellence and application relevance of research organisations. The instrument for achieving this objective is the creation of a sufficiently stable and long-term applied research base (in the form of national centres of competence) by concentrating research capacities and making them strongly oriented towards the application of their research results in practice. The sub-objectives of the programme include (i) networking of existing research centres, (ii) focusing on promising sectors of the Czech economy according to the National S3 Strategy, (iii) ensuring interdisciplinarity and supporting long-term cooperation, (iv) promoting innovation through technology transfer, emphasising the applicability of results in practice, and (v) increasing the number of innovation

	leaders.
Results	31 projects of National Centres of Competence
Impact	The interim evaluation of the National Competence Centres has shown that the programme's success in commercialisation has so far been limited, not least because even sophisticated research activities still tend to focus on partial improvements, incremental innovations that help companies maintain their competitive advantage rather than establish themselves in new markets. On the other hand, National Competence Centres build trust and long-term stability in relationships between companies and research organisations.

MINISTRY OF INDUSTRY AND TRADE

Programme	OP TAC – Innovation Vouchers
Focus	Initiation of science-industry collaboration
Funding provider	Ministry of Industry and Trade
Funding period	2024-2027
Total support	€6,560,000 (so far)
Link	https://www.optak.cz/inovacni-vouchery-vyzva-ii/a-163/
Objectives	The aim of the call is to develop communication and the exchange of knowledge and know-how between business and research, which can be used by companies to start or intensify their own innovation activities. Support is provided for the purchase of consultancy, expert and support services for innovation from research and knowledge dissemination organisations or accredited laboratories, with the aim of launching or intensifying the innovation activities of SMEs. The project must take place in the territory of Czechia outside Prague.
Results	The call follows similarly focused calls in the OP TAC, implemented by MIT for the period 2014-2020, where a total of six calls for innovation vouchers were implemented. A total of 1,238 companies with 2,439 projects applied for support in these six calls. Over half (54%) of the projects were successfully implemented with total support of approx. €17.5 million. More than 200 research organisations were involved in cooperation with enterprises as providers of research services to enterprises.
Impact	More than 90% of participating enterprises and research organisations considered their involvement in the project as beneficial. Enterprises particularly appreciate the professional level of

	cooperation and the high quality of the results obtained. In addition to the high level of expertise and professionalism, the research organisations appreciate in particular the clarity of the task set by the enterprises and the practical application of the result produced. Almost half of the supported companies continued their cooperation with research organisations.

Programme	OP TAC – Innovation Vouchers for IPR
Focus	IP protection
Funding provider	Ministry of Industry and Trade
Funding period	2024-2027
Total support	€4,100,000 (so far)
Link	https://www.optak.cz/inovacni-vouchery/a-118/
Objectives	The objective of this call is to increase the innovation potential of Czech companies through more effective protection of intellectual property in domestic and foreign markets. Support is provided for the costs of patent attorney services. The project must take place in the territory of Czechia outside Prague.
Results	The calls in OP TAC follow the Innovation – Project for the protection of IPR calls in OP EIC, implemented by MIT in the period 2014-2020. Nearly 100 projects have been funded under this programme to promote industrial property protection in businesses, with total funding of around €1.2 million.
Impact	Not available

Programme	OP TAC – Knowledge Transfer Partnership
Focus	Knowledge transfer
Funding provider	Ministry of Industry and Trade
Funding period	2024-2027
Total support	€10,200,000 (so far)

Link	https://www.optak.cz/partnerstvi-znalostniho-transferu-vyzva-ii/a-300/
Objectives	The call supports the creation of partnerships between SMEs and research organisations for the transfer of knowledge, related technologies and skills to which SMEs do not have access. It supports the implementation of R&D results and new knowledge generated in the research organisation in the innovation processes of the company. An important role plays the so-called Knowledge Transfer Assistant, who is a Masters' or PhD graduate at the beginning of his/her career (within six years after graduation). His or her role is to help transfer knowledge from the research organisation to the company. Support for a knowledge transfer project will range from €60,000 to €480,000. The call for projects was announced in April 2024. The project must take place in the territory of Czechia outside Prague.
Results	The call follows similarly focused calls in OP EIC, implemented by MIT in the period 2014-2020, where a total of six calls for knowledge transfer partnerships were implemented. In these six calls a total of 75 projects were supported for a total of €8.7 million.
Impact	The evaluation of the previous programme supporting knowledge transfer partnership has confirmed that support led directly to partnerships with research organisations. Researchers from researcher organisations became de facto members of an implementation team set up to address a specific problem faced by companies. The companies thus gained access to unique know-how that they could not have generated on their own and, together with the researchers, focused on a concrete way to apply this know-how in practice. The companies also highlighted that the support led to an increase in staff excellence and the company was able to introduce new and innovative approaches to services.

Programme	**OP TAC – Proof-of-Concept**
Focus	Proof of Concept
Funding provider	Ministry of Industry and Trade
Funding period	2022-2027
Total support	€18,000,000 (so far)
Link	https://www.optak.cz/proof-of-concept-vyzva-ii/a-302/
Objectives	The aim of the call is to strengthen the innovation potential of SMEs and small mid-caps that will be able to develop and commercialise new products and solutions based on the results of research and development and the use of advanced technologies.

	Funding is available for activities related to the verification of the technical feasibility and commercial potential of research and development with the aim of bringing a new product/technology/service to the market, as well as for activities aimed at bringing research and development to the final stage and preparing it for commercialisation. The project must take place in the territory of Czechia outside Prague.
Results	The call follows similarly focused calls in OP EIC, implemented by MIT in the period 2014-2020, where a total of five calls for knowledge transfer partnerships were implemented. In these five calls a total of 47 projects were supported for a total of €11.3 million.
Impact	Evaluation of the previous programme has shown that the support provided by the proof-of-concept programme strengthens the links between research organisations and enterprises and enhances the innovation potential of enterprises. Often, a team of researchers is linked to employees of the supported companies, and the potential for putting R&D results into practice is tested in this collaboration. An important benefit is that the support provides companies with access to relevant know-how, while reducing the economic risk of verifying its applicability in practice.

Programme	**OP TAC – Clusters and Technology Platforms**
Focus	Long-term science-industry collaboration
Funding provider	Ministry of Industry and Trade
Funding period	2023-2027
Total support	€38,000,000 (so far)
Link	https://www.optak.cz/spoluprace-klastry/a-110/ https://www.optak.cz/technologicke-platformy-vyzva-ii/a-353/
Objectives	The objective is to support the development of innovation clusters and technology platforms as tools to increase the intensity of joint research and innovation activities between enterprises and research organisations, and to create joint opportunities related to the implementation of advanced technologies. The support is provided to the coordination activities of innovation clusters and technology platforms in developing and implementing strategies to strengthen the international competitiveness and technological development of the industry. In the case of clusters, research and development activities that respond to the innovation needs of SMEs in a specific industrial sector or a specific technological area within the cluster will also be supported. Funding will also be given to the creation of an open-access cluster research centre for carrying out industrial research and to activities aimed at

	improving and extending specialised support services for SMEs. The project must take place in the territory of Czechia outside Prague.
Results	The call follows similarly focused calls in OP EIC, implemented by MIT in the period 2014-2020, where a total of seven calls for clusters and four calls for technology platforms were implemented. In these 11 calls a total of 50 projects were supported for a total of €45.7 million.
Impact	The main benefits of the support include the strengthening of the capacity of the clusters and technology platforms to carry out their own research and development. Another important result of the project implementation was the increased participation of the cluster/platform in European programmes and projects supporting research, development and innovation. Almost a quarter of the beneficiaries were involved in a European project as a direct result of the support. In the overall assessment of the benefits of the project for the cluster/platform members, the strengthening of the members' cooperation in joint business research and development is highlighted. The fact that the project has enabled the development of cooperation between cluster/platform members and research institutions is even more appreciated.

CZECHINVEST

Programme	Technology Incubation
Focus	Startups
Funding provider	CzechInvest
Funding period	2020-2025
Total support	€14,000,000 (so far)
Link	https://technologickainkubace.org/en/
Objectives	The goal of the CzechInvest Technology Incubation Programme is to find and help create companies/projects that are exceptionally innovative, viable, and scalable. Selected technology startups can receive direct support of €45,000-180,000 and indirect support in the form of workshops, seminars, support from incubation managers, consultations with business and technology experts for up to two years, all without losing their stake in the company. In addition, CzechInvest provides startups with advice on recruiting researchers from abroad and managing the visa process, or information on funding opportunities for startups, including possible contacts with investors. Seven technology hubs support the startup environment and new companies: Advanced Tech & Materials Hub, AI Hub, Creative Hub, EcoTech Hub, Mobility Innovation Hub, Space Hub, Tech4Life Hub.

Results	Of the three calls evaluated so far, 140 startups have been supported in 2022 and 2023. A total of €14 million has been distributed.
Impact	Not available yet

MINISTRY OF EDUCATION, YOUTH AND SPORTS

Programme	**OP JAC – Science-Industry Collaboration**
Focus	Science-Industry Collaboration
Funding provider	Ministry of Education, Youth and Sports
Funding period	2023-2027
Total support	€170,000,000
Link	https://opjak.cz/vyzvy/vyzva-c-02_23_020-mezisektorova-spoluprace/
Objectives	The calls facilitate the creation or deepening of cooperation between research organisations and enterprises with the aim of generating and subsequently using research and development results in practice. In particular, it supports collaborative research projects carried out by a research organisation in cooperation with industry. This may be complemented by the involvement of experts from industry in teaching activities. Projects must be thematically in line with the S3 Strategy.
Results	To date, two calls have been launched with a total budget of €170 million. These calls received 116 project proposals with a total requested support of more than €400 million, which were still being evaluated at the time of writing this background report. The call follows similarly focused calls in OP RDE, implemented by MEYS in the period 2014-2020. The previous programme supported 30 long-term collaborative projects between research organisations and industry. The total funding amounted to approximately €95 million.
Impact	Not available yet

Programme	**OP JAC – Smart Accelerator**
Focus	Regional capacities for innovation governance
Funding provider	Ministry of Education, Youth and Sports

Funding period	2023-2027
Total support	€38,100,000
Link	https://opjak.cz/vyzvy/vyzva-c-02_22_009-smart-akcelerator-i/
Objectives	The objective of the Smart Accelerator call is to enable the development of capacities and competences in individual regions of Czechia that contribute to the creation of conditions for the strengthening of smart specialisation, the development of innovation ecosystems, and the development of cooperation between actors from all spheres of the so-called triple/quadruple helix (in particular research organisations, educational institutions, the business sphere, and the public sector) in accordance with the priorities defined in the National Research and Innovation Strategy for Smart Specialisation of Czechia 2021-2027 and its regional dimension. Several types of activities are supported. The main activity is the funding of human capacity and key competences to coordinate and implement regional S3 strategies. In addition, the Smart Accelerator projects support training and education to develop the competences of regional innovation system actors involved in the development of the innovation ecosystem in the region and in the preparation of strategic interventions implementing the regional S3 Strategy. An integral part of the supported activities in all regions is the monitoring, analysis and evaluation of changes in the development of the regional innovation ecosystem, the identification of its needs and potential, and the evaluation of the effects and impacts of the implementation of the regional S3 Strategy. In addition to these activities, support is also provided for consultancy services (assistance vouchers) aimed at developing strategic projects of the region for funding from regional, national or international programmes. Another supported activity is twinning with foreign institutions aimed at exchanging experience in the implementation of regional innovation support instruments, pilot testing of new instruments to support the development of the innovation ecosystem or marketing activities aimed at promoting the innovation potential of the region. The Smart Accelerator call is materially related to the calls implemented in the 2014-2020 programming period in OP RDE.
Results	14 projects (one in each region) have been supported so far Total support amounted to €38.1 million
Impact	The Smart Accelerator initiatives have led to a significant increase in funding for innovation support in all regions, as agreed by the political representatives of the regions. Another general finding is the significant strengthening of human capacity to innovation support in regions – this capacity is concentrated in the Smart Accelerator teams. The anchoring of organisational structures and processes for managing the innovation support and moving towards smart specialisation of the region is also significant. The Smart Accelerator initiatives contributed to increased interest of political representation and other stakeholders in activities to support the innovation ecosystem in regions. In some regions,

Smart Accelerator support has led to the creation of a dedicated agency and the launch of a number of activities that are completely new for the region, as well as an increased capacity for consensus building (both within regional decision-making structures and within broader partnerships with stakeholders).

The implementation of the Smart Accelerator projects has also increased the credibility of regional innovation agencies as partners in discussing the common direction of the region and as a provider of support/services that benefit local stakeholders.

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This report has been prepared to inform the work of the PSF panel of experts who will be responsible for formulating recommendations for improving the knowledge transfer from universities and public research institutions to innovation in the business and public sectors in Czechia. The aim of this study was to provide a broader framework of the Czech R&I system so that opportunities for improvement in the knowledge valorisation system could be identified and assessed in the context of the institutional and cultural environment for R&I in Czechia.

Studies and reports

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