

INNOVATION DIFFUSION IN THE CZECH REPUBLIC A REGIONAL APPROACH

Background document for the implementation workshops in Spring 2020

Document updated December 2020

**Information Note:**

This report was prepared as background for a series of implementation workshops involving the regions of the Czech Republic and the national government. The workshops are part of an OECD project to develop a self-assessment toolkit for barriers to regional innovation diffusion that aims provide policy makers a tool to assess strengths and weaknesses of innovation diffusion channels in their regions.

This report draws on data collected by the OECD and stakeholder interviews that underpin the workshops at national and regional level in the Czech Republic. It leverages a conceptual framework currently being developed for the project. The report was prepared by OECD officials as a background document and should not be reported to reflect the views of OECD member countries or those of the European Union who co-finance the project.

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The project for which this report was prepared is co-financed by the European Union, via the European Commission Directorate-General for Regional and Urban Policy.

1 Introduction

1.1. The concept of innovation diffusion

Innovation diffusion can be defined as the process through which firms gather knowledge, information and innovations from outside and use them to introduce their own innovative products or processes. It is a broad concept, referring, among other things, to the adoption of new-to-the-firm technologies, the introduction of new management techniques, the digitalisation of certain processes, or the introduction on the market of a new product.

According to the Oslo Manual 2018 “*innovation diffusion encompasses both the process by which ideas underpinning product and business process innovations spread (innovation knowledge diffusion), and the adoption of such products, or business processes by other firms (innovation output diffusion)*”. (OECD/Eurostat, 2018).

1.2. Purpose and overview of the report

The aim of this report is to apply the concept of innovation diffusion and provide insights into its enablers and barriers within the different regions of the Czech Republic.

This report is divided into five different sections. After the introduction, the framework conditions that impact the creation and spread of knowledge in the Czech Republic are discussed, followed by an overview of the main channels through which innovation diffusion takes place. Section four covers the main intermediaries that support innovation diffusion in the Czech Republic. These sections provide information and insights at the national level as well as, when relevant, regional variations across the country. Section five concludes and offers some implications for regional innovation policy in the Czech Republic.

1.3. The report is part of a wider project

The output is part of a wider European Commission-OECD project to develop an interactive policy self-assessment toolkit on innovation diffusion across regions and cities. The aim of this overall project is to help policy makers in the European Union and beyond to gain a view of the strengths and weaknesses of their regional innovation challenges and policy support that is provided.

The self-assessment toolkit will provide each region with a regional innovation profile (relative to other OECD and EU-28 regions), quantifying the strengths of different innovation diffusion channels in the region and allowing policy makers to engage local stakeholders to gather their views on the (regional) innovation system that the toolkit summarises and consider actions for improvement.

Regional innovation diffusion processes and obstacles in the Czech Republic have been assessed as part of this exercise with the support of national and regional authorities and stakeholders. The repeated interactions with key stakeholders in the country at the national and regional level, and this report summarising main findings, will serve as input to identify the dimensions to be examined in the toolkit and on

how to get the questions right. It will also support Czech authorities to design future regional innovation policies based on an evidence-based assessment and stakeholder consultation.

1.4. Process and methodology

A number of consultation meetings, discussions and interviews between the OECD and relevant stakeholders of the Czech Republic took place in the first half of 2020, underpinning this report. Contacted stakeholders include policy makers, both from the national and subnational level, representatives of higher learning institutions, cluster organisations, accelerators and incubators, entrepreneurs and business owners.

In addition, representatives of all 14 regions of the Czech Republic filled in a detailed questionnaire on the framework conditions for innovation diffusion, the different actors and how they interact, the channels through which innovation diffusion takes place, and the relevant policy initiatives, from different levels of government in this area.

The information collected this way was processed and scrutinised by analysts of the Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) at the OECD. This report reflects their insights and opinions, complemented by desktop research and independent analysis.

2 Framework conditions

Framework conditions in a region influence the pace and probability of innovations being widely disseminated and adopted by firms. Important framework conditions include the availability of finance for SMEs and start-ups, access to foreign and domestic markets, availability of skilled labour, digital infrastructure and entrepreneurial culture. Each of these issues will be discussed below.

2.1. The innovation and R&D climate

Overall insights

The Czech Republic is a moderate innovator

Overall, the Czech Republic is classified as a moderate innovator in a European context, according to the European Innovation Scoreboard, which provides a comprehensive picture of the innovation and R&D climate. Areas where the country performs well below the EU average include intellectual assets (i.e. patent, design and trademark applications), venture capital investments (see section below), and the low incidence of opportunity-driven entrepreneurship. On the plus side, innovative SMEs have a relatively high propensity to collaborate with others and the employment in fast-growing enterprises is above average (European Commission, 2020^[1]).

Innovation activities among businesses are more concentrated than in most other countries with 5.6% of all R&D-performing enterprises responsible for 63.3% of all expenditures. In addition, the country is highly dependent on international funding for R&D (OECD, 2017^[2]). The overall R&D intensity of indigenous enterprises is generally weak (European Commission, 2019^[3]).

Public investments are moderate and innovation support is deemed overly complex

Public R&D investments are modest, lack a coherent strategy and are dependent on EU funding (casting doubts about their long-term sustainability). In addition, higher education institutions and research institutes lack sufficient institutional funding for R&D activities and the funding they receive is largely independent of their output and performance (European Commission, 2019^[3]).

Stakeholders, especially from the business community, highlighted the importance of the ease of accessing public support. Government support measures, especially when it comes to innovation support mechanisms, are generally perceived as cumbersome, procedurally difficult and time-consuming, therefore considerably limiting their relevance for smaller enterprises. There are also only limited spillover effects from public investments in innovation to the regional innovation eco-system, according to some key stakeholders, since public and private activities are largely disconnected.

The government has ambitions to improve the R&D and innovation climate

Under the “Innovation Strategy of the Czech Republic 2019 – 2030”, the Czech Government set out the ambition to become an innovation leader within ten years. To that end, the government aims to increase

public spending in this area to 2.5% of GDP in 2025 and 3% by 2030, conduct more evaluations of policy initiatives (and change them accordingly), improve the intellectual property regime and increase the support for spin-offs, among other measures.

Other strategies, if fully implemented, would also mark an improvement in the overall R&D and innovation environment. These include the Integrated Territorial Investments (ITI), which outlines the regional development strategies for seven metropolitan areas in the country, as well as the “National Research and Innovation Strategy for Smart Specialization,” which was updated in 2018.

Regional variations

As the annex to this document illustrates, regions in the Czech Republic can be categorised by their overall innovation performance. The region of Prague is the only one classified as a strong innovator. A majority of regions (Hradec Kralove, Liberec, Olomouc, Pardubice, Plzen, South Bohemia, South Moravia, Vysocina, Zlin) can be classified as “moderate +” innovators. Two more regions as moderate innovators (Central Bohemia, Moravia-Silesia). Finally, Karlovay-Vary and Usti nad Labem are “moderate -” innovators.

Variables to determine the position of a region include the R&D expenditure by the public sector (as a percentage of regional GDP), the expenditure by SMEs on R&D and non R&D innovation (again as a percentage of regional GDP), the share of the population of the region with tertiary education, the relative number of patent and design applications and so on. For each of these indicators, there are variations across the country. For example, the region of Prague is a frontrunner of most measures, in particular for the relative number of inhabitants with tertiary education and by public R&D expenditure, but lags behind when it comes to non R&D innovation expenditure in SMEs or by patent applications.

At the other end of the spectrum, the below average performance of Karlovay-Vary and Usti nad Labem is largely due to the relatively paucity of R&D activities. Both regions underperform in terms of the R&D expenditure as a percentage of regional GDP and the share of R&D personnel, both by higher education institutions as well as the business sector.

2.2. Availability of finance

Overall insights

Access to straight debt does not represent a major barrier for established companies

Indicators point to gradual improvements in the SME finance environment over the 2012-18 period, as witnessed by a continuous rise of the outstanding stock of SME loans over this period (OECD, 2020^[4]). There was agreement among interviewed stakeholders that access to straight debt was fairly accessible and affordable for viable businesses with a proven business model, especially for investments in tangible assets.

This is in line with evidence of the survey on enterprises’ access to finance (SAFE) conducted by the European Central Bank and European Commission. 8% of firms in the country consider access to finance to be their main concern, slightly above the EU average. This percentage was well below the share of firms that stated finding and retaining qualified personnel, finding costumers and keeping costs under control as their main concern; at 30%, 23% and 12% respectively (ECB and EU, 2019^[1]).

In addition, the government has also introduced several support mechanisms for companies in need of finance, such as grants, guarantee programmes (most notably GUARANTEE which provides guarantees both for working capital and investment loans) and the EXPANSION programme which provides soft

(subsidised, preferential) investment loans and financial contribution in the form of interest rate subsidies of commercial co-loans (applicable only for projects in disadvantaged regions) (OECD, 2020^[4]). On the whole, these initiatives serve their purpose and address gaps in the provision of debt by the private sector.

Early stage equity financing is in short supply, however

The availability of finance for innovative start-ups, especially in the very early stages of their life cycle (the so-called proof of concept stage), was repeatedly described as problematic. Banks are generally unwilling to lend to this segment of the enterprise population, while much of the public financial support is not geared to these ventures either. Equity finance instruments, which are generally well suited to the needs of this segment, is hard to come by according to interviewed stakeholders.

This perception is borne out by comparative data and independent analysis. Venture capital investments declined every year between 2008 and 2017 in the Czech Republic. In 2018, despite a reversal of trends and an uptick in investments, they remained at 33.6% of their 2008 value. In 2018, venture capital investments amounted to 0.0067% of GDP, well below the median value of 0.035% of 50-odd (mostly high-income) countries for which comparable data are available. According to the official data, which sometimes underestimates the real inflow, growth capital fell even more steeply, from EUR 191.9 million in 2009, to EUR 4.9 million in 2016 and even further to EUR 3.5 million in 2018 (OECD, 2020^[4]).

Business angel investment activities are modest

Few interviewed stakeholders referred to business angels (BAs) as important vectors of innovation, even though they potentially could be. International evidence highlights the potential role the business angel community can play in the ecosystem for start-ups, especially for innovative firms. Angel investors, aside from providing funding at a critical and early stage of an innovative firms' life cycle, provide services beyond financing, such as mentoring, business advice and access to networks. Angel investment is a potential avenue for innovation to diffuse from experienced entrepreneurs to young companies (OECD, 2016^[6]).

A 2018 study of business angel activities in the Czech Republic revealed that there are few angel investors active in the country. In addition, joint investments, through business angel syndicated are uncommon, in contrast to countries with a more developed market. A key observation is the absence of a structured and formal business angel organisation, despite the recent emergence of small-scale network and syndication activities. These networks, for example in place in Brno, are typically informal and unstructured, making it hard for innovative ventures in need of finance to reach out to potential investors. The creation of a formal and structured business angel network, spanning the country, would boost activities, and raise the profile of angels as a driver of innovation diffusion (World Bank, 2018^[2]).

Indeed, stakeholders often refer to the absence (or underdevelopment) of regional networks of angel investors, as well as venture capital investors, as a key weakness in the innovation eco-system, and identified this area as a possible area for policy intervention that is currently underexplored.

Financial literacy is weak among many SMEs in the Czech Republic

Anecdotal evidence points to a dearth in financial skills and vision among many SMEs and entrepreneurs in the Czech Republic. In contrast to larger companies, SMEs often lack a dedicated expert in financial matters. The business owner often makes financial decisions for this reason, even though (s)he may lack training or qualification. This may limit the uptake of financial instruments other than straight debt, in particular equity instruments, which are of particular relevance for innovative ventures. It also blunts the effectiveness of public support measures (which often require a degree of financial capabilities to benefit from), and make firms over-reliant on internally-generated revenues, thereby reducing their innovation and growth potential (Boschmans and Pissareva, 2018^[3]). The Czech Republic has developed a national plan

for financial education, but most of its efforts seem to be geared towards the general population, rather than the business owners and entrepreneurs (OECD, 2016^[4]).

Regional variations

All Czech Republic regions are affected by the above-noted weaknesses in venture capital and business angel investment and the level of financial literacy among SMEs. Furthermore, equity investments are concentrated in the region of Prague and better links are needed from other regions to equity investors in the capital.

2.3. Ability to reach (foreign) customers

Overall insights

The Czech Republic performs poorly when it comes to SME internationalisation

According to the 2019 SBA Fact Sheet of the European Commission, the Czech Republic has the worst performance among EU member states on SME internationalisation. Formalities are relatively cumbersome with limited digitalisation, and SMEs trade less often in goods outside of the EU compared to their counterparts in other EU countries (European Commission, 2019^[3]).

These observations were echoed by policy makers and other stakeholders, who often reported limited access to foreign markets for most businesses, a few exceptions (of mainly large companies) notwithstanding.

Czechinvest and Czechtrade are important actors in this area

Internationalisation of businesses is promoted through two key vehicles in the Czech Republic. Czechinvest provides mentoring to their beneficiaries about how to start, expand internationally, exhibit in fairs, and promote the products in other countries. Czechtrade is the country's national trade promotion agency and provides services (for favourable fees or free-of-charge) to exporting companies, including networking and trade events.

Public procurement is not typically regarded as an instrument to stimulate the creation and diffusion of knowledge

In 2017, general government procurement expenditures amounted to 31.5%, which is above the OECD average (<https://www.oecd.org/gov/gov-at-a-glance-2019-czech-republic.pdf>). Government contracts thus represent an important market for Czech companies, and reach firms of all sizes.

In addition, public procurement offers a potential market for innovative products and services. A 2017 report by the OECD identified the possibilities of public procurement to enable governments to stimulate innovation at both the national and local level. It concluded that close to four in five countries that responded to a large-scale questionnaire reported supporting procurement for innovation, and around half have developed an action plan for procurement for innovation (either as a stand-alone initiative or as part of a broader strategy). Even in countries without such an action plan, as is the case in the Czech Republic, public procurements could be regarded as potential innovation support tool and an integral part of innovation policy (OECD, 2017^[8]).

Nonetheless, stakeholders rarely perceived public procurement procedures as an important framework condition for innovation diffusion to take place. While access to public tenders by smaller companies, and

public procurement practices more generally, were sometimes emphasised as important, these were usually not perceived as particularly relevant for the topic of innovation diffusion.

Regional variations

Despite the presence of Czechinvest and Czechtrade in different regions of the Czech Republic, their support is relatively uniform across the country, and decided at the national level with little involvement of local or regional governments. Internationalisation support policies could be more effective with greater tailoring to regional needs and opportunities, including sector and cluster concentrations.

2.4. Recruitment, training and utilisation of skilled workers

Overall insights

Skill levels are above the OECD average and policy initiatives have fostered the development of adult skills

The OECD Programme for International Student Assessment (PISA) ranks the performance of 15 year olds across the globe in three key dimensions. The 2015 data, the most recent available at the time of writing, shows that the Czech Republic performs about average when it comes to reading abilities, and above average for mathematics and sciences (<https://www.oecd.org/czech/pisa-2015-czech-republic.htm>).

In a similar fashion, the OECD survey of adult skills (PIAAC), measures adults' proficiency in several key information-processing skills, i.e. literacy, numeracy and problem solving in technology-rich environments. The Czech Republic performs above average in all three dimensions, according to 2018 data (<https://www.oecd.org/skills/piaac/>).

The government of the Czech Republic has made strides over the past decade to provide better access to training, promote lifelong learning opportunities and improve the system of vocational training (OECD, 2018_[11]).

Nonetheless, there are mounting labour shortages and skills mismatches, which likely impact SMEs disproportionately

Despite the progress in recent years in terms of skills development, research indicates that labour shortages and skills mismatches represent important hurdles for the Czech Republic. Demand from the labour market is shifting towards more high-skilled profiles. At the same time, an ageing work force and a significant brain drain to other European countries adds pressure to the labour market. Labour force shortages are concentrated in certain economic sectors, such as ICT and the health industry (OECD, 2018_[12]). There was wide agreement among interviewed stakeholders that there is a mounting shortage of people with technical skills as well, as for example evidenced by a series of interviews of employers in the Olomouc region. Pupils and parents alike often regard technical studies as “less prestigious” and underestimate the employment opportunities and appeal of such skills in the labour market.

SMEs find themselves typically at a disadvantage compared to large enterprises in attracting and retaining talent. They often lack the capacity and networks to identify the most suitable profiles, and tend to offer less attractive compensation packages compared to their larger counterparts (OECD, 2019_[13]). This most likely holds especially true in the Czech Republic, as the country is a major recipient of foreign direct investment and the host of many multinational enterprises. Stakeholders referred to strong competition in

the labour market with university students commonly being poached by large employers before graduation to the detriment of smaller and younger enterprises.

There is a clear impact of skills shortages on innovation diffusion

In previous publications, the OECD highlighted the importance of addressing skills shortages, which has been identified as one of the key factors explaining below-average productivity levels in the Czech Republic (compared to most other OECD countries). Shifts in the labour market, i.e. a structural increase in demand for skilled labour, will put increasing pressure on the labour market. Further policy efforts to instil the workforce with “the skills of the future” are deemed essential for the country to move up the value chain and stimulate innovation (OECD, 2018^[3]).

This was widely echoed throughout interviews and questionnaires, where labour force shortages and skills mismatches were often identified as the single most important hurdle for innovation diffusion. In particular, innovative firms are constrained in their activities in general and more traditional firms struggle to find the right personnel to digitalise, expand to other markets, produce new services and so on. Some stakeholders also reported that the competition for scarce skills may discourage on-the-job training activities, especially by smaller firms. The return on investment of training for personnel is constrained by the considerable risk that the beneficiaries of training or upskilling programmes may be poached by other firms.

There was some disagreement about the impact of skills shortages, however

Nonetheless, there was some variation in the perception, with a minority view that the constrained availability of (skilled) labour could be a possible driver of innovation by businesses, by spurring them to adopt digital tools and invest in labour-saving technologies. In addition, a tight labour market may stimulate worker mobility, a potential driver for innovation diffusion. As another example, there were mixed arguments about the consequences for the start-up scene. While start-up rates are likely negatively impacted by the low unemployment rates, this may be especially relevant for necessity-driven entrepreneurial activities, rather than for innovative ventures.

The Czech Republic has become a net recipient of migration in recent years

In 2017, the Czech Republic received around 46 000 immigrants, up from 36 500 in 2016. At the same time, 17 700 Czechs emigrated in 2017, a similar number as in the preceding year. The Czech Republic has thus become a net recipient of migration in recent years with most of the arrivals hailing from Ukraine, the Slovak Republic and the Russian Federation (but also increasingly from other parts of the world such as Viet Nam or Mongolia). Since 2018, integration centres have been established in all 14 regions of the country (OECD, 2019^[8]).

The labour market outcomes of the foreign-born population is generally favourable in terms of the labour participation rate, employment rate and unemployment rate (see Figure 1).

Figure 1. Labour market outcomes of foreign and native born, 2017



Source: (OECD, 2019_[6]).

While this development may reduce skills shortages in the labour market and can act as a driver of innovation, some stakeholders voiced support for stimulating migration from knowledge workers into the country, including from the diaspora, for example through incentives or the establishment of welcome centres that would facilitate the process (for example in terms of finding housing, international schools, and employment opportunities for their spouses).

Regional variations

Some regions face more acute skills shortages than others

Educational attainment varies by region. The capital region, for instance, has the largest share of the population with tertiary education, while Karlovy Vary and Ústí nad Labem are regions at the opposite spectrum with a relatively large proportion of the workforce with primary education only. In terms of skills mismatches, there are regional variations as well. Six regions in the Czech Republic can be classified to be in a low-skilled equilibrium with high demand for low skills from business coinciding with high supply in the labour force. The limited demand for high-skilled labour can blunt incentives to upgrade skills (OECD, 2016_[16]).

In addition, internal labour mobility, especially to Prague, may also pose particular challenges for rural and peripheral regions in the country. As an illustration, the population declined by 4.4% between December 2014 and December 2017, in the Karviná municipality, in the far east of the country, the strongest drop among the 82 municipalities in the Czech Republic. By contrast, the population rose fastest in the Prague municipality over the same period (by 2.2%).¹ Anecdotal evidence suggests that higher-educated, relatively young people have a higher propensity to move to urban areas in the country, sharpening skills shortages in the region of origin.

Finally, unemployment levels vary somewhat between different regions, which is indicative of labour shortages. The lowest unemployment rate at 31 March 2019 was in Prague (1.9%), in the Plzeň region (2.1%), in the Pardubice region (2.1%) and in the Hradec Králové region (2.3%). The Ústí nad Labem region had the highest unemployment rate at the same period at 4.3% (<https://ec.europa.eu/eures>).

¹ These data come from the Czech Statistical Office, “Czech Republic in Figures – 2015” and “Czech Republic in Figures – 2018” with calculations from the author.

There is limited opportunity to identify and remedy specific skills shortages at the subnational level

Most of regions has platforms to bring together representatives of the education system, policy makers and the local business community. Besides so-called Employment Pacts, where the main stakeholders are the municipalities, labour offices and the Chamber of Commerce, every region has a Tripartite (region, employers, unions), where they implement projects to address specific job challenges. For example, in Usti such a platform was recently developed and functions reasonably well, notwithstanding some difficulties in finding the right interlocutors from (innovative) businesses and in gauging future skills needs. The Regional Innovation Platform in South Bohemia set up an education section, which aims to connect the local business community and education providers. The Chamber of Commerce in the region of South Bohemia provides similar matchmaking services.

A final consideration is that policies for higher education are made at the central level with limited autonomy at the regional level. In other words, there are limited policy instruments by policy makers at the subnational level to address potential shortcomings in high level skills, even though federal programmes are not always sufficiently tailored to local and regional circumstances, according to some interviewed stakeholders. In particular, the overall framework for curricula are set at the national level. While there is some scope for individual schools to tailor its programme within the boundaries of this framework, the framework has been described as quite inflexible and the freedom limited in practice. More responsiveness is needed from higher education institutions to the higher level skill demands of businesses in the regions where they are located. For example, greater emphasis could be placed on internships of students in businesses, or higher level apprenticeships.

Welcome centres for skilled migrants are perceived to be a good practice, but are not ubiquitous across the Czech Republic

Welcome centres have sprung up across the country in recent years, for example at the South Moravian and Zlin region. However, in other parts of the country, such as in the Central Bohemian region or the Usti region, welcome centres are absent, despite broad agreement that they are a useful instrument to stimulate (re)location of expats and the diaspora community.

2.5. Digital and physical infrastructure

Overall insights

The Czech Republic has made significant strides in terms of digital infrastructure

Investments in fast broadband lead to more ICT investments by firms of all sizes, which are in turn important vectors for innovation diffusion (Andrews, Nicoletti and Timiliotis, 2018^[17]). As in many countries, the digital infrastructure lags behind in rural and remote areas in the Czech Republic. Interviewed stakeholders highlighted the importance of access and affordability of broadband connection, as well as data storage capacity. There was broad acknowledgement, however, that the Czech Republic has made significant improvements in the digital infrastructure all across the territory, including outside of urban areas, and the issue is not perceived as a major hurdle. This progress is also reflected by comparative data, for example by “The Digital Economy and Society Index (DESI).” This database illustrates a substantial improvement of key parameters in the Czech Republic in comparison to other EU members (MPO, 2020^[11]).

The government also has ambitions to further invest in digital infrastructure, in particular by rolling out 5G networks (MPO, 2020^[11]). Several cities and municipalities all around the country, including from sparsely

populated regions, are implementing 5G pilot schemes, which are expected to stimulate innovation. As an example, investments in physical infrastructure may encourage foreign direct investment activities and integration into global value chains, especially from R&D-intensive industries.

Physical infrastructure investments lag behind

Investment levels in physical infrastructure fall below the EU average and declined significantly since 2000, and the suburban transport infrastructure, as well as transport links between different parts of the country are relatively weak (European Commission, 2019^[7]). This widens regional inequalities and puts pressure on housing prices in urban areas.

Regional variations

Stakeholders from some regions highlighted the importance of physical infrastructure and “remoteness” from major urban agglomerations as a constraint to their economic development. The Moravian-Silesian region, for instance, is located in the far east of the country and hence geographically far from the capital. This distance is perceived to be a barrier to innovation participation by local actors, requiring additional public support.

At the western-most side of the country, similar sentiments were voiced by the Karlovy Vary region. Deficiencies in road and rail connectivity, both within the region and to other parts of the country (Prague in particular) and nearby German cities, represent a potential brake on innovation diffusion. This contrasts with digital infrastructure, which, by and large, is widely perceived as solid in all regions of the country.

2.6. Entrepreneurial culture

Overall insights

Deficiencies in entrepreneurial culture reportedly represent a major innovation barrier.

All across regions in the Czech Republic, stakeholders highlighted shortcomings in entrepreneurial culture as a key factor holding back innovation diffusion. Often described as a legacy of the era when the country had a planned economy, many people are risk-averse, which negatively impacts start-up rates, as well as growth of existing enterprises. There is broad agreement that the education system needs to be more attuned to entrepreneurship and small business development.

This sentiment is echoed by comparable data. A relatively large proportion of entrepreneurs and business owners in the Czech Republic are primarily motivated by necessity rather than opportunity (European Commission, 2020^[1]). In addition, data from the Global Entrepreneurship Monitor (GEM) indicate that comparatively few Czechs perceive opportunities to start a business, while a relatively large proportion of the population consider they lack the skills. Hence, few people have the intention to set up businesses and early-stage entrepreneurial activities are below average (<https://www.gemconsortium.org/economy-profiles/czech-republic>).

Stakeholders repeatedly highlighted that the majority of business owners are not ambitious and are hesitant to adopt innovations, even incrementally, as long as the enterprise is profitable. Innovation diffusion policies should target these firms differently than the much smaller segment of (mostly young) enterprises with high growth ambitions.

Every region in the Czech Republic has introduced some initiatives to improve the attractiveness of setting up business and promote a culture of innovation in existing enterprises. The initiatives in the Zlín region are fairly representative and include the following:

- A contest to award the most innovative company called “Innovation Company of the Zlín Region;”
- An Entrepreneurship Academy which encourages entrepreneurship and creativity;
- An ongoing pilot project to foster entrepreneurship and creative thinking in secondary schools.

Entrepreneurial culture could also be strengthened in government bodies and academia

At the same time, government bodies and civil servants are often also perceived to lack an entrepreneurial culture. This is manifested in support schemes with cumbersome and time-consuming application procedures, and a limited appetite to guide entrepreneurs and small business owners through the policy landscape in a language they can easily understand. In addition, there are scant opportunities for collaboration between different regional government bodies. While there appears scope for peer-to-peer learning to take place and the adoption of good practices from one region to another, this is reported not to happen often, and not in any systematic way.

Finally, interactions between higher learning institutes and businesses are also stymied by cultural factors. Faculty staff and management are reportedly sceptical concerning the commercialisation of research, providing guidance and services to firms in need of specific expertise, or labour mobility between the academic and business world. These activities are often not considered as an integral part of the mission statement of universities and related institutions. University personnel collaborating with for-profit businesses are reportedly even regarded with suspicion by some of their peers. This mindset will hinder efforts to form academic-industry partnerships and hamper scaling-up of existing initiatives in this area.

Managerial skills are often lacking

Managerial skills have repeatedly been described as weak, possibly because of an educational system that does not sufficiently prepare for entrepreneurship. Some of the key skills that are reportedly lacking relate to human resource management and business finance. The issues are reportedly especially apparent in smaller businesses, which cannot recruit personnel with specific skills complementary to the business owner.

Regional variations

Workforce skills are not distributed uniformly across the country

The statistical annex to this publication shows considerable variation in terms of key indicators related to skills between the best and worst performing regions. For example, the combined region of South Bohemia and Plzeň (NUTS2 Jihozápad) lags behind the country average in terms of the share of the population with tertiary education, as well as the proportion of the workforce in training. NUTS2 Jihovýchod (Vysocina and South Moravia), by contrast, score relatively well on both indicators, but this is due to the above-average values of the South Moravian region.

Regions with a legacy of heavy and extractive industries face additional challenges

Although difficult to compare or quantify, some regions highlighted particular difficulties in terms of entrepreneurial culture. The economy in the Moravian-Silesian region, for instance, has traditionally been dominated by heavy industry and SMEs represent a smaller share than is the case in other parts of the country. Working for a manufacturing incumbent may be considered as a more appealing career option in this region than in others as a consequence because of this legacy. This hampers policy initiatives to stimulate entrepreneurship and boost start-up rates. In other regions, lacking this economic background, people may have more of an appetite to start their own business (or work for a start-up).

Similar challenges are apparent in Usti and Karlovy Vary, two other regions with a history of heavy industry and coal mining. The three aforementioned regions have been classified as “coal mining regions.” To overcome these challenges, and the challenges posed by the structural decline in coal mining jobs and activities more generally, the Czech Government designed the “RE:START Strategy.” This overall strategy to transition these regions into a more sustainable footing is currently being implemented, broken down into 65 measures in action plans. Overall, the strategy emphasises the importance of strengthening R&D activities and innovation diffusion as part of this strategy (European Commission, 2019^[11]).

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3. Innovation diffusion channels

Knowledge and ideas can flow through different channels. These channels include collaboration between SMEs and foreign direct investors (FDI) and supply chain relationships in global value chains, workers changing jobs between firms and between firms, higher education institutes (HEIs) and public research institutions (PRIs), collaborations between firms and HEIs, including university spin-offs, and knowledge exchanges in clusters and peer-to-peer learning networks.

3.1. Foreign direct investment (FDI) and global value chains

Overall insights

There are untapped opportunities for FDI to have spill-over effects on indigenous firms in the Czech Republic...

The Czech Republic has successfully attracted increasing investments from abroad, mainly from other EU countries (with Germany and the Netherlands representing the most important sources of FDI in the country). The stock of FDI as a percentage of GDP has grown six-fold between 1993 and 2018 with motor vehicle manufacturing, financial services, wholesale and retail the main sectors driving this trend. Almost one-third of all jobs in the country are provided by multinational firms. In addition, labour productivity in these companies is around 60% higher than in indigenous enterprises (Szabo, 2019^[20]).

Among central and eastern European countries, the Czech Republic has the highest FDI stock and per capita inflows, according to data from the Business and Investment Development Agency. The Agency highlights investment incentives, the availability of a skilled and relatively inexpensive labour force, and the geographical location in the heart of Europe as key assets to attract foreign investments (<https://www.czechinvest.org/en>). During interviews, industry zones were also highlighted as important factors behind decisions to invest in the Czech Republic, especially in the period after transitioning from a planned economy. They are typically well located and provide the necessary utilities and infrastructure.

... but many foreign large companies are inward-looking

These observations indicate that there is ample scope for innovation diffusion from large foreign enterprises to local Czech firms. However, stakeholders report that multinational firms in the Czech Republic are often inward-looking and not open to reach out to the local business community and/or include indigenous firms in their value chains. A recurring observation was that foreign companies active in the country through branches and subsidiaries typically have limited autonomy and decision power, thereby limiting the potential to use local suppliers, set up collaborative research projects, create spin-offs and so on. This holds especially true, according to interviewed stakeholders, for branches of foreign firms that are active solely in production and/or logistics, and have limited R&D activities in the Czech Republic.

However, several stakeholders reported a mentality shift in recent years, at least among some firms, and a tentative movement to collaborate with local enterprises in various ways.

A meta-analysis of empirical studies about FDI spill-over effects in the Czech Republic confirms this anecdotal evidence. More recent studies indicate stronger spill-over effects than studies exploiting older data. All in all, a 10-percentage-point increase in foreign presence is likely to lift the productivity of domestic firms by 11%. For joint ventures involving Czech firms, the latter number even rises to 19% (Hampl and Havranek, 2018^[12]).

Governments try to connect large (foreign) companies with small indigenous ones mainly through Czechinvest and Czechtrade

Governments, especially at the local and regional level, can facilitate linkages between large companies and SMEs mainly by organising match-making events, bringing together local companies with sufficient “absorptive capacity,” large firms and other innovation diffusion actors.

Czechinvest, the Investment and Business Development Agency of the Czech Republic, is an important actor in this area. It not only tries to attract foreign direct investments to the country, but also provides information to indigenous companies with the ambition of becoming part of the value chain of multinationals.

CzechTrade is the public trade promotion agency of the Czech Republic. As part of its mandate, the organisation links foreign companies with potential indigenous partners called the Czech Business Partner Search and has a database with information relevant for foreign companies that want to become or are active in the country with relevant information and potential local partners.

Stakeholders emphasised the importance of identifying the right contact persons from multinational enterprises and establishing a solid, long-term working relationship. The success of efforts from regional or national authorities or SME associations to foster links with multinational enterprises present in the country are reported to be much greater if such a relationship has been created.

The Czech Republic aims to attract FDI with innovation potential

In addition, the central government has introduced new legislation related to FDI (implementing Regulation (EU) 2019/452 from the European Parliament and Council). The so-called “Foreign Investment Review Act” came into force on 19 April, 2019. This establishes a framework for screening foreign direct investments by the Czech Ministry of Industry and Trade.

The Ministry aims to more actively attract activities higher up the value chain and with more of a focus on R&D. In 2019, the government adopted an amendment to Act No. 72/2000 Coll., On investment incentives. This shift has implications for investment incentives that are provided with a preferential treatment of projects with higher value added, particularly technology centres, which will newly be able to obtain cash grants for job creation and training and retraining of new employees in all regions of the Czech Republic with the exception of Prague.

This general approach contrasts with the past when the labour-intensive FDI tended to be attracted. This shift, if successful, may boost FDI as a driver of innovation.

Regional variations

FDI is unevenly distributed, despite policy efforts to the contrary

The Czech Government tries to diversify FDI flows across the country. Grants and subsidies are higher in regions with high unemployment, for example. Nonetheless, FDI attraction has traditionally been concentrated in the capital region, which is home to more than half of the inward FDI stock (around twice its contribution to the Czech GDP). At a considerable distance, Central Bohemia is the second-most FDI-

intensive region, accounting for 10 to 12% of the FDI stock. By comparison, FDI activities are modest in Central Moravia and the North-West of the Czech Republic, each accounting for around 3% of outstanding investments (Szabo, 2019^[20]). As a consequence, the scope for innovation diffusion from FDI also varies significantly within the country.

In addition, there are differences in the average productivity level of foreign firms based in the country. The region of Prague, in particular, hosts a higher share of foreign-owned firms in the upper productivity segment than the rest of the country, as the statistical annex to this report illustrates. The large presence of foreign firms, as well as their high productivity on average, explains to some extent why there is a large productivity gap across firms in the capital region, suggesting significant (untapped) potential for knowledge spillovers.

Only a segment of foreign firms plays a large role in innovation diffusion

It should be noted that the presence of foreign firms is not a sufficient condition for (large-scale) innovation diffusion to take place. Some investments are more likely to generate positive spill-over effects than others. Multinational firms often use their own foreign suppliers and have little interaction with the local business community. Both the level of autonomy of subsidiaries based in the Czech Republic, as well as their activities are considered as crucial parameters. Karlovy Vary and Liberec, for instance, are home to a number of foreign companies. Nonetheless and a few notable exceptions aside, these companies are not deemed by stakeholders to be important drivers of regional innovation, reflecting their low autonomy and innovation intensity.

This sentiment was echoed in many other regions, for example by experts based in Ústí nad Labem and is in line with independent analysis. A 2018 study by the OECD for instance, highlighted that “despite the high integration in GVCs, the value-added resulting from this participation is low and most jobs are in less knowledge-intensive sectors (e.g. mass assembly in the automotive industry).” The report suggests putting more efforts into place for “chain upgrading”, i.e. “participating in new GVCs that produce higher value-added goods or services, often leveraging the knowledge and skill acquired from the current participation in GVCs” (OECD, 2018^[31]).

Empirical studies about the impact of FDI on the productivity of local enterprises often show mixed results, possibly as a result of the composition of current foreign direct investments. Government intervention may be appropriate to foster ties, but have occurred with varying intensity and success in the Czech Republic. The Czech Government is therefore focussing attention on attracting R&D-intensive FDI (rather than low-value added industries that are primarily interested in cheap labour), as described in more detail above.

There are some success stories in creating linkages between FDI and SMEs

While the presence of a multinational company is not a sufficient condition to realise innovation spillovers to the wider regional community, some experiences are testament to the potential. South Moravia is a case in point of a region where there have been some recent improvements in relationships between multinational firms and local enterprises. The regional government has organised several “breakfast and brains” events, which discuss issues of importance for businesses located in South Moravia, both among small, indigenous firms and large foreign companies. The creation of a solid network of business owners and entrepreneurs with the necessary mindset and organisational capital to add value to these discussions represents a key success factor. Another one is to find the right person(s) from large companies, who can champion possible partnerships and knowledge sharing arrangements within their firm. These meetings bring benefits only in the long term, as it takes time to create trust among its participants, and require resources to properly manage, but are perceived as very valuable and a key vector for innovation to trickle down to local firms.

As a concrete example of a successful case, Honeywell, an American industrial conglomerate, opened an R&D Centre of Excellence in 2015 in Brno, an investment of USD 10 million, the largest in Europe. This includes an innovation lab, which enables the firm to open up its research facilities to selected indigenous firms, share research and conduct open innovation projects. This experience is perceived as a good model for other large firms present in the region.

Preciosa is a Czech multinational company headquartered in the Liberec region, and with branches in seven other countries. It is one of the few large employers in the region (where the automotive sector is relatively important) that invests heavily in R&D, has established several smaller companies and works (in part) with local suppliers.

More could be done to connect large foreign companies with small indigenous enterprises

Other regions are reported to organise similar events, but they are not ubiquitous in the Czech Republic. In addition, the periodicity of these meetings, the issues under discussion, the engagement and buy-in from multinational firms and involvement of regional governments appear to vary significantly across the country.

Both Czechtrade and CzechInvest have regional offices throughout the country. However, their presence and linkages with other innovation diffusion actors appears uneven across the country. Multiple interviewees were not aware of their activities. On other occasions, their activities (and personnel) were described as quite modest with limited impact on the diffusion of innovation in the region.

The office of CzechInvest in the region of Zlín, however, could be a good example for other offices in the country. Among other activities, they organise workshops, sometimes also inviting representatives from abroad, where peer learning takes place. They also provide a “market screening” service upon request (and against a fee). The office has a database of local companies and offers recommendations when contacted by foreign enterprises in need of a local partner.

3.2. Labour mobility

Overall insights

Labour mobility is considered a crucial driver of innovation diffusion, but hard to quantify

There is generally a strong link between labour mobility, broadly defined, and knowledge diffusion and innovation. This especially holds true for highly educated, so-called knowledge workers changing jobs. Empirical evidence shows that labour mobility of knowledge workers has a positive and strongly significant impact on firm innovation output, as measured by firm patent applications. Interestingly, the effect is strongest for intra-regional labour flows (i.e. within the same region, not across regions) (Braunerhjelm, Ding and Thulin, 2020^[7]).

The movement of workers is indeed widely perceived as a crucial driver of innovation diffusion by interviewed stakeholders in the Czech Republic. For instance, interviews of entrepreneurs in the Moravian-Silesian region revealed that they consider the experience acquired while working for large companies as vital for starting their own business successfully.

The tight labour market could spur raise competition for talent, and thus open up opportunities for “knowledge embodied in labour.”

Nonetheless, the extent to which labour mobility contributes to the diffusion of knowledge is hard to measure, in part because of labour mobility as such is only rudimentarily documented.

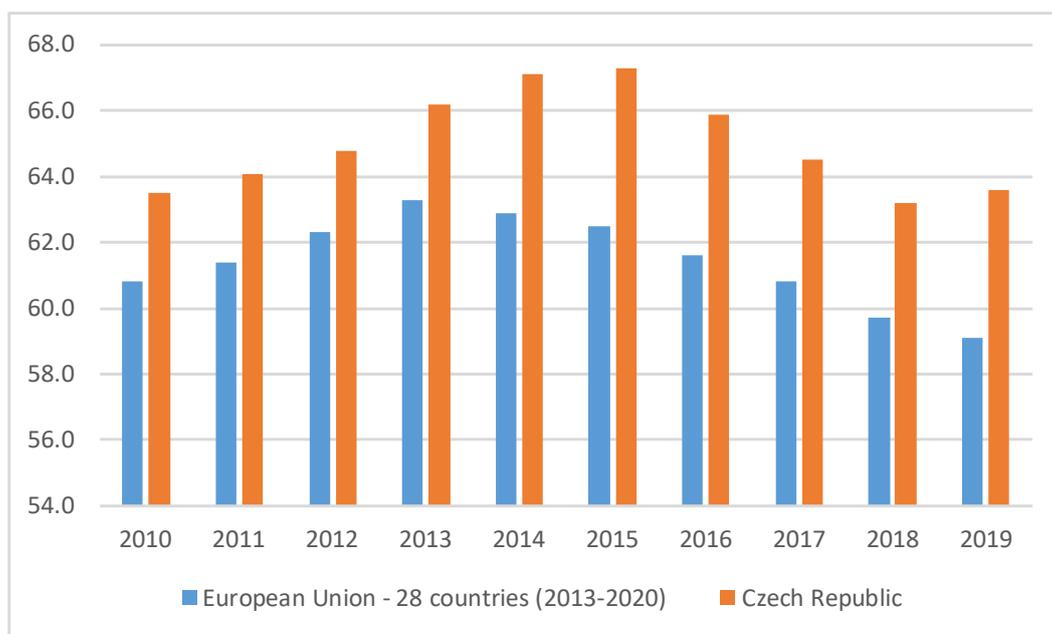
Job mobility is limited in general

The OECD 2018 Economic Survey of the Czech Republic (as well as previous editions of the same publication) recommended that the Czech Republic take more action to boost labour mobility, by improving the functioning of the private rental market, lowering the cost of closing a business and easing the stringency of employment protection legislation (OECD, 2018^[5]).

Bearing limitations to the data in mind, it appears that job tenure is relatively high in the Czech Republic or, indicating that fewer employees move jobs, on average, than in other EU 28 countries (see Figure below). More granular data, capturing job mobility across sectors or regions, are not available unfortunately.

Figure. Job tenure is higher in the Czech Republic than in most other EU countries

Percentage of 20-64 year olds with job tenure of at least 60 months, EU 28 average and the Czech Republic, 2010-19



Source: Eurostat, own calculations

This is in line with the viewpoint of many interviewed stakeholders, who generally consider job mobility to be generally weak based on anecdotal information. The main exception would be personnel employed by large companies, who reportedly move jobs more frequently, both within their own company and to other large firms. Job mobility across different actors of the economy (for instance from large companies to SMEs, academics to businesses or between the public and private sector) was consistently described as uncommon. Cultural factors were typically raised as to why labour mobility is regarded as weak.

Moving jobs among HEIs remains relatively uncommon

Although hard to quantify, several stakeholders reported limited labour mobility among HEIs as an important issue holding back knowledge from spreading. It seems commonplace to remain at the

organisation where one graduated and the influx of researchers from other organisations, both domestic and foreign, is limited. Stakeholders saw this as especially true for smaller institutions. This “inbreeding,” as it was sometimes referred to, inhibits ideas from spreading. Some institutions, especially larger ones, have taken action to recruit talented staff, including from other countries, for example by setting up welcome centres.

There are few levers at the disposal of policy makers to encourage labour mobility

Stakeholders reported there to be little scope for policy intervention to encourage labour mobility with the possible exception to motivate people to move in areas with labour shortages. Welcome centres that facilitate relocation have been established in several parts of the country, catering to the diaspora population and migrants without pre-existing ties to the Czech Republic and even Czechs who have moved within the country. Improving the attractiveness of the region, such as through infrastructure projects and marketing campaigns were also repeatedly mentioned as possible means to stimulate labour mobility.

Regional variations

All Czech Republic regions are suffering from the issue that limited labour mobility among organisations is reducing the opportunities for innovation diffusion. This is likely to be particularly the case for relatively peripheral and economically lagging regions of the country that are losing population. Tools that regions can introduce that may make a difference include welcome centres for migrants and regional marketing. However, an increase in labour mobility is also likely to require more fundamental change in labour market institutions at national level.

3.3. Business collaboration with higher education institutions (HEIs) and Public Research Institutions (PRIs)

Overall insights

HEIs are sceptical of working with the local business community

Stakeholders often report limited interactions between the academic world and businesses in the Czech Republic. The main issue appears to be a general unwillingness of many institutions to collaborate with other public actors and especially for-profit businesses. In a similar vein, there is a perceived reluctance to produce output of relevance to (small) firms and to market research of potential use in a business environment. Matchmaking events and other efforts to connect the academic and business communities have had mixed results, largely because of these difficulties.

In addition, even when there is a willingness from the academic sector to engage with businesses, there is often no structure or model in place to facilitate the process.

This anecdotal evidence is supported by research from the European Commission which revealed comparatively weak cooperation between the private sector and academia in the Czech Republic compared to most other EU countries, for example as evidenced by the low share of public-private copublications. Collaborations, when they do occur, typically happen on an ad-hoc basis (European Commission, 2019^[3]).

The prevailing reluctance to engage with the business community contrasts with the experience of some other countries where industry-HEI collaborations have a long tradition, and are considered as a “third mission” by HEIs alongside teaching and research.

Academic spin-offs are rare and deemed overly complex

In OECD countries, academic start-ups account for around 15% of all start-ups. They are especially prevalent in science-based technological fields. In addition, academic spin-offs have a significantly higher propensity to patent than non-academic start-ups (OECD, 2019^[6]).

Data for the Czech Republic is not collected on a systematic basis, but there was broad agreement among regional stakeholders that this represents an area with ample scope for improvement. There appear to be few incentives for institutions, as well as for individual researchers, to create and work for an academic spin-off in the Czech Republic. In addition, the legal framework and (internal) procedure to create a spin-off and establish an appropriate licensing agreement, appears not to be clear and is time-consuming for most HEIs active in the country. Obtaining financing, as well as establishing clear rules of ownership and intellectual property rights are further problems.

Charles University in Prague is the only HEI in the country that has set up a completely independent subsidiary fund with the aim to initiate and develop spin-offs. This model appears to work well and a similar approach to ease procedures could potentially be established throughout the country.

Regional variations

The presence of HEIs represents a limiting factor in some regions

The regional location of HEIs impacts the extent to which collaborations with the business community can be established for obvious reasons. The Prague region, for instance is home to some of the best universities of the country. Unsurprisingly, collaborations between HEIs and businesses appear more common than in other regions. Vysocina, by contrast, is a largely rural region without a university, limiting the potential for linkages between HEIs and businesses. Karlovy Vary, the region with the lowest number of inhabitants in the Czech Republic, also lacks a HEI, and this represents a barrier to develop a full-fledged innovation eco-system. In Hradec Králové, the absence of a technical university is also regarded as a major issue.

Academic research underlines the importance of universities and public research institutions for business innovation. Firms that are located within 30 kilometres of a research institution have a significantly higher probability to file EPO patent applications, all other things equal (OECD, 2019^[6]).

However, there appears to be scope to stimulate innovation diffusion and adopt good practices in every region to some extent. Vysočina, for instance, has a polytechnic institute and a potato research institute. The latter undertakes research on more resistant crops, increased crop yields and other research relevant to an important agricultural crop in the region. From its inception, the institute had a mandate to transfer its R&D findings into agricultural practice, and is in close contact with farmers in the region (and beyond). It provides consultancy services, in the field of economic consultancy, technological consultancy and cross compliance. Already in 1998, an association was formed with 35 potato producers across the country, especially from the Bohemian-Moravian Highlands. Consulting activities are provided on a regular basis for these members.

While not replacing the need for HEIs based in the region to anchor innovation activities, (small) companies also benefit from HEIs in nearby regions.

Some universities are more active in collaborating with businesses than others

At the same time, the presence of HEIs does not guarantee knowledge spill-overs into the regional economy. Prague, for instance, has been described as a victim of its own success. While home to many HEIs, many of them do not (systematically) engage with the business community and policy makers may be complacent to actively foster closer linkages. On the other hand, and despite the aforementioned

difficulties in connecting HEIs with the business community, some institutions were highlighted by stakeholders as being further advanced in this area.

The Technical University of Liberec, for instance, reportedly collaborated with around 200 companies in 2019, which they perceive as part of their core business (in contrast to many other HEIs in the country) and a considerable source of revenue. As a technical university mainly conducting applied research, the institution is well placed to provide services to enterprises in need of expertise. Rather than relying on a central transfer office, different faculties have staff members who act as “liaison officers” and contact points, who look for opportunities in this area and match both parties involved. The Technical University of Liberec, together with like-minded science-research organisations, the public sector and selected businesses established the AMIA (Advanced Materials Industrial Association) 2013 as part of the Copernicus programme. This organisation aims to support cooperation among the participants in a systematic and structured way, especially to enable individual companies to get support on specific technical issues.

CEITEC represents another good policy practice. CEITEC (the Central European Institute of Technology) was founded by a group of universities based in Brno and research institutes with support from the City of Brno and the regional government of South Moravia. It is foremost a partnership among research organisations with a focus on basic and applied research in advanced nanotechnology and micro-technology and advanced material. In addition, however, they also have close ties with businesses in the region. This involves providing training and other business development services on a needs basis, facilitating internships from academic personnel to businesses and vice versa, and the sharing of research facilities.

Another example is the University of South Bohemia (SBU) based in České Budějovice. It is well connected to the South Bohemian Science and Technology Park (JVTP) and has an active cooperation with companies in the fields of biotech, fishing, cosmetics and virtual reality. It provides laboratory capacity, contract research, licensing and professional consultation, active support in setting up spin-off and start-up companies and consultation on how to protect the results of your own research. Students are often sometimes assigned concrete business cases coming from companies active in the region as part of their thesis.

Some current arrangements that work well could potentially be scaled up and improved

At the same time, even if partnerships or modes of collaboration exist, they could often be scaled up significantly. For example, a sizeable number of business owners of the Moravian-Silesian region reported that research collaborations with HEIs (such as the Technical University of Ostrava) benefitted their business. At the same time, these collaborations appear to take place on a small scale only, indicating scope to expand current engagements. The Science and Technology Park of Palacký University, based in the Olomouc region, provides consulting services to businesses and competitions for students and employees of university to address real-world business cases. More financial resources would enable the expansion of these activities, including to parts of the region currently not well covered (in particular the Jeseník-Šumperk region). The University of Hradec Králové has realised a single spin-off (related to sensors and “smart sensors”). Nonetheless, this experience may be a catalyst to improve the procedure henceforward, in particular to simplify the conditions for establishment, approval and financing arrangement and shorten the deadlines, and this is reportedly underway.

3.4. Clusters

Overall insights

There are a good number of cluster organisations active in the country

The National Cluster Association of the Czech Republic (NCA) is an umbrella organisation bringing together cluster organizations and cluster-supportive bodies in the country. 31 organisations with legal structures are members, with more cluster organisations in the pipeline (for instance one on nanotechnology and another one on chemicals in the Usti region). Clusters, and especially formally organised cluster organisations are considered important vectors for innovation diffusion. Several of these organisations have received a label from the “European Cluster Excellence Programme,” indicating relatively strong cluster management skills, strategies and joint activities through benchmarking, training and mentoring.

Czechinvest, the Investment and Business Development Agency of the Czech Republic, has developed a programme to promote innovation and raise business competitiveness through clusters. This support includes the provision of cluster mappings, feasibility studies for cluster projects, creating collaboration platforms between companies, logistical and infrastructure assistance.

Ensuring sufficient coordination among stakeholders represents a challenge. This appears especially manifest among HEIs, which often want to specialise in the same research field, thereby causing fragmentation in the available expertise, and reducing the diversity of clusters across the different regions of the country and a specialisation of innovation activities matching true regional advantages. The National Cluster Association is an important actor for developing cluster policy in the Czech Republic and improving collaboration and coordination across the different organisations.

Regional variations

The presence of a research institute and or a large company can act as a catalyst for clusters

A first observation is that clusters in the Czech Republic are sector-based. While cluster organisations are typically based in a region where the relevant economic activity is concentrated, they represent firms (and other stakeholders) throughout the country. The mix of regional and national actors in the cluster organisations is beneficial for innovation diffusion in the country. Whilst maintaining national pipelines, the cluster organisations often play a key role for regional innovation eco-systems, bringing together the main “helix” actors.

Research organisations or large companies often function as cluster anchors. In the Moravian-Silesian region, for instance, the development of an ICT-cluster benefitted substantially from collaborations and technical expertise of the Technical University of Ostrava and the associated Moravian-Silesian Innovation Centre (MSIC). In addition, Tieto Oyj, an IT services and software company from Finland, has a site in Ostrava (and one in Brno), which spurred related activities in the region.

In South Moravia, as another example, there is an emerging gaming cluster. Firms active in this sector, or the creative industry more generally, are reported to share insights and collaborate through the relevant cluster organisation.

Only a few cluster organisations have set up partnerships with organisations outside of the country

The Nanoprogess cluster, based in the Pardubice region, which focuses on researching and developing functionalized nanofiber structures and their industrial and medical applications, is an exception, having established international partnerships with 14 organisations across Europe. CLUTEX, the cluster of technical textiles, based in Liberec is another example bucking the general trend. It set up the Tex4IM partnership, which aims at bringing together the main European textile-based clusters in countries/regions where the textile and clothing industry represents a significant share of the national/regional economy. In 2020, the partnership included 8 members from across Europe.

The aim of such partnerships, among others, is to enhance knowledge capacity for its members by learning about business practices and experiences. Such arrangements likely benefit the flow of ideas for their members, and therefore constitute a good practice that other cluster organisations can benefit from.

Some clusters organisations are very small and lack clout

The Plzen region, for instance, is home to two cluster organisations, *Cluster Chytrý Plzeňský kraj, zs* and *Cluster MECHATRONIKA, zs*, for smart regions and for mechatronics (a brand of engineering) respectively. Both of these organisations reportedly only have a handful of participating companies and regional institutions as members and have limited activities and ways to influence policy making. Reinforcing cluster organisations can play an important role in supporting innovation diffusion in Czech regions.

4

4. Innovation diffusion intermediaries

This section explores the role of innovation diffusion intermediaries, i.e. organisations that are key in facilitating the transfer of innovation, such as chambers of commerce and business associations, public business support providers, technology transfer offices and accelerators, incubators and technology parks. Key attention is paid to how these organisations link different actors together and allow innovation to flow from one segment of the economy to another.

4.1. Chambers of commerce and business associations

Overall insights

Chambers and business associations are not very active in the dissemination of innovation and knowledge in the Czech Republic

In many countries, chambers of commerce and other organisations representing entrepreneurs and business owners play a vital role in diffusing innovation among businesses in general and disseminating good (managerial) practices in particular. They provide a vital platform for peer learning activities to take place. In addition, they are often an important intermediary for policy makers to interact with, share information about relevant legislation and public support and to voice the concerns and needs of the (local) business community to public authorities. The latter point is often deemed crucial for small firms, which find it more difficult to reach out to policy makers than their larger counterparts.

In the Czech Republic, business associations play a less active role in supporting innovation diffusion than in some other EU countries and focus mainly on their representative role towards the government. Many stakeholders highlighted limited interactions and lack of awareness of potential activities of chambers of commerce and similar organisations. This is partly explained by the fact that membership is not obligatory as in some other countries such as Germany. In addition, these organisations, even when active and engaged with (local and regional) policy makers, are not always perceived as relevant for innovation diffusion, but rather provide generic advice, for example on how to establish a new company.

Regional variations

The outreach and activities of chambers of commerce varies significantly across the regions

Despite the generally limited involvement of chambers and business associations, regional differences are apparent with some regions bucking the trend. In the Hradec Králové region, for instance, chambers and similar organisations have around 450 companies of all sizes in their database, and they do organise events where peer learning takes place (in addition to other platforms related to their Research and Innovation Strategies for Smart Specialisation, RIS, in particular for the electronics, biomedicine and

textiles sectors). As another example, the chamber of commerce in the Karlovy Vary region, the smallest region by population in the Czech Republic, has around 250 members of different sectors, and organises various events, webinars and workshops, for example to exchange practices on how to internationalise or to inform their members of changes to the legal framework and the support measures they may be eligible for. In South Bohemia, chambers provide a range of services to their members, for instance related to training, networking meetings, consulting services, assistance in finding foreign employees, support for vocational training and support for cooperation between schools and companies.

By contrast, organisations representing (small) businesses have limited outreach in the Plzen region, among others, and are thus not perceived as a useful organisation to partner with by policy makers, who have to communicate and reach out to individual companies as a consequence. In Vysocina, where chambers and other similar organisation play only a minor role, there are only a few platforms on specific issues where peer learning takes place, for instance the “Raising awareness of the Industry 4.0 among companies in Vysocina.”

There are mixed viewpoints regarding the need for additional support to develop peer-to-peer learning platforms

In some regions, there are reportedly few alternative platforms where entrepreneurs and businesses owners can share their experiences and could facilitate peer-to-peer learning. Even in regions where peer-to-peer activities take place more frequently, for example organised by cluster organisations, business accelerators or innovation centres (for instance in the Usti region), stakeholders reported a need for more (logistical and financial) support to meet the untapped demand. The region of Central Bohemia provides a counterexample, with policy makers describing ample opportunities to engage in peer learning, mostly through informal networks. The city of Prague, where the Business and Innovation Centre organises informal seminars was sometimes referred to as an example to follow for areas lagging behind in this respect.

4.2. Public business support providers

Overall insights

Innovation vouchers are a widely used instrument through which business development services are provided, both by the national government as well as by regions

“Innovation vouchers are small lines of credit provided by governments to small and medium-sized enterprises to purchase services from public knowledge providers with a view to introducing innovations (new products, processes or services) in their business operations. The main purpose of an innovation voucher is to build new relationships between SMEs and public research institutions which will: i) stimulate knowledge transfer directly; ii) act as a catalyst for the formation of longer-term more in-depth relationships.” Amounts involved are typically modest, below EUR 10 000, and target smaller enterprises’ in need of external expertise. It is a popular tool among OECD countries to incentive SMEs, as well as research institutions to establish first relationships (OECD, 2019^[3]).

In the Czech Republic, innovation vouchers were first introduced by the South Moravian Innovation Centre in 2009. When first introduced, it was a subsidy of up to CZK 100 000 (around EUR 4 000). Vouchers can be used for product or service development, feasibility studies, the development of a business plan, market analysis and so on (OECD, 2014^[4]).

Similar schemes have later been introduced in other regions in the Czech Republic, where they currently constitute an important tool to introduce small-scale innovations to firms that otherwise have limited

exposure to public knowledge providers. They are provided by regional and sometimes city governments. The modalities and design of voucher schemes varies somewhat across the country; in Plzen, for instance, these vouchers are only awarded for collaborations with research institutions based in the region. In the Liberec region, they designed the so-called start-up voucher (in addition to the technology voucher and the innovation voucher, which are more common throughout the country), to address a perceived gap in the policy provision for start-ups. In Karlovy Vary creative vouchers have been introduced, with the aim to strengthen the marketing and branding capabilities of its beneficiaries.

At the federal level of government, the Ministry of Industry and Trade of the Czech Republic also awards vouchers to SMEs, typically of a larger ticket size and for more intense collaboration projects. The general perception of voucher schemes is very positive, and is often described as an instrument that has proven its worth and makes a difference on the ground.

Business development services are typically provided both by in-house and external consultants

Most business development service providers offer support through both in-house consultants and external experts, such as (former) managers and entrepreneurs, certified coaches, consultants and academics. Several stakeholders find it difficult to develop and maintain a network of external experts with the required expertise and track record. While there are some initiatives to share the pool of networks across regions and providers, these appear to be nascent and not very structured.

Regional variations

Innovation centres are important actors throughout the country, but their functions vary across regions

Innovation centres are spread across all regions of the Czech Republic. Each innovation centre has a different structure, ownership, activities, budget and resources however. The three examples below were perceived as successful models that other regions could follow, where their centres lag behind in terms of services and outreach.

The South Moravian Innovation Centre (JIC) was widely considered as a best practice in the country, and has significant resources and capacity at its disposal. It is an association of companies in Brno, that connects universities and research institutions with companies. It manages two technology incubators at Brno University of Technology and a biotechnological incubator in the university campus in Brno-Bohunice. Overall, it connects more than 100 experts that can provide business development services with more than 300 businesses and has a track record of 17 years (<https://www.jic.cz/>).

The Moravian-Silesian Innovation Centre (MSIC) could be considered as a good practice as well. Although it employs only around 25 people, it is an important actor in the local innovation eco-system. It provides free-of-charge consulting services to firms wishing to adopt different technologies (and also has a pool of external experts to rely upon when they lack the capacity in-house), and provides match-making services, both among businesses as well as between higher learning institutions and firms

The Innovation centre of the Usti Region (ICUK) acts as a one-stop shop for start-ups, established enterprises that require innovation support and businesses in need of consultancy services. Crucially, it provides various match-making services, connecting their beneficiaries to (potential) investors, academic partners and large businesses.

Other public service providers are scattered across the country

Public business service providers have been set up in larger cities across the country, as well as by regional bodies throughout the country. Their activities vary in terms of the content, outreach, eligibility criteria and so on.

A good example is the business development agency in Pilsen, owned by the City authority. The main goal is to support start-ups and innovative companies. The agency provides consulting services, premises, connections with science parks, services for internationalisation and assists clients with accessing support for financing, such as national grants or EU subsidies. A similar organisation, the regional development agency in Liberec, provides mentoring and networking for start-ups (and thus not for established companies).

4.3. Intermediaries facilitating knowledge diffusion from HEIs and PRIs

Overall insights

There is a good number of technology transfer offices (TTOs) active in the country

Since the mid-1990s, many OECD countries have established technology transfer offices, typically as units of universities. They support different steps in the commercialisation cycle. This includes dealing with patent applications, invention disclosures, pilots and prototypes, establishing spin-off companies, contracts with industry, identifying business needs, searching for partners and funding sources (OECD, 2019^[14]).

Transfera.cz (<https://www.transfera.cz/>), an association of technology transfer offices in the Czech Republic, has 42 members across the country, and most large universities, especially technical and science institutions, have adopted a TTO. Often, these institutions are affiliated with accelerators, incubators, or science and technology parks (see section below).

Regional variations

There are regional variations in the activities of transfer offices

Some TTOs appear more successful than others in transferring technology. InQbay is the TTO of the Czech Technical University (CTU), based in Prague, and could be considered a good practice. It aims to support the transfer and commercialisation of research results, but also to raise awareness and cultivate innovative thinking and co-operation and better connect the research of the CTU with industry. In addition, it manages the incubator at the CTU, provides specialised education to academics and researchers at the university and shares lessons learned with other technology transfer agents

The quality of the services provided by transfer offices crucially hinges on their staff. In particular, they have to be familiar with how a for-profit business operates and be able to “speak their language.” In addition, difficulties in finding an appropriate template to deal with intellectual property were also highlighted repeatedly. Licensing agreements were a common avenue, with a few universities having established a special purpose vehicle for direct and indirect commercialisation. Finally, many institutions reported that the current funding arrangements for researchers discourage transfer.

Regional innovation centres offer matchmaking services between academic institutions and businesses, with varying intensity

Regional innovation centres typically see a role to liaise between local businesses in need of innovation support and HEIs and PRIs. In some regions, this is already on track. In other regions, such as Olomouc, matchmaking services are currently not widely offered, but considered a key priority in the near future.

4.4. Accelerators, incubators and science and technology parks (STPs)

Overall insights

Accelerators, incubators and STPs are important vectors for innovation diffusion

Accelerators, incubators and STPs are widely considered by interviewed stakeholders as key organisations to disseminate innovation. The science and technology parks association of the Czech Republic (SVTP CR - <https://www.svtp.cz/>) represents science parks and similar organisations in the country that combine innovation and incubation activities (the latter referring to support to start-up and innovative SMEs).

Incubators tend to provide more comprehensive but less specialised training and mentoring, while accelerators often provide targeted support with management skills and strategy. Table 1 highlights the differences between both organisations.

Table 1. Differences and similarities between business accelerators and business incubators

	Business incubators	Business accelerators
Objective	Support business creation and development	Accelerate business growth
Service portfolio	Training: Entrepreneurship skills	Seminars: Management skills
	Mentoring: Focus on business model and initial business plan	Mentoring: Intense, with a focus on growth strategy
	Networking: Other entrepreneurs and actors in the broader entrepreneurial eco-system	Networking: Other entrepreneurs and actors in the broader entrepreneurial eco-system
	Access to finance: Grants or seed capital	Access to finance: Debt or equity
	Other: Managerial support (e.g. accounting), access to specialised equipment	
Service provision	On-demand	Mandatory and provided in a structured programme
Length of support	Often up to 3 or 4 years, or more	Usually 3 or 6 months
Business model	Mostly non-profit, with operating costs being largely covered by the rental fees collected	Mostly for-profit, associated with private venture capitalist funds (in the US) or a mix of private and public investors (in Europe)

Source: (OECD, 2020^[14]).

STPs are a broader concept, of which accelerators and incubators are often part of. Although STPs vary across the globe, they are typically characterised by the following:

- A localised economic development goal;
- A focus on fostering science-industry relationships;
- A priority placed on innovative and technology-based activities;
- The provision of value-added services to companies;

- A property-based initiative (European Commission, 2014_[15]).

Regional variations

Accelerators, incubators and technology parks are not evenly distributed across the country, and they appear to vary according to their size and activities they provide. The Science and Technology Park Pízen, for instance, is reported to be one of the largest in the country and an essential actor in the regional innovation ecosystem.

This is not the case in all regions in the country, however. By contrast, the Karlovy Vary region is home to two accelerators, but these provide only lease space and no business development services, and therefore are only of limited relevance for innovation diffusion. The region of Liberec lacks a science park, and this absence is perceived as problematic for the development of its regional innovation eco-system. The innovation intermediary infrastructure needs to be strengthened in these regions.

In other regions, these institutions have been established only recently, and their activities and awareness among the business community could be increased. Pardubice, for instance, set up its business incubator, P-Pink, in 2018. It provides a range of support measures, ranging from assistance to start a new enterprise, a six-month incubator programme, an accelerator programme, shared work space and so on. There appears to be scope, however, to scale up current activities and raise awareness among industry.

5

5. Conclusion and policy implications

1. There is a perceived need to further foster the linkages between relevant actors

A central takeaway of this exercise is that current efforts to strengthen linkages between the main stakeholders in innovation diffusion, both within the public sector and beyond, are considered as very welcome and should possibly be strengthened further. This should include representatives from university, industry and government, ideally complemented by civil society and the broader environment (in line with the so-called quintuple innovation helix framework).

The Smart Accelerator programme aims to initiate collaboration between the research, business and public sectors (among other ambitions), and is widely perceived as impactful and useful by interviewed stakeholders. It is financed by EU structural and investment funds of 2014-2020 programming period, and co-financed by national/regional resources.

Another good practice is the Moravian-Silesian Employment Pact (MSEP). This is a strategic partnership of all relevant actors in the region with the following signatories:

- the Moravian-Silesian region (as a founder of secondary schools within the region);
- the Regional Chamber of Commerce of the Moravian-Silesian Region;
- the Confederation of Industry of the Czech Republic;
- the Labour Office of the Czech Republic;
- the Regional Council of Trade Unions ČMKOS in the Moravian-Silesian Region;
- the Government Commissioner for Moravian-Silesian, Ústí nad Labem and Karlovy Vary Region;
- the Union for the Development of the Moravian-Silesian Region (EMCC, 2020_[19]).

The Employment Pact, while established in most of others regions, could be expanded in all of them. Its cross-cutting approach could be deployed for other policy areas relevant to innovation diffusion.

2. More could be done to identify and address skills shortages at the subnational level

Skills shortages were identified as a possible challenge for (innovative) companies with specific shortages apparent in different regions and sectors. Although the education system generally functions well, more could be done to better align the skills developed by training providers and both secondary schools and HEIs with the needs of the local business community, for example through lifelong learning activities. Keeping track of skills shortages, including at the subnational level, represents a first and necessary

condition towards improving the match between the demand and supply for skills in the labour market, as well as for better preparing for likely future skill need developments.

Platforms in each region with representatives of local businesses, providers of educational services and government could help to identify current shortages as well as predict future ones. Countries across the globe have established and/or strengthened such platforms in recent years. The Czech Republic has set up “Sector Councils” as a platform for systematic cooperation between employers and other stakeholders. Interviewed regional policy makers and other stakeholders appeared largely unaware of its activities, however, suggesting room for improvement to the current system. The Irish National Skills Council (NSC) and the nine Regional Skills Fora is a possible international good practice and learning model.

3. More information and good policy practices could be shared among policy makers active at the subnational level of government

Interviews with policy makers active at the subnational level revealed a lack of engagement from the central government. While this often pertains to shortages in funding, there appears to be a need for closer involvement from the central government in the design and implementation of relevant policies, and ensuring coordination. In a similar vein, there are untapped opportunities to share lessons learned and good policy practices among peers working at subnational government bodies. For example, there is reportedly little interaction between policy makers in the Central Bohemian region and the capital region, despite their geographical proximity.

The Smart Accelerator project aims, among other things, to establish collaboration between the innovation centres in the Czech Republic, and beyond, and holds the potential to professionalise these centres and adopt good practices more widely.

4. There appears to be more appetite for incremental innovation than for Industry 4.0 applications

Stakeholders repeatedly highlighted that Industry 4.0 applications and (digitally) transformative innovation projects are not within the reach of the vast majority of SMEs in the country that generally lack the capacity, willingness and growth ambition to disrupt their business model profoundly. Only a very small slice of the enterprise population appears ready to embrace innovation that is more radical, and policy making in this area should therefore be targeted to a selected and limited number of enterprises. In a similar vein, only a small number of indigenous firms have the potential to become part of the value chain of foreign multinationals, and efforts to increase the “absorptive capacity” to that end should therefore be focussed.

More incremental approaches to innovation, such as adopting better software or improvements to the accounting and administrative processes are thought more promising to stimulate the productivity of the bulk of active enterprises. This is relevant, for instance, for the development of digital innovation hubs across the country (an area where the Czech Republic lags behind many other EU countries), which need to combine specialised support for digital frontrunners as well as more generic and basic services for the bulk of the SME population.

5. Business support measures, especially in the area of innovation, are thought to be complex and overly cumbersome by many (potential) beneficiaries

Public support measures, despite some notable exceptions to the contrary, are generally perceived as complex and time-consuming in the Czech Republic. This is a disincentive to potentially eligible companies

to apply. The possibility of an audit, resulting in a fine or clawback of the provided innovation support, was considered as a major reason for many companies not to apply for government support programmes in the first place.

EU-funded programmes represent a case in point and were repeatedly singled out as too administratively complex. Possibly, the main reason why not all the support available at the EU level is not utilised at full capacity is because it is often perceived as “not worth it.” This holds especially for SMEs that have not received support in the past, and are unable to comply with the administrative requirements. Even larger enterprises reportedly often have to rely on expensive outside consultants to navigate them through the process. Several stakeholders highlighted the need to develop additional innovation instruments at the regional level with low application thresholds.

The need to reduce the administrative burden and support potential recipients of innovation support was often voiced by stakeholders. While stakeholders agreed with the need to be strict in the evaluation process for innovation support, government bodies active in this area should act more as partners and guide them through the process (for example in terms of proving innovation activities took place). The lack of qualified evaluators, in turn related to their remuneration, was also identified as problematic.

A comprehensive analysis of the above, and the extent the issue lies with the transposition of EU directives into national laws (the so-called “gold plating”) is beyond the scope of this report. In any case and given prevailing perceptions, policy makers in the Czech Republic would be well advised to reduce any unnecessary administrative burden of their innovation support to ensure enough take-up, especially by smaller companies.

Part of the reason why innovation vouchers represent a crucially important instrument for policy makers at various levels of governments is the relative ease to apply and receive support, enabling smaller enterprises with no prior experience in receiving government support to successfully apply. A counterexample is the aforementioned Knowledge Transfer Partnerships programme, which aims to foster links between HEIs and businesses. Participation in the programme is considered as particularly administratively complex and time-consuming from both involved parties. As a consequence, the take-up remains modest, especially for smaller businesses that often lack the administrative capacity to comply with the necessary procedures.

6. A formal and structured business angel association or federation would stimulate the diffusion of innovation to high-potential start-ups and young firms

The role of business angels in innovation diffusion appears limited, based on interviews with key stakeholders across the Czech Republic. The creation of a formal and structured association or federation could raise the profile of angels as a vector and stimulate joint investments (and thereby overall activities). A 2016 report by the OECD highlights that “federations raise awareness and visibility about angel investments to a wider public, collect and distribute data, provide training, mentoring activities and other services to (potential) investors, represent the sector to policy makers and aim to professionalise the industry by sharing good practices and developing professional standards” (OECD, 2016_[30]). The same report indicates that governments have a potential role to play in the creation and development of such an organisation by providing logistical or financial support. The study also highlights other possible policy tools to advance the market, such as tax incentives for angel investors, public-private co-investment schemes and investor-readiness programmes (OECD, 2016_[30]). The association should seek to be active in all regions and attract appropriate regional members and organise regional events.

7. Business development service providers could pool and share their networks of external experts more than they currently do

Business development services for SMEs, such as coaching, mentoring and training are provided by a range of organisations, at the national and subnational government (as well as private sector providers) levels, through a mix of in-house consultants and external experts. Stakeholders expressed an interest in sharing and pooling these networks so as to improve the quality of provided services, especially for specialised expertise, which cannot always be easily found within the borders of the region. This would also open up more possibilities to include foreign experts and hence diffuse innovation from further afield.

Possibly, there is scope to rationalise and harmonise the business development services throughout the country. This represents one area where there is scope to exchange lessons learned in a more systematic way than is currently taking place. In the Moravian-Silesian region, for instance, business development services are provided by the MSIC (Moravian-Silesian Innovation Centre), the MSID (Moravian-Silesian Investment and Development), the MEC (Moravian-Silesian Energy Centre), MS Pakt (Moravian-Silesian Employment Pact), as well as by private entities. This fragmentation, and reported lack of coordination among these bodies, also hinders the professionalisation of the offered services and wasted scarce resources.

The Platinn.cz network covers six regions in the country. This platform allows its members to share their experiences, but also their resources, such as experts, contact with investors and corporations and know-how, ultimately allowing entrepreneurs and to benefit from a wider range of services. It is perceived as valuable by its members and could be strengthened, both by increasing the geographical coverage as well as the intensity by which information and resources are pooled. As another possible good practice, the city of Prague is in the process of establishing a central organisation in charge of business development services, the Prague Innovation Institute.

8. The innovation support system is complex

A 2016 OECD study referred to the Czech innovation support system as a complex matrix of strategies, policy instruments, programmes and institutions. This fragmented nature makes it hard to assess the merits of the available support and raises the bar for entrepreneurs to identify and apply for the appropriate support (OECD, 2016^[11]). This observation appears to be still valid in 2020 with several stakeholders stating difficulties to navigate the support landscape.

As a case in point, many public institutions are active in the innovation and R&D domain. While the Ministry of Industry and Trade takes a leading role, other line ministries play a role too, as well as organisations like the Czech Science Foundation, the Academy of Sciences, the Technology Agency and CzechInvest (OECD, 2016^[11]). At the subnational level, many regions and cities have set up innovation support entities, in the form of innovation centres, co-working spaces, regional development agencies, incubators, regional innovation platforms and technology centres.

Efforts have been put in place to improve coordination between these entities to avoid overlaps, ensure a single point of access (for example by housing different support bodies in the same premises), streamline their activities and refer (potential) clients to each other. Nonetheless, stakeholders mentioned that structures and organisations still often operate in silos, consider each other as competitors for public support rather than partners to deliver services to their constituency and hence still have limited interactions with others active in the area. This was sometimes partly blamed on a lack of continuity and long-term vision from politics.

The situation was seen as unfavourable compared to the Polish innovation support system, which is deemed to be easier to navigate and provide a clear trajectory for (high-potential) firms in need of public support through different stages in their life cycle.

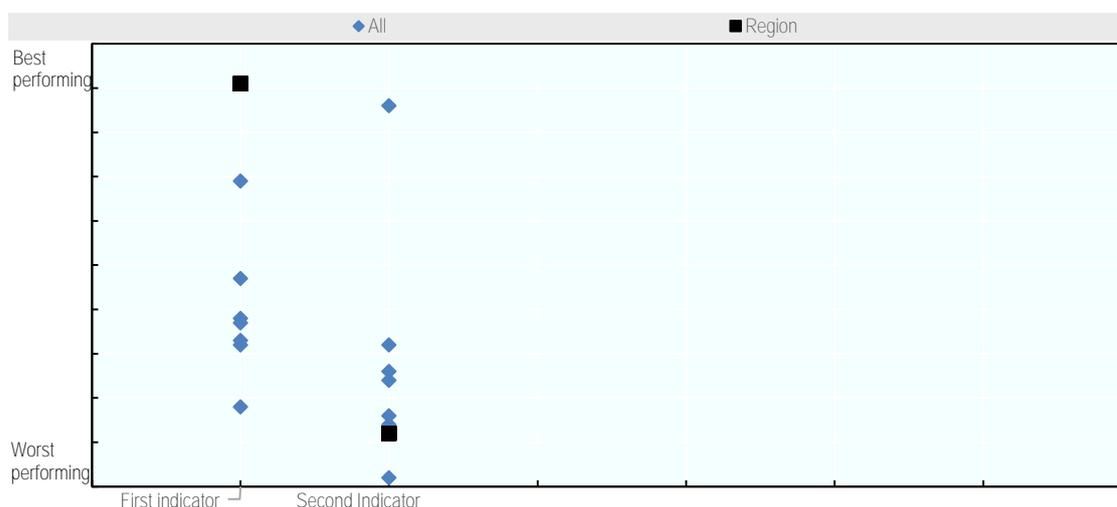
6 Annex: Regional profiles

Reader's guide

The regional profiles include one map that depicts the innovation performance of Czech regions according to the European Union's Regional Innovation Scoreboard (EU RIS, 2019) and highlights the strengths and weaknesses relative to other European regions on selected indicators. As the EU RIS, nearly all innovation-diffusion-related indicators are only available for the 8 *Oblasti* (NUTS 2 regions) rather than the 14 *Kraje* (NUTS 3 regions) that are the focus in the previous five chapters. Data sources for all indicators and elaborations on labels can be found in the Data annex.

The regional profiles includes different types of graphs to depict the performance along a wide range of innovation-diffusion-relevant indicators. The first type of chart are scatter plots that shows the performance of the Czech region relative to other regions in the Czech Republic and in relation to all other OECD regions with available data. In Figure 1, the region was the best-performing Czech region for the first indicator and the second worst performing region for the second indicator. Across OECD regions with available data, the Czech region is among the top-10% of OECD's regions, i.e. in the "top decile", for the first indicator and in the bottom 10-20% of regions, i.e. the second lowest decile, for the second indicator.

Figure 1. Innovation diffusion indicators – Regional rank charts

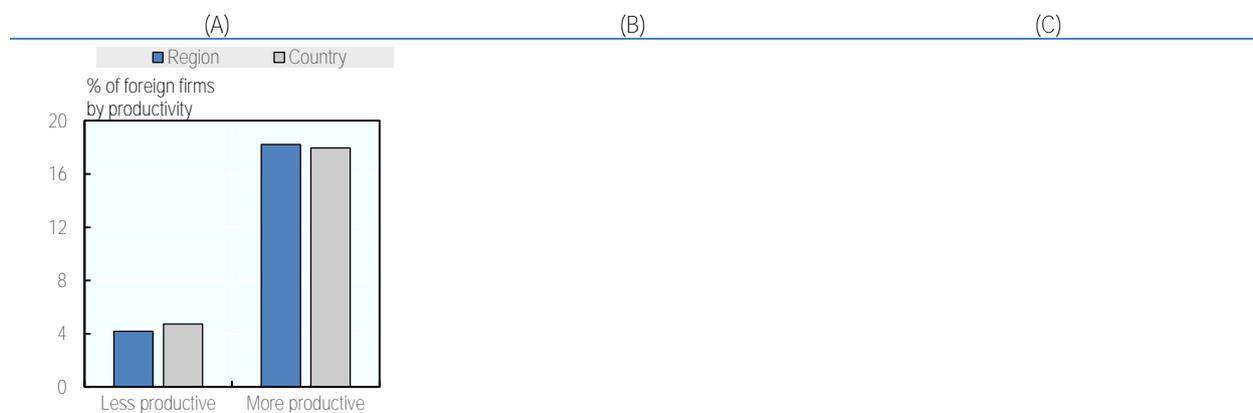


The second type of chart are bar charts provide information on the productivity performance of firms in Czech regions. The first (A) shows the share of foreign-owned firms among the top 10% ("more productive") firms in terms of labour productivity and among the rest of the firms in the region and the country ("less productive", i.e. the other 90% of firms). In this region the share of foreign-owned firms among the most productive is slightly higher than in the country as a whole. In both the region and the country foreign-firms are an important part of the productivity frontier.

The second (B) considers labour productivity in all firms and shows the labour productivity at the 20th percentile, the median and the 80th percentile, i.e. 20% of firms in the region/country have labour productivity below the 20th percentile, 50% of firms have labour productivity below the median and 20% of firms have a level of labour productivity in excess of the 80th percentile. In this example, firms with lower levels of productivity (below the 20th percentile and the median) are less productive than in the country as a whole, but the top-performing firms are significantly more productive (the threshold to be part of the top 20% is about 14% higher in the region than in the country). A key challenge for the region is therefore the underperformance of the long tail of lower productivity firms.

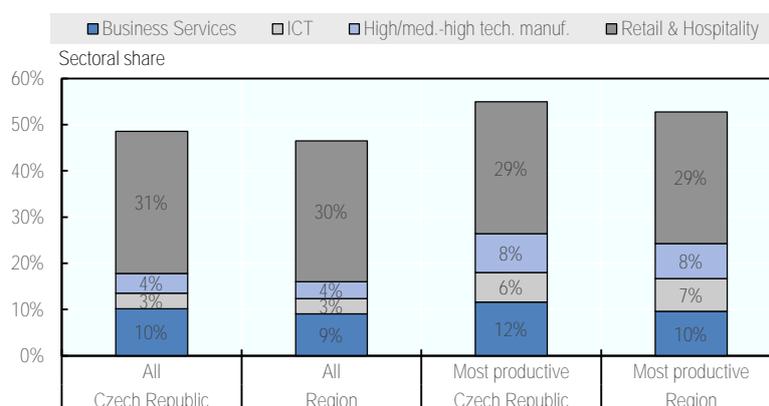
The third (C) chart shows the transition of firms from the bottom half (below median) part of the labour productivity distribution to the top 10% of firms in terms of labour productivity within three years. For the region, 1.6% of the firms in the lower half of the productivity distribution in 2012 became top-10% firms in terms of labour productivity in 2015. There was less upgrading of low productivity firms between 2015 and 2018 in both the country and the region and the advantage the region held compared to the country shrank.

Figure 2. Productivity performance of firms in the Czech Republic – Bar charts



The final type of figure is a stacked bar chart that compares the sectoral distribution of “All” firms (i.e. irrespective of their productivity) 1) in the Czech Republic (first stacked bar), 2) “in the region (second stacked bar) with the sectoral distribution of the most productive firms 3) in the Czech Republic (third stacked bar), 4) in the region (fourth stacked bar). Retail and hospitality services make up a large part of the overall firm distribution, which is reflected in their large share among the country’s and region’s most productive firms (29% of the top 10% most productive firms are in the sector). Importantly High-tech and Medium-high-tech manufacturers, ICT companies and those in business services are overrepresented among the most productive firms. Compared to the Czech Republic the region in this example has fewer highly-productive business service firms but slightly more ICT firms.

Figure 3. Sectoral distribution of firms in the Czech Republic – Bar chart



Sources of data

The analysis relies on different sources of data that are all available at the NUTS 2 level. For each source the most recent year with available data is used.

Innovation performance

Innovation performance uses the indicators of the Regional Innovation Scoreboard (2019) (Table 6.1).

Table 6.1. Innovation performance indicators

Indicators
% population aged between 25 and 64 in lifelong learning
% R&D expenditure in the public sector
% R&D expenditure in the private sector
% SME collaborating in Innovation
% SMEs innovating in-house or in collaboration with others
% SMEs with sales new-to-market or new-to-product
% SMEs with marketing or organisational innovations
% SMEs with product or process Innovation
% design applications (per million population)
% non-R&D innovation expenditure over turnover in SMEs
% patent applications (per million population)
% public-private copublications (per million population)
% trademark applications (per million population)
% population with tertiary education

Framework conditions

Table 6.2. Access to physical and digital infrastructure indicators description

Indicator name	Notes on the indicator	Source
% population with broadband access		OECD Regional Well-Being Database
Market access in terms of GDP	Total GDP accessible from the region where the GDP of surrounding regions is multiplied by a factor	(Adler et al., 2020 ^[11])

	inversely proportional to distance via highways in 2012	
Market access in terms of population	Same as above applied to population instead of GDP	(Adler et al., 2020 ⁽¹¹⁾)

Table 6.3. Access to skills indicators description

Indicator name	Notes on indicator	Source
% population 25-34 age with tertiary education	Data for 2015	OECD Regional Skills Database
% population 25-64 age with tertiary education	Data for 2015	OECD Regional Skills Database
% employment with tertiary education	Data for 2018	Labour Force Survey
% employment in training	Data for 2018	Labour Force Survey
% employment with tertiary education in SMEE	Data for 2018	Labour Force Survey
% employment in training in SMEE	Data for 2018	Labour Force Survey

Note: The sample selection applied for elaborations based on the Labour Force Survey consists of all individuals with an employment aged between 20 and 64 with non-missing information on: educational level (hat11lev), region of work (regionw), region of residence (region) and region where resident the previous year (region1y). SMEE employment amounts to individuals either working for firms with size less than 11 employees (sizefirm=10 or sizefirm=14) or working as self-employed, with or without employees (stapro=0).

Table 6.4. Access to R&D indicators description

Indicator name	Notes on indicator	Source
R&D personnel in higher education institutions (% total employment)	Data for 2015	OECD Regional Innovation Database
R&D personnel in the business sector (% total employment)	Data for 2015	OECD Regional Innovation Database
R&D expenditure in higher education institutions (% GDP)	Data for 2015	OECD Regional Innovation Database
R&D expenditure in the business sector (% GDP)	Data for 2015	OECD Regional Innovation Database

Innovation diffusion channels

Table 6.5. Internationalisation, GVCs and FDI indicators description

Indicator name	Notes on indicator	Source
Export share in the manufacturing sector	Data for 2010	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
Export share in the market services sector	Data for 2010. Market services include: Construction, Distribution, Hotels and restaurants, Transport, storage and communication, Financial intermediation and Real Estate activities	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
Export share (only for intermediate use) in the manufacturing sector	Same as above	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
Export share (only for intermediate use) in the market services sector	Same as above	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
Trade in Value added for manufacturing	Same as above	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
Trade in Value added for market services	Same as above	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
% of value added in manufacturing production	Same as above	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
% of value added in market services production	Same as above	Regional Input-Output Data for Europe (EUROSTAT, 2020 ⁽²¹⁾)
% of foreign firms in top labour productivity segment	Data for 2017. The top productivity segment is composed of the top 10% of establishments – both domestic and foreign – in terms of labour productivity, i.e. those firms above the 90 th	Czech Statistical Office

	percentile of the region-specific labour productivity distribution	
% of foreign firms in bottom labour productivity segment	Data for 2017. The bottom productivity segment is composed of establishments that do not classify as part of the top productivity segment	Czech Statistical Office

Table 6.6. Collaboration in research and innovation indicators description

Indicator name	Notes on indicator	Source
% joint applications co-patented with foreign regions	Data for 2015	OECD Regional Innovation Database
% joint applications co-patented within the country	Data for 2015	OECD Regional Innovation Database
% joint applications co-patented within the region	Data for 2015	OECD Regional Innovation Database
% university-industry applications	Share of patent applications where at least one applicant belongs to the HEIs sector and one to the business sector. Data for 2015	PATSTAT
# applicants	Data for 2015	PATSTAT
% SME collaborating in innovation	Data for 2019	Regional Innovation Scoreboard
% public-private copublications (per million population)	Data for 2019	Regional Innovation Scoreboard

Table 6.7. Technology adoption indicators description

Indicator name	Notes on indicator	Source
% employment in digital occupations	Data for 2018	Labour Force Survey
% employment in digital occupations between 20 and 29 years old	Data for 2018	Labour Force Survey
% employment in digital occupations between 55 and 64 years old	Data for 2018	Labour Force Survey
% employment in digital occupations in SMEE	Data for 2018	Labour Force Survey
% vacancies in digital occupations (all economy)	Data for 2019	Burning Glass Technologies
% vacancies in digital occupations (manufacturing)	Data for 2019	Burning Glass Technologies
% vacancies in digital occupations (market services)	Data for 2019	Burning Glass Technologies

Note: Digital occupations are classified as in (Calvino et al., 2018^[3]). The sample selection for the Labour Force Survey is the same as detailed for Table 6.3. The sample selection for Burning Glass Technologies data corresponds to all vacancies with non-missing information on occupation, sector of economic activity and region. Market services include NACE sectors: B, D, E, F, G, H, I, J, K, M, N.

Innovation diffusion performance

D1. Productivity differences with the rest of the country

The graph reports the average productivity in firms in the region/country for selected groups of productivity deciles. Specifically:

Bottom productive = the 50% least productive firms in terms of labour productivity, i.e. the bottom 5 deciles of the region-specific labour productivity distribution.

Middle productive = firms among the 60-90% most productive in the region/country, i.e. those falling into the 6th to 9th decile of the region-specific labour productivity distribution.

Top productive = top 10% of firms in terms of labour productive, i.e. those in the 10th decile of the region-specific labour productivity distribution.

D2. Differences with the rest of the country in the probability for bottom productive firms to become top productive

The graph reports the difference in percentage points between the share of a bottom productive firm to become a top productive one within 3 years in the region relative to the average Czech region.

D3. Differences in the sectoral composition of the top productive firms' pool

The graph reports the sectoral composition of top productive firms in the region and in the country according to some predefined industry groups defined in Table 6.8.

Table 6.8. Industry group definition

NACE aggregate sector	Industry group	NACE detailed industry
A	high-technology manufacturing	Manufacture of basic pharmaceutical products and pharmaceutical preparations (21);
A	high-technology manufacturing	Manufacture of computer, electronic and optical products (26);
A	high-technology manufacturing	Manufacture of air and spacecraft and related machinery (30.3)
B	medium-high technology manufacturing	Manufacture of chemicals and chemical products (20);
B	medium-high technology manufacturing	Manufacture of weapons and ammunition (25.4);
B	medium-high technology manufacturing	Manufacture of electrical equipment (27);
B	medium-high technology manufacturing	Manufacture of machinery and equipment n.e.c. (28);
B	medium-high technology manufacturing	Manufacture of motor vehicles, trailers and semi-trailers (29);
B	medium-high technology manufacturing	Manufacture of other transport equipment (30) excluding Building of ships and boats (30.1) and excluding Manufacture of air and spacecraft and related machinery (30.3);
B	medium-high technology manufacturing	Manufacture of medical and dental instruments and supplies (32.5)
C	medium-low technology manufacturing	Reproduction of recorded media (18.2);
C	medium-low technology manufacturing	Manufacture of coke and refined petroleum products (19);
C	medium-low technology manufacturing	Manufacture of rubber and plastic products (22);
C	medium-low technology manufacturing	Manufacture of other non-metallic mineral products (23);
C	medium-low technology manufacturing	Manufacture of basic metals (24);
C	medium-low technology manufacturing	Manufacture of fabricated metal products, except machinery and equipment (25) excluding Manufacture of weapons and ammunition (25.4);
C	medium-low technology manufacturing	Building of ships and boats (30.1);
C	medium-low technology manufacturing	Repair and installation of machinery and equipment (33)
D	low-technology manufacturing	Manufacture of food products (10);
D	low-technology manufacturing	Manufacture of beverages (11);
D	low-technology manufacturing	Manufacture of tobacco products (12);
D	low-technology manufacturing	Manufacture of textiles (13);
D	low-technology manufacturing	Manufacture of wearing apparel (14);
D	low-technology manufacturing	Manufacture of leather and related products (15);
D	low-technology manufacturing	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (16);
D	low-technology manufacturing	Manufacture of paper and paper products (17);
D	low-technology manufacturing	Printing and reproduction of recorded media (18) excluding Reproduction of recorded media (18.2);
D	low-technology manufacturing	Manufacture of furniture (31);
D	low-technology manufacturing	Other manufacturing (32) excluding Manufacture of medical and dental instruments and supplies (32.5)

E	business services	Software publishing
E	business services	Computer programming, consultancy and related activities
E	business services	Data processing, hosting and related activities; web portals
E	business services	Legal activities
E	business services	Accounting, bookkeeping and auditing activities; tax consultancy
E	business services	Management consultancy activities
E	business services	Architectural activities
E	business services	Engineering activities and related technical consultancy
E	business services	Technical testing and analysis
E	business services	Advertising
E	business services	Market research and public opinion polling
E	business services	Employment activities
F	retail and accommodation services	retail and accommodation services
G	ICT	261 Manufacture of electronic components and boards
G	ICT	262 Manufacture of computers and peripheral equipment
G	ICT	263 Manufacture of communication equipment
G	ICT	264 Manufacture of consumer electronics
G	ICT	268 Manufacture of magnetic and optical media
G	ICT	4651 Wholesale of computers, computer peripheral equipment and software
G	ICT	4652 Wholesale of electronic and telecommunications equipment and parts
G	ICT	582 Software publishing
G	ICT	6110 Wired telecommunications activities
G	ICT	6120 Wireless telecommunications activities
G	ICT	6130 Satellite telecommunications activities
G	ICT	6190 Other telecommunications activities
G	ICT	6201 Computer programming activities
G	ICT	6202 Computer consultancy activities
G	ICT	6203 Computer facilities management activities
G	ICT	6209 Other information technology and computer service activities
G	ICT	6311 Data processing, hosting and related activities
G	ICT	6312 Web portals
G	ICT	9511 Repair of computers and peripheral equipment
G	ICT	9512 Repair of communication equipment

1. Prague

Innovation performance

The region of Prague is a strong innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

Share of population with tertiary education

R&D expenditure in the public sector (% GDP)

Weaknesses

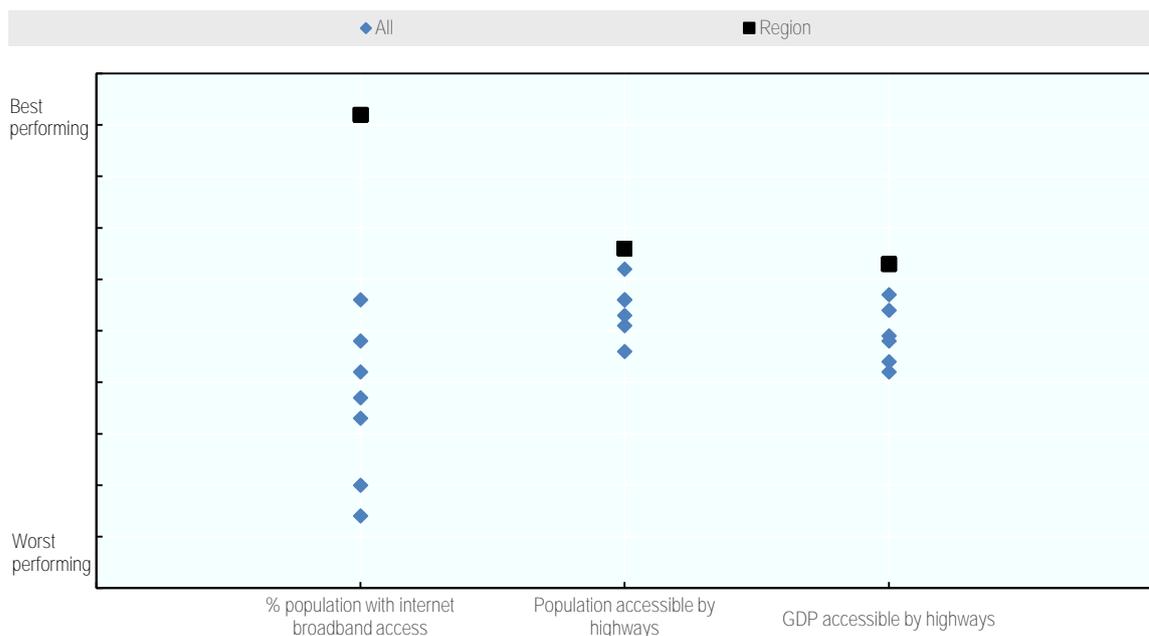
Non R&D innovation expenditure in SMEs (% turnover)

Patent applications (per 1M inhabitants)

B. Framework conditions

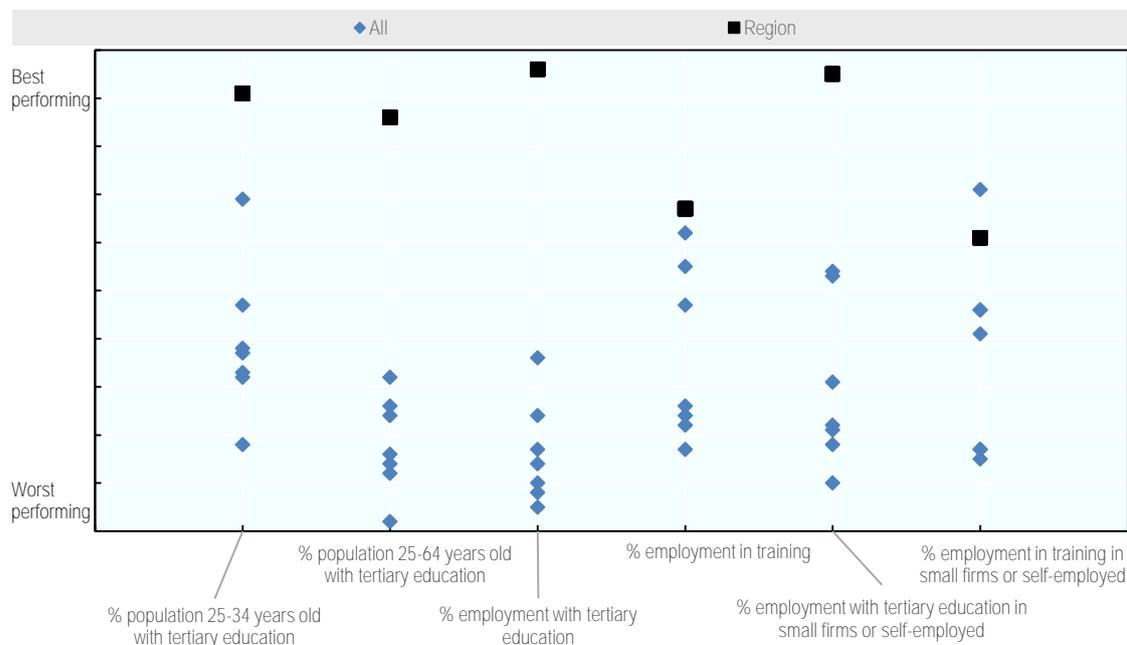
The region of Prague is in the top 10% of OECD regions in terms of the percentage of population covered by internet broadband access. It is the best performing region in the Czech Republic concerning economic activity accessible by highways.

B1. Access to digital and physical infrastructure



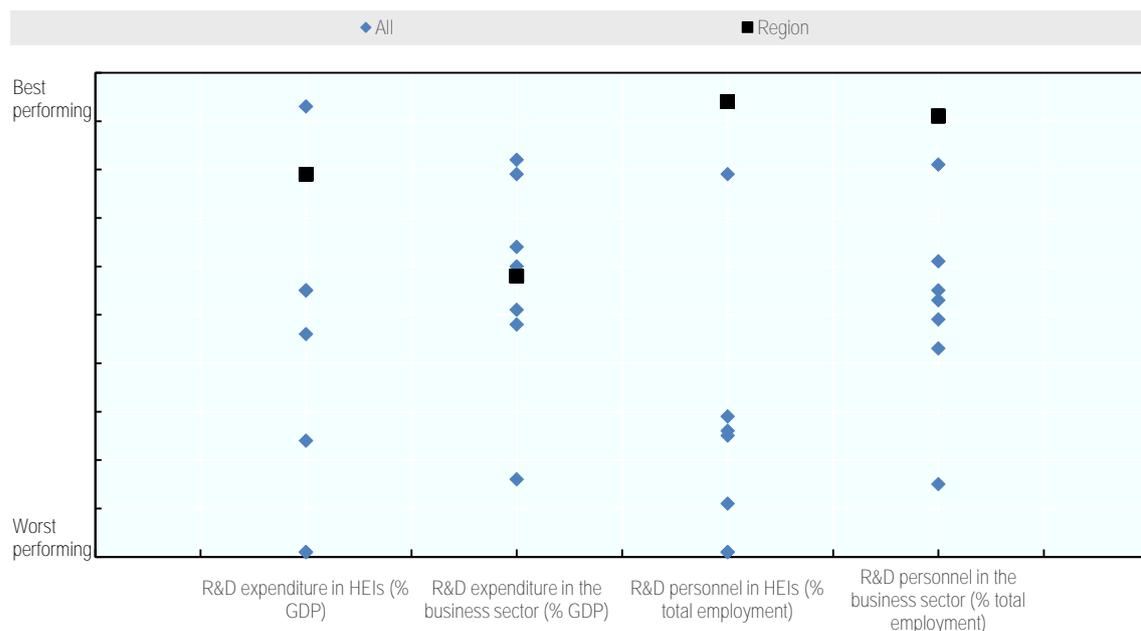
The region of Prague excels among all indicators measuring the availability of skills in the region, with the exception for the share of workers that received training in the past four weeks. Firms' provided training could be strengthened to better help workers build the competencies needed for the firm to adopt newer technologies.

B2. Access to skills



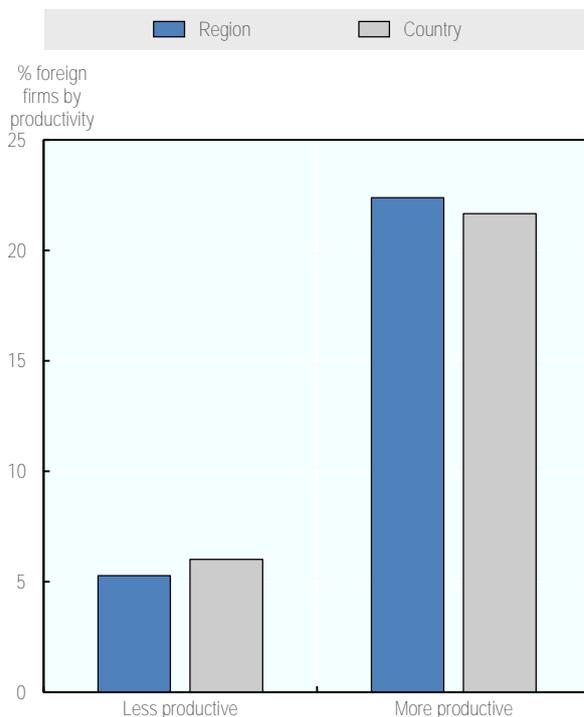
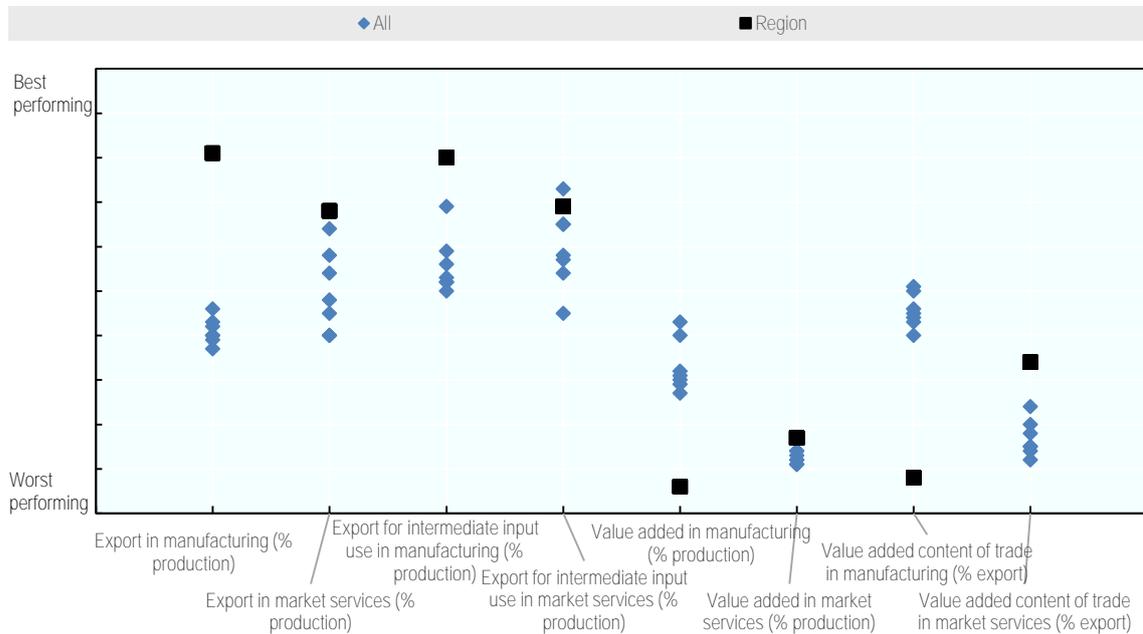
The region of Prague is in the top 10% of OECD regions in terms of the share of R&D personnel both among HEIs and in the business sector. R&D expenditure share as a fraction of GDP could be increased since the region ranks just in line with the average Czech region with respect to this indicator.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI



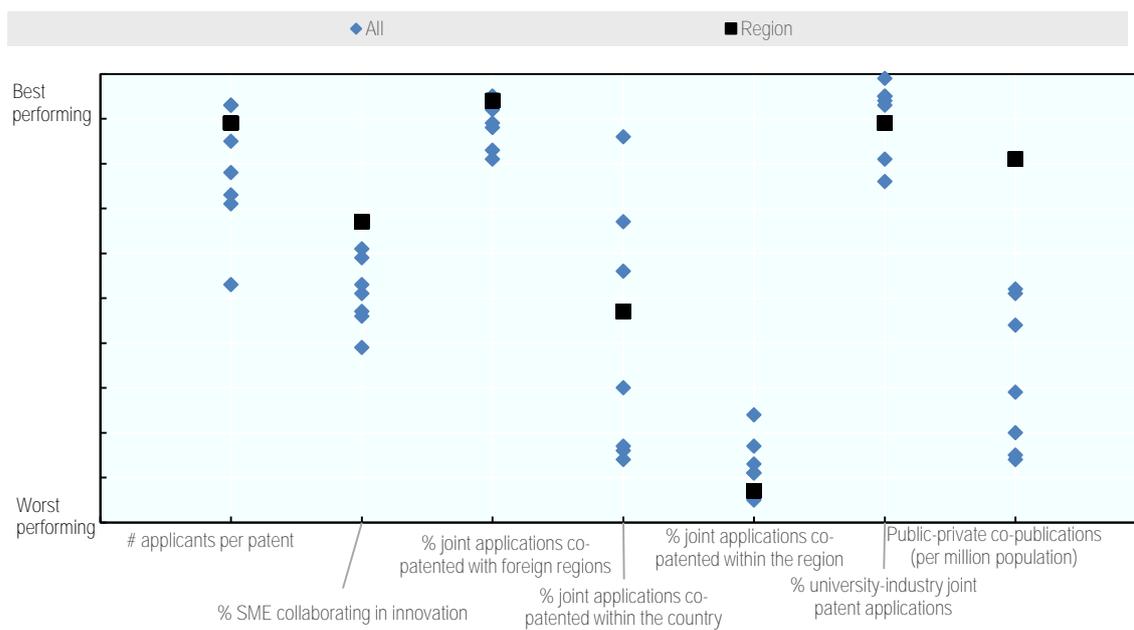
The region of Prague ranks in the upper tier group of OECD and Czech regions when it comes to internationalisation indicators that do not take into account the value added content of exports.

However, the value added share of production and content of export is low. The specialisation of the region of Prague in low value added production segments is a less severe problem for market services, in the production of which the region is specialised, compared to manufacturing. The reduced value added content of trade might impair internationalisation as a diffusion channel being low value added industries also typically less innovation-oriented.

The region of Prague features a higher share of foreign-owned firms in the upper productivity segment than the rest of the country, which places it in a good position to benefit from FDI-driven diffusion of knowledge.

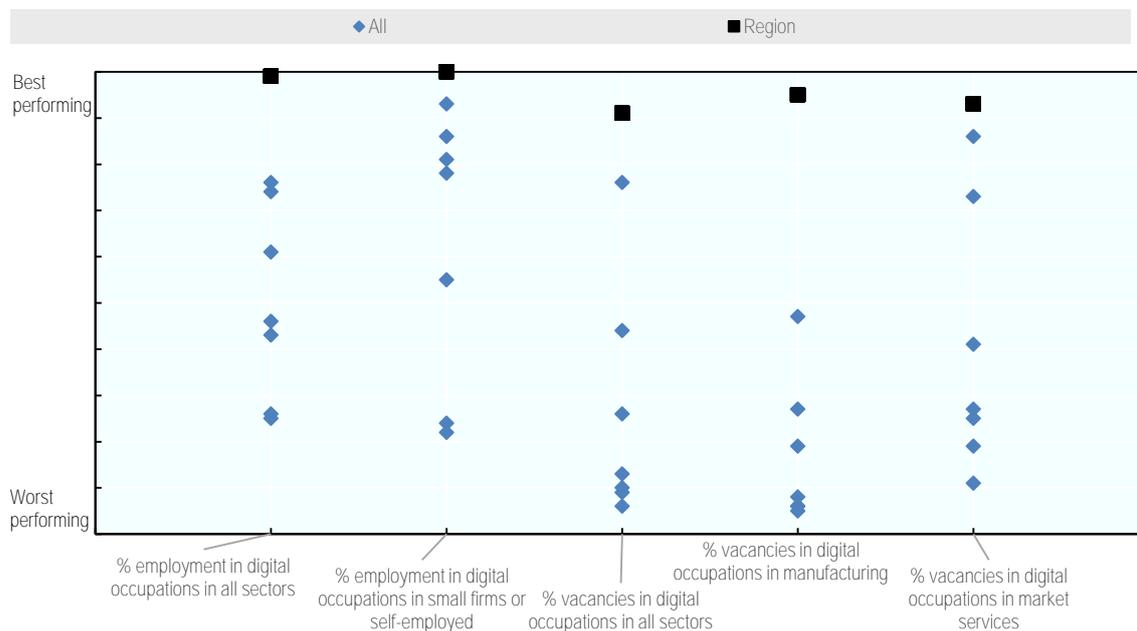
C2. Collaboration in research and innovation

The region of Prague is a top-performer within the OECD and the Czech Republic when it comes to collaborating in research and innovation along several dimensions. Collaboration in research and innovation privileges cooperation with abroad as opposed to within the country. Better cooperation within the country might be an important diffusion mechanism helping also less economically developed regions catching-up.

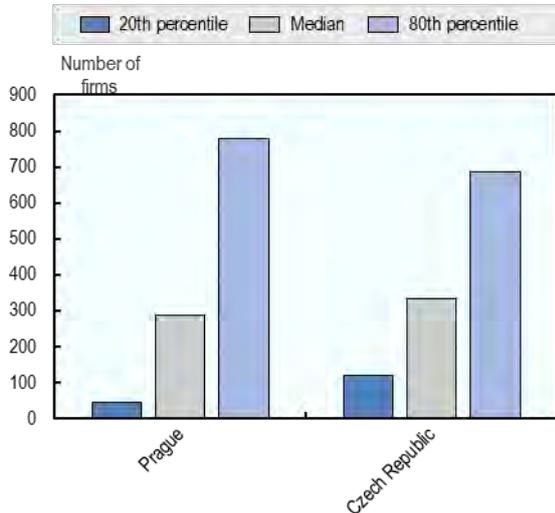


C3. Technology adoption

The region of Prague ranks systematically in the upper decile among OECD regions and at the top of the ranking among Czech regions when it comes to technology adoption as measured by the percentage of the workforce apt at managing digital tasks.



D. Innovation diffusion performance

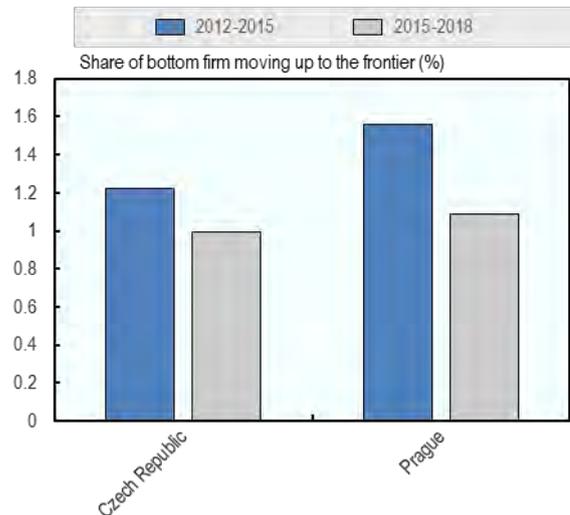


D1. Productivity differences with the rest of the country

The median firm is more productive in the average Czech region than in Prague. The top 20% productive firm in the region of Prague is more productive than the counterpart in an average Czech region. Differences in productivity between top and bottom firms are more pronounced in Prague, where the ratio between the 80th and the 20th percentile of the productivity distribution is more than three times higher than the same ratio for an average Czech region (17 vs. 5).

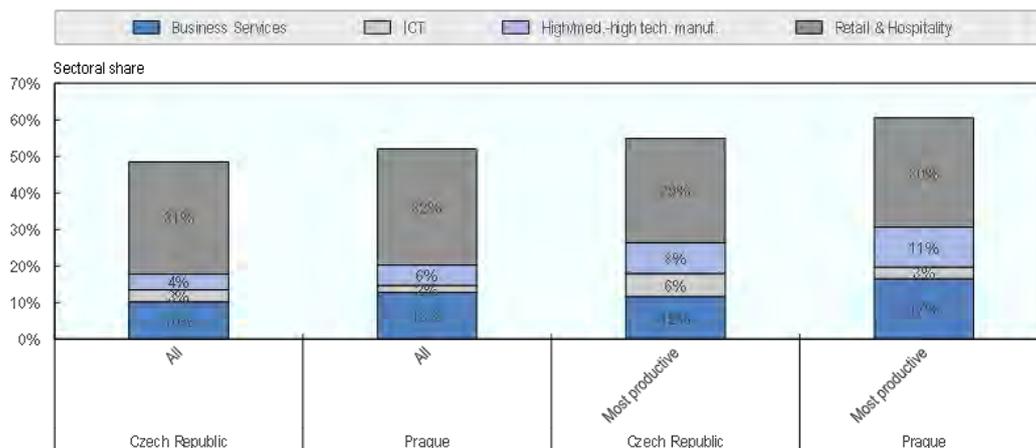
D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

The probability of a bottom firm moving up to the frontier has declined between 2015 and 2018 everywhere but in the region of Prague more than elsewhere, thus suggesting the importance of reviving the channels for the diffusion of knowledge among firms especially for this region.



D3. Sectoral composition by firm productivity

The region of Prague is specialised in the production of business services and high-technology manufacturing compared to the rest of the country. The composition of the pool of most productive firms is also tilted towards these two sectors, more than what the overall sectoral composition would suggest.



2. Central Bohemia

A. Innovation performance

The region of Central Bohemia is a moderate innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

Design applications (per 1M inhabitants)

R&D expenditure in the private sector (% GDP)

Weaknesses

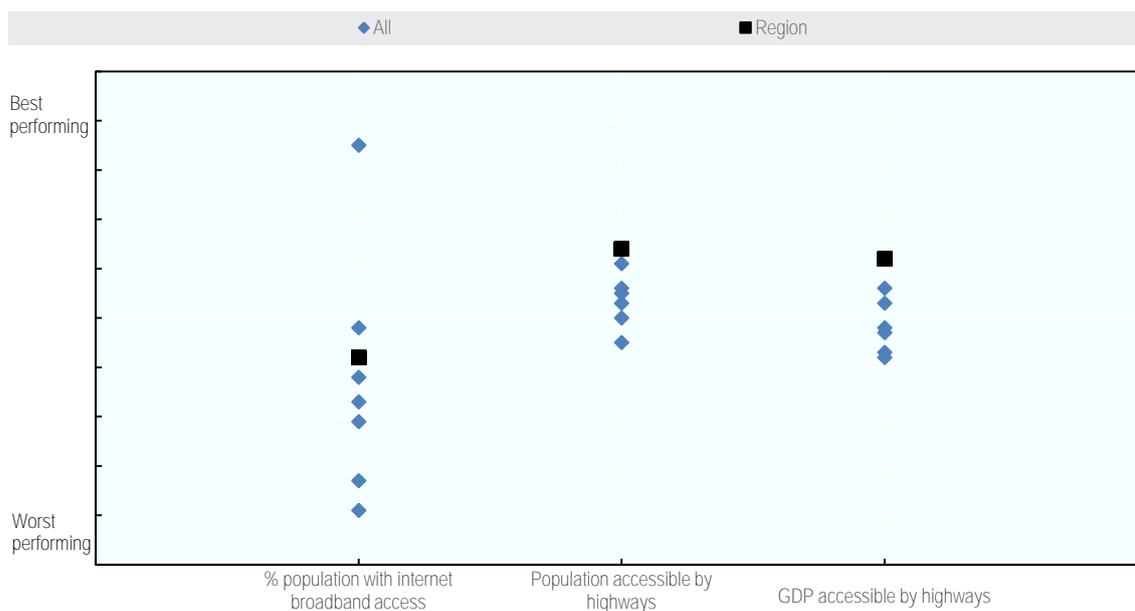
Public-private co-publications (per 1M inhabitants)

Trademark applications (per 1M inhabitants)

B. Framework conditions

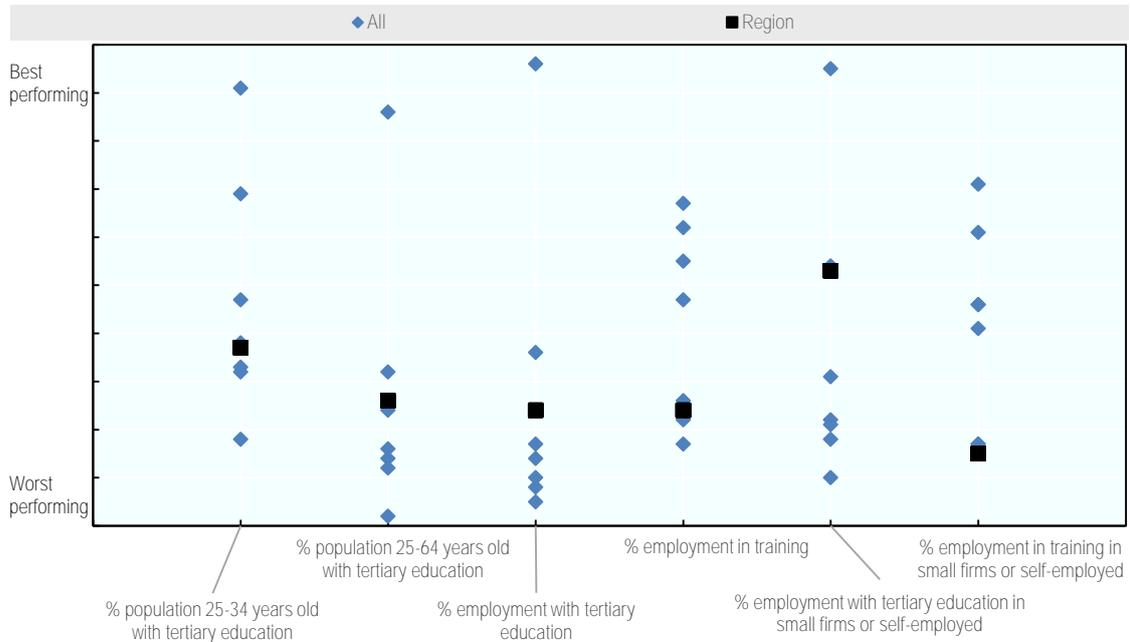
The share of population covered by internet broadband access in the region of Central Bohemia is slightly below the OECD average. Thanks to its proximity to Prague, the region has a good access via highways to the surrounding economic activity.

B1. Access to digital and physical infrastructure



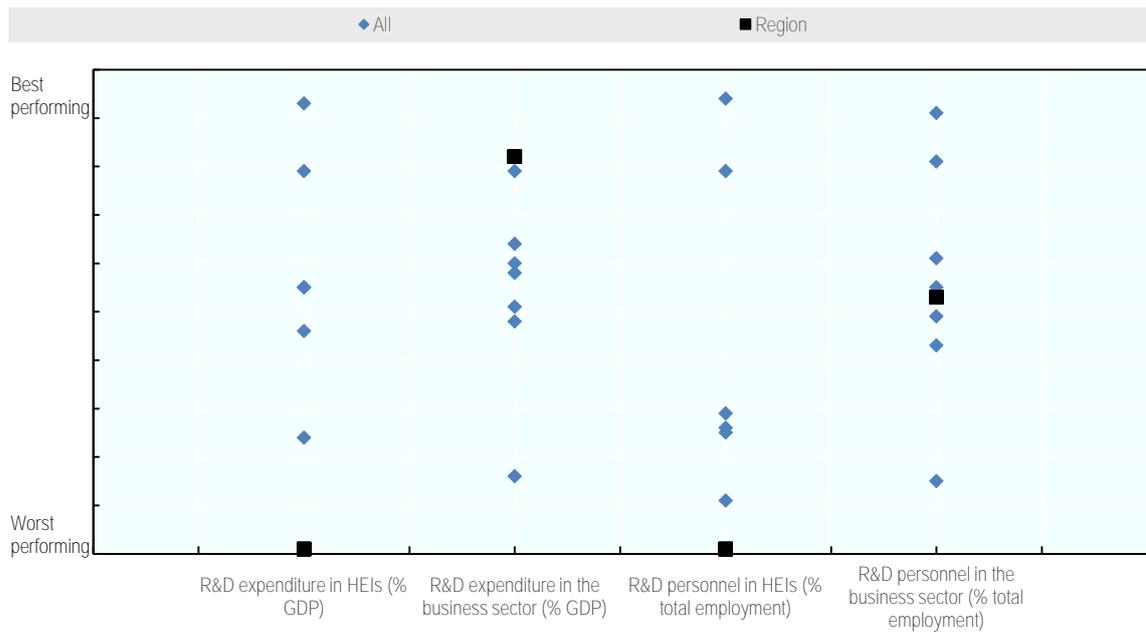
The region of Central Bohemia is in the lower tier group of OECD regions when it comes to access to skills. Within the Czech Republic the region performs well in terms of share of employment with tertiary education but badly in terms of share of employment that has received training in the past four weeks. Central Bohemia appears to be the Czech region with the lowest fraction of SMEs employees and self-employed that recently received training.

B2. Access to skills



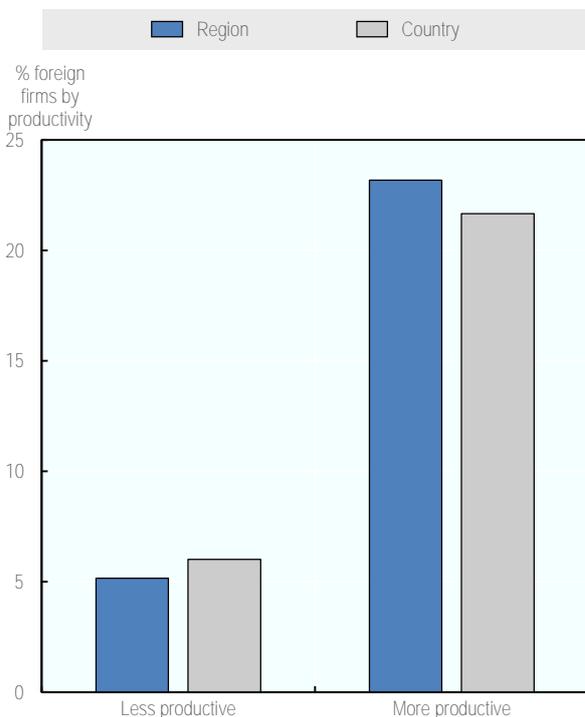
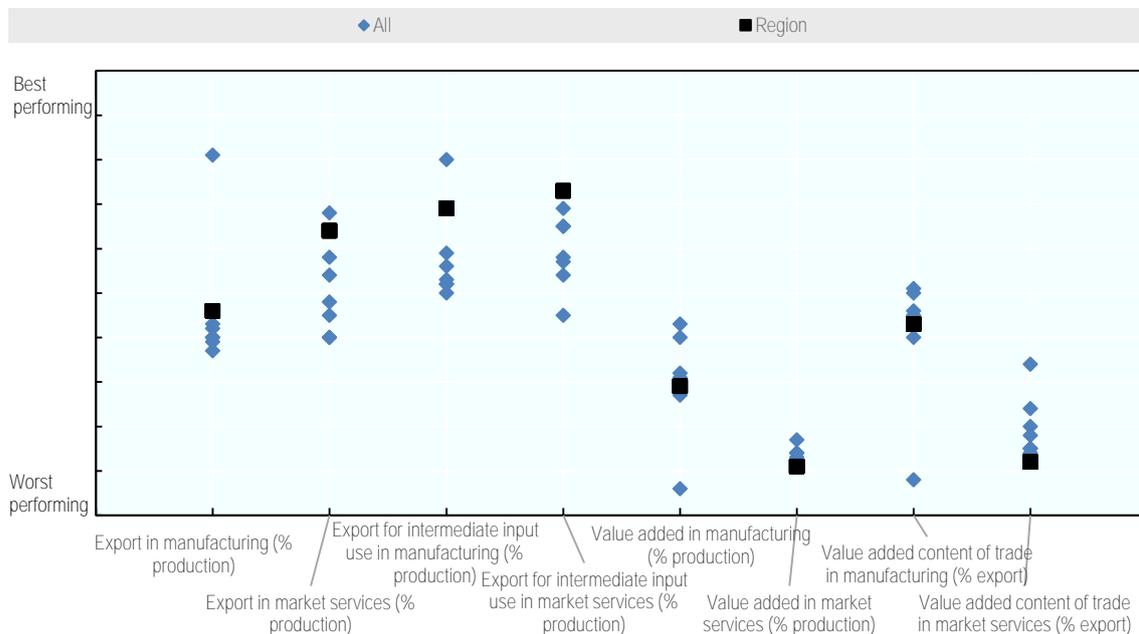
R&D activity lags behind in Central Bohemia both relative to the OECD and the rest of the Czech Republic, especially among higher education institutions.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI



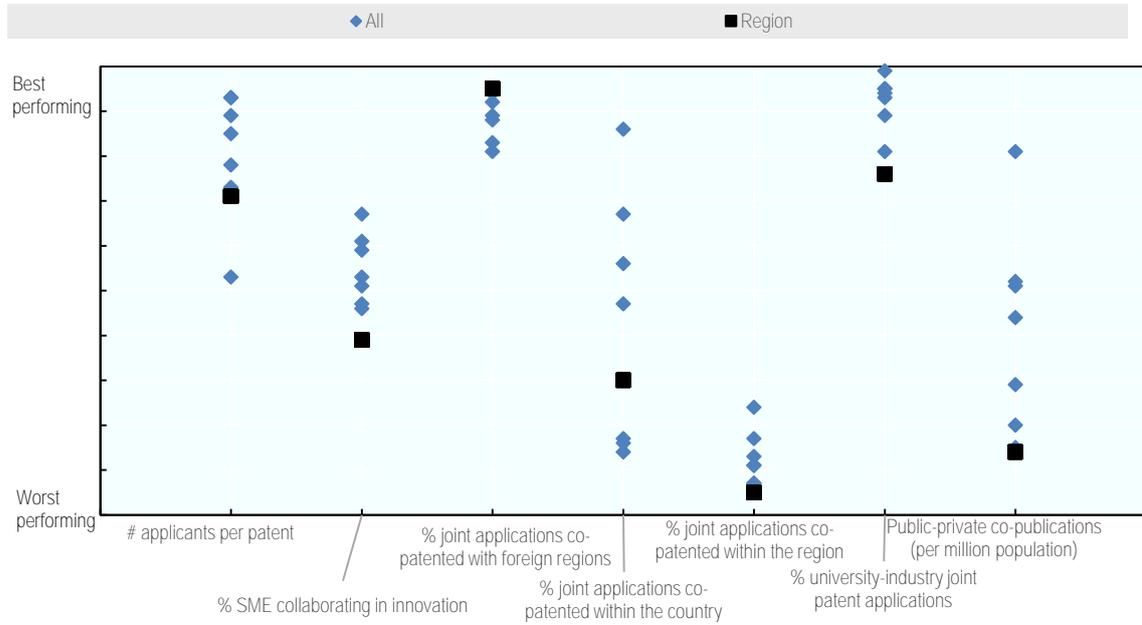
The region of Central Bohemia ranks in the upper tier group of OECD and Czech regions when it comes to internationalisation indicators that do not take into account the value added content of exports.

However, the value added share of production and content of export is low, especially in the market services sector. The reduced value added content of trade might impair internationalisation as a diffusion channel being low value added industries also typically less innovation-oriented.

The region of Central Bohemia features a higher share of foreign-owned firms in the upper productivity segment than the rest of the country, which places it in a good position to benefit from FDI-driven diffusion of knowledge.

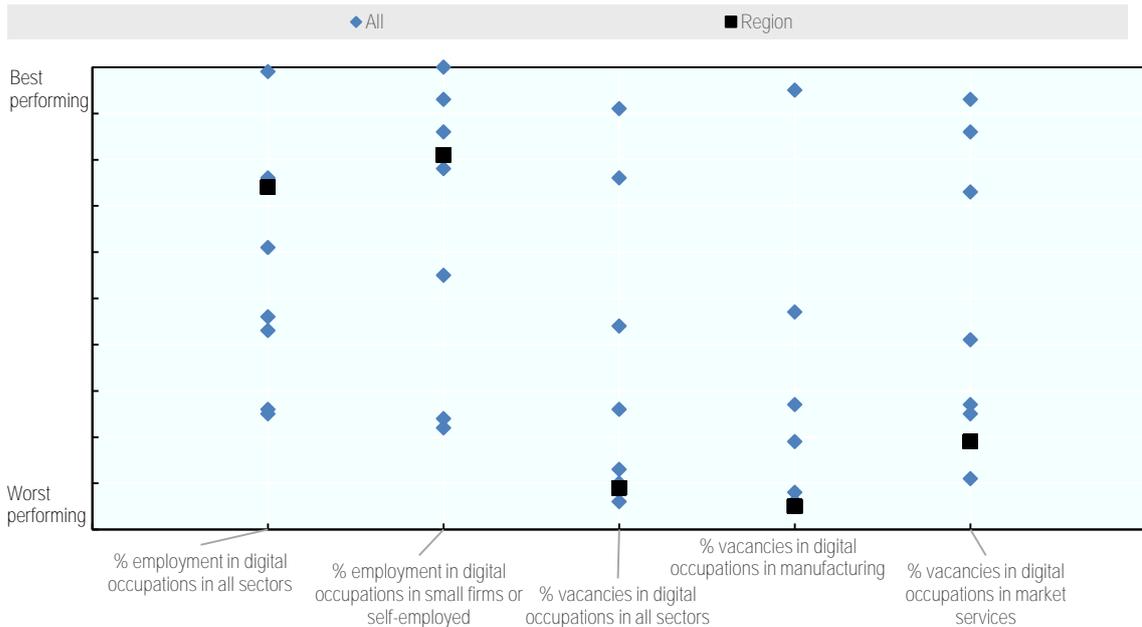
C2. Collaboration in research and innovation

The region of Central Bohemia features a mixed performance when it comes to collaboration in research and innovation. The region ranks among top 10% OECD regions when it comes to joint patent applications co-patented with foreign regions. However, the level of university-industry cooperation in the region is the lowest in comparison with the rest of the country, which could impair the process of putting to productive use the knowledge produced by universities.

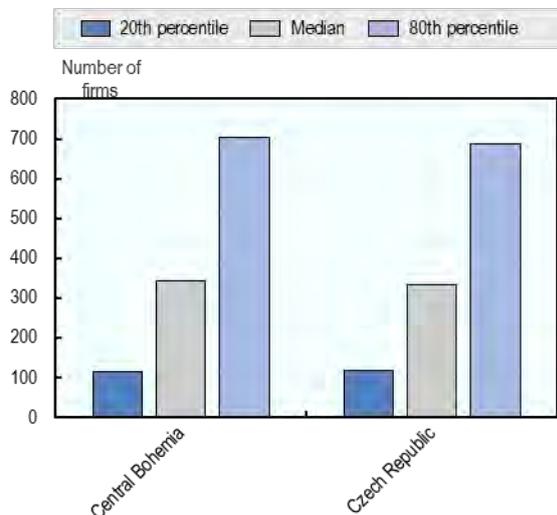


C3. Technology adoption

The share of jobs in digital occupations in Central Bohemia is among the highest among OECD regions. However, the share of vacancies posted in digital jobs is part of the bottom 10% among OECD regions, especially in the manufacturing sector, thus signalling potentially weak growth in demand for digital skills.



D. Innovation diffusion performance

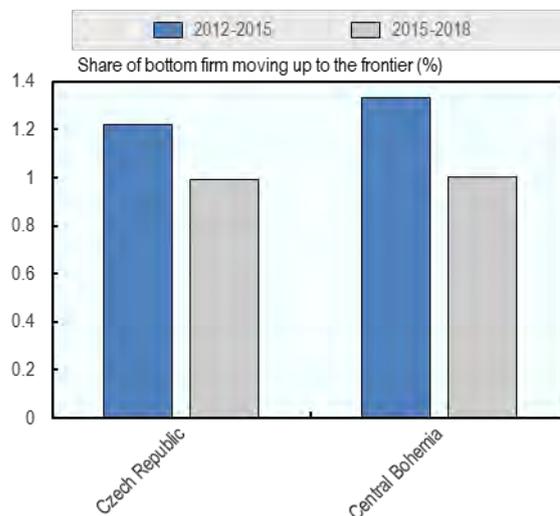


D1. Productivity differences with the rest of the country

The productivity distribution in Central Bohemia is quite similar to the one of an average Czech region.

D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

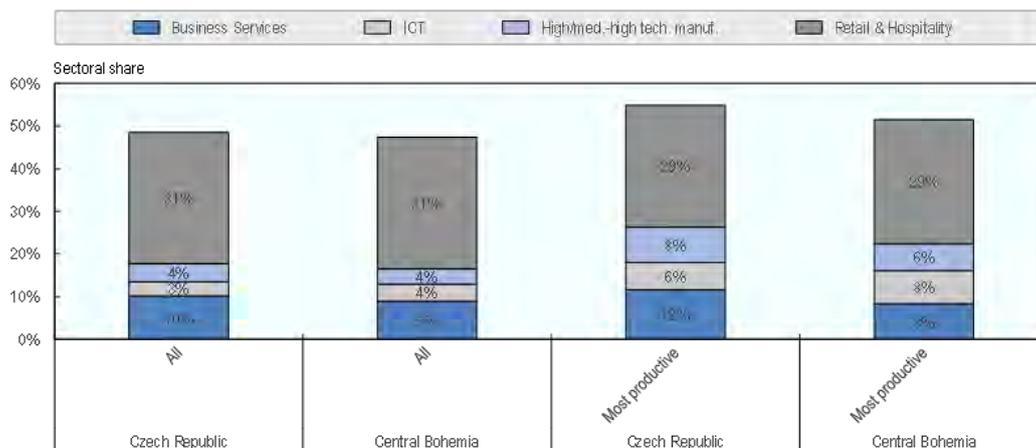
The probability of a bottom firm moving up to the frontier has declined between 2015 and 2018 more in Central Bohemia than in other parts of the country.



D3. Sectoral composition by firm productivity

Sectoral composition for all firms in Central Bohemia is substantially in line with the average Czech region.

The same is true for the composition of the pool of most productive firms, with the exception for the ICT sector, where a smaller share of most productive firms operate compared to the rest of the country.



3. South Bohemia and Plzen

A. Innovation performance

The region of Jihozápad combining the NUTS 3 regions of South Bohemia and Plzen is a moderate + innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

Design applications (per 1M inhabitants)

R&D expenditure in the private sector (% GDP)

Weaknesses

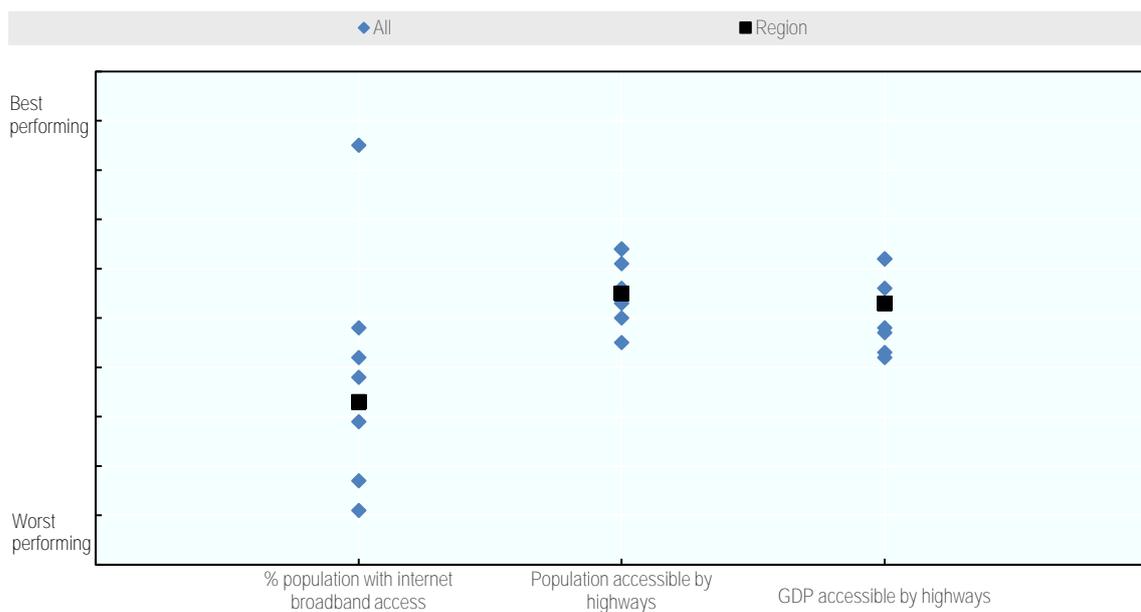
Share of population with tertiary education

Patent applications (per 1M inhabitants)

B. Framework conditions

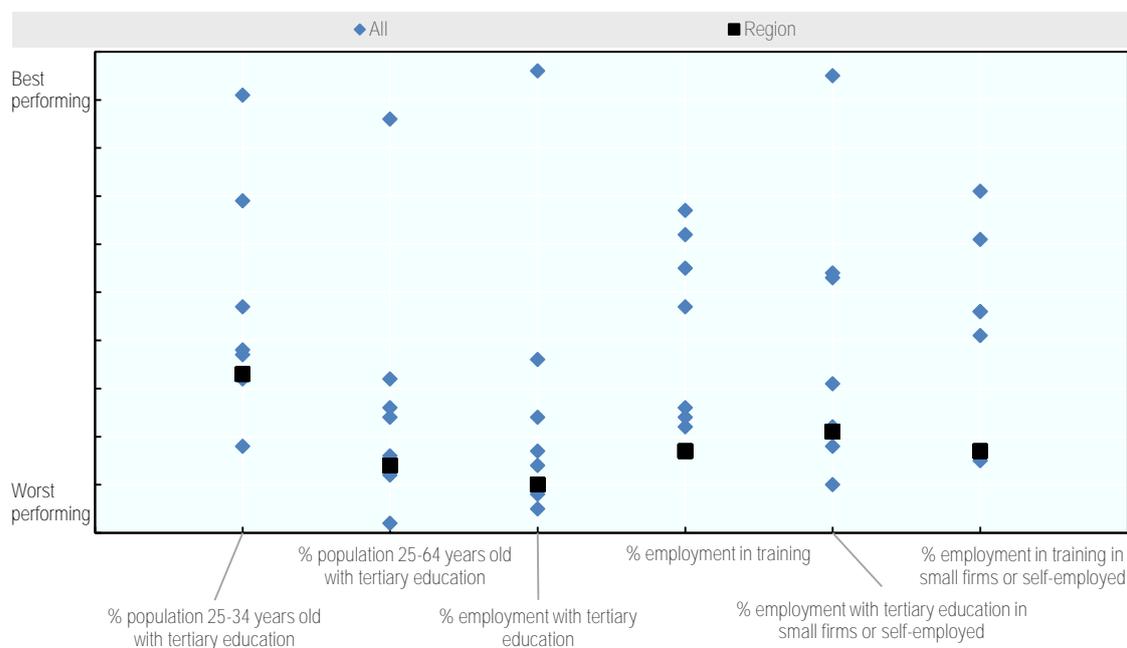
The combined region of South Bohemia and Plzen is in line with the OECD average when it comes to the population and GDP accessible by highways. Access to digital infrastructure could be strengthened.

B1. Access to digital and physical infrastructure



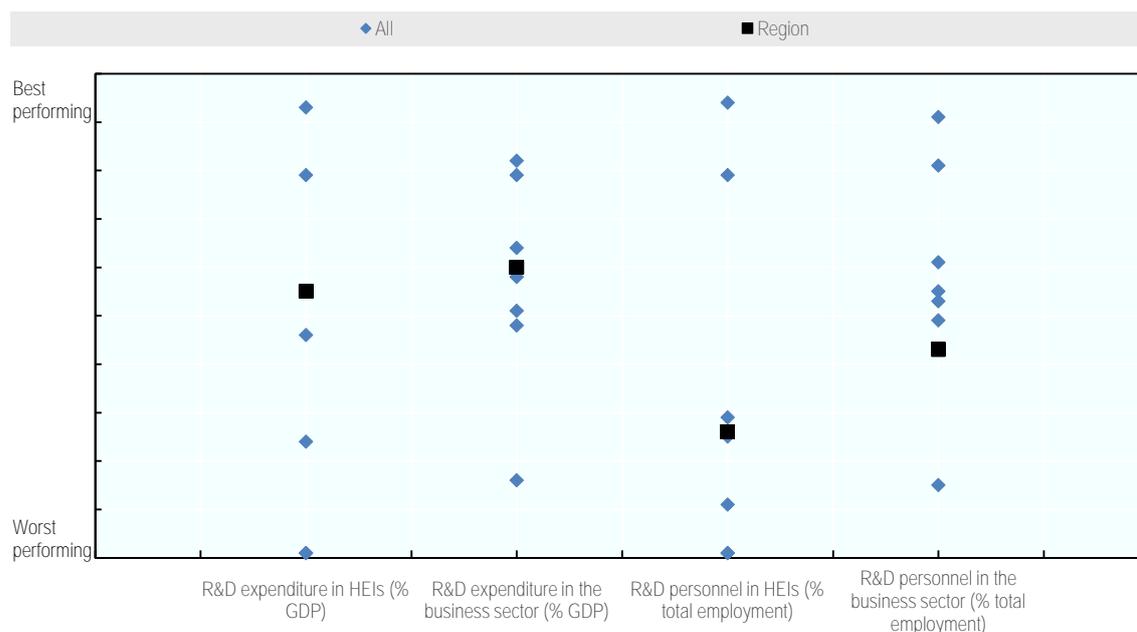
The combined region of South Bohemia and Plzen ranks in the bottom half among both OECD and Czech regions when it comes to access to skills. While educational attainment in terms of tertiary education has been improving, as the positive difference in the share of population with tertiary education between 25-34 and 35-64 years old witnesses, **still much can be done to improve workers' level of skills, as measured by the amount of training they receive.**

B2. Access to skills



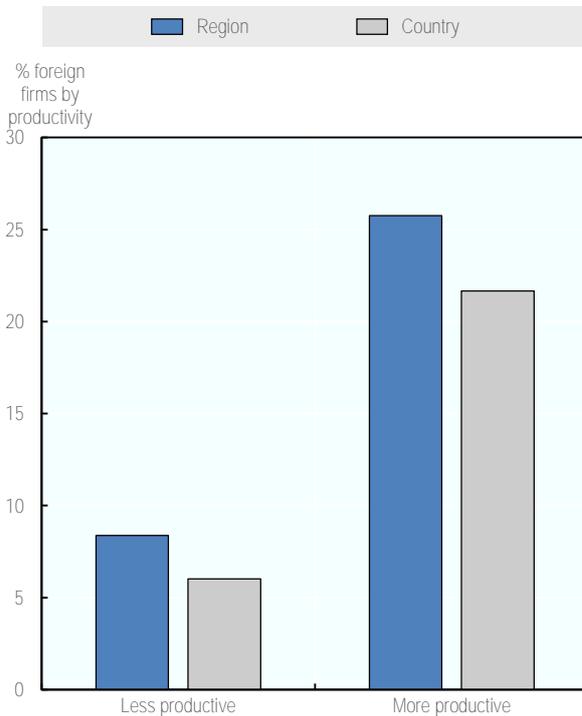
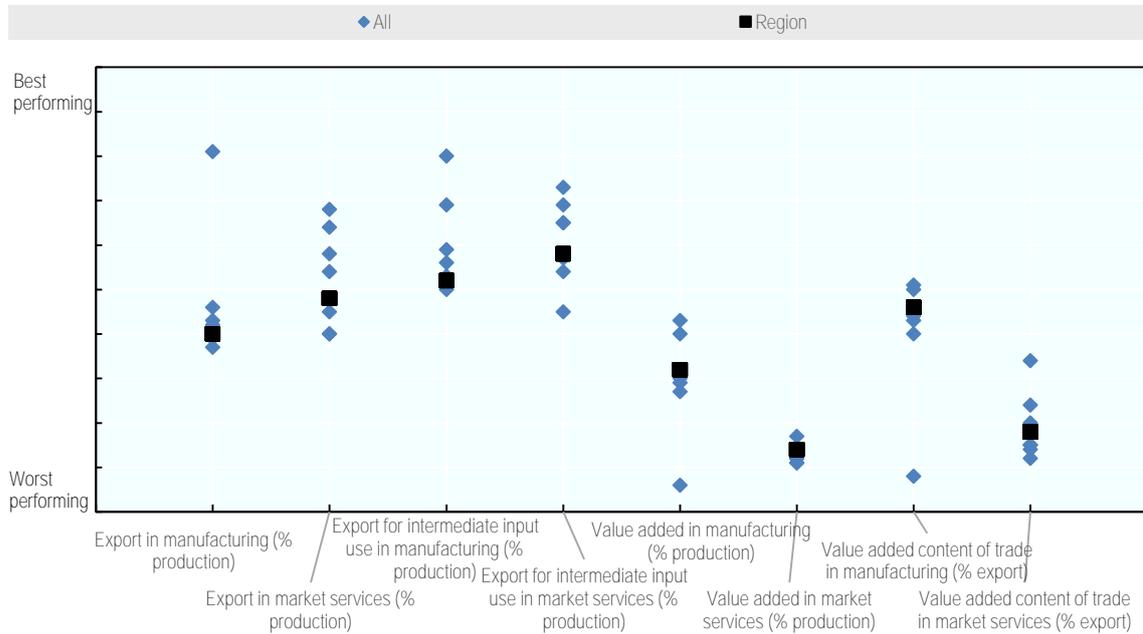
R&D activity is substantially in line with the average OECD region, except for the share of R&D personnel employed by higher education institutions, which is also lagging in most of the rest of the country.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI

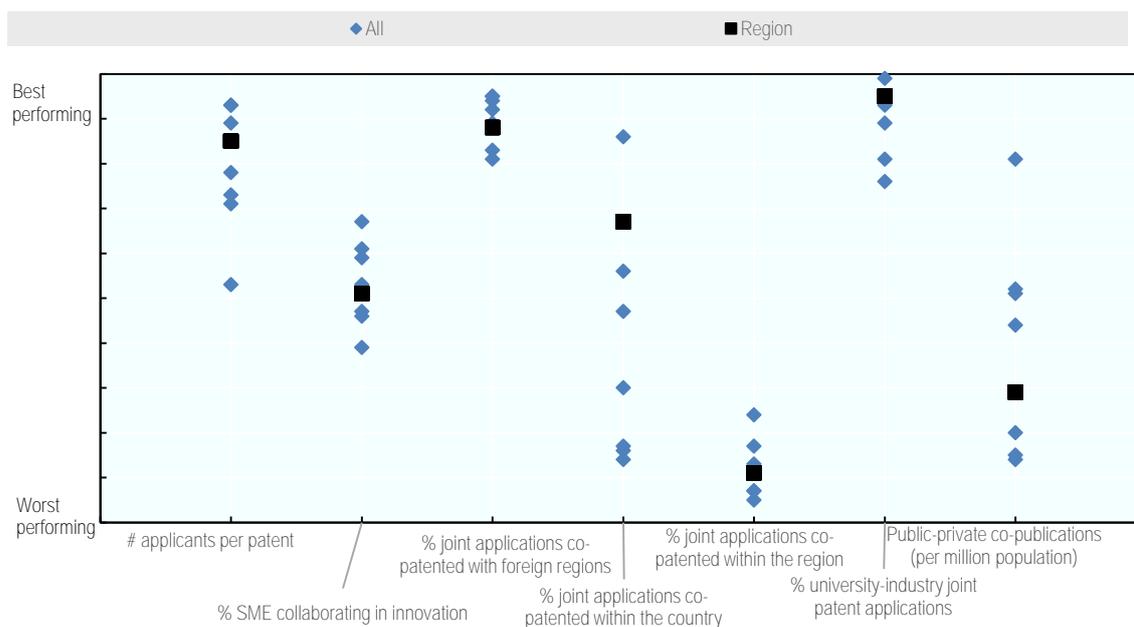


The combined region of South Bohemia and Plzen is fairly internationalised with respect to other OECD regions but less than the average Czech region. As for the rest of the country, exports concentrate in low value added industries, especially in the market services sector. The reduced value added content of trade might impair internationalisation as a diffusion channel being high value added industries also typically more innovation-oriented.

The combined region of South Bohemia and Plzen features a higher share of foreign-owned firms both in the upper and the lower productivity segment than the rest of the country. The presence of high-productivity foreign-owned firms places the region in a good position to potentially benefit from FDI-driven diffusion of knowledge, which however depends also on the industries where foreign firms operate and the absorptive capacity of local firms.

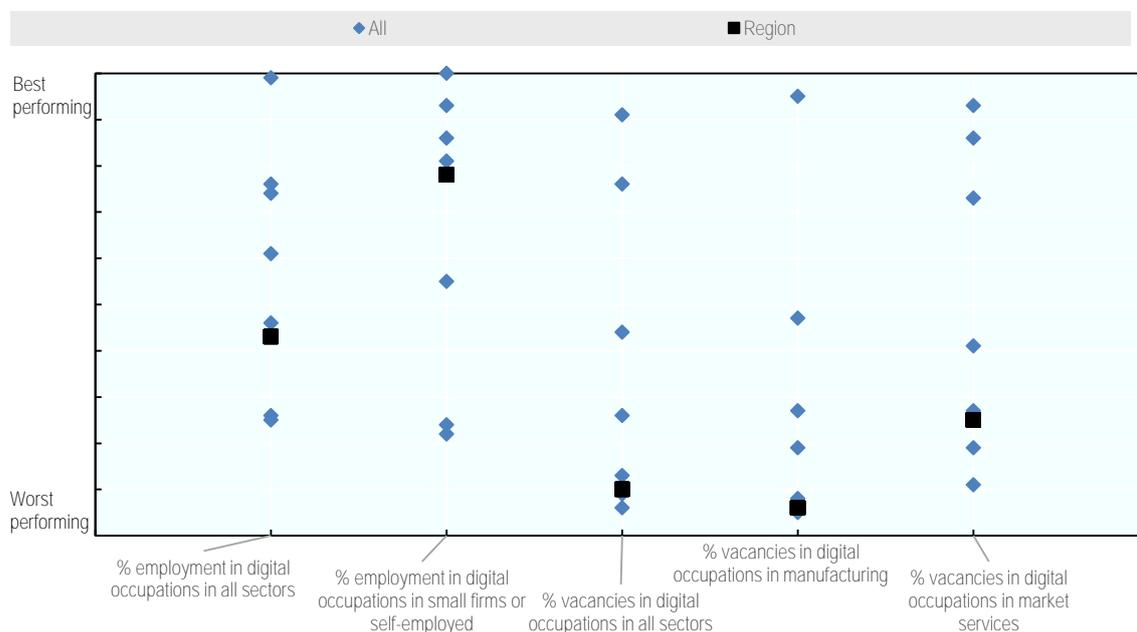
C2. Collaboration in research and innovation

The combined region of South Bohemia and Plzen features overall an average performance relative to other OECD regions when it comes to collaboration in research and innovation. The region exploits well international channels for the transmission of knowledge and the channel of university-industry collaboration.

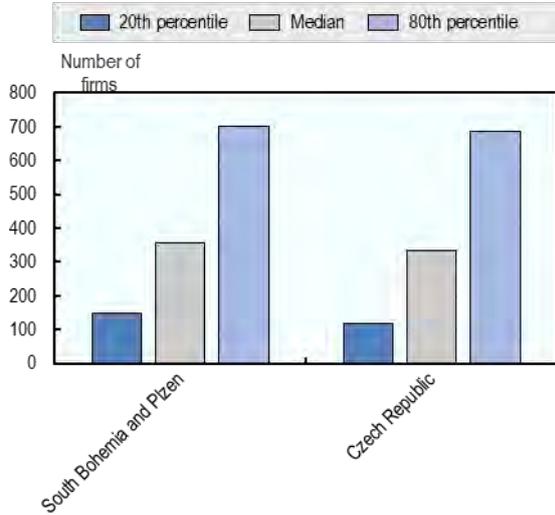


C3. Technology adoption

The share of jobs in digital occupations in South Bohemia and Plzen ranks behind both the country and OECD average. It is however high relative to the OECD average when restricting the attention to SMEs and self-employed, similarly to the rest of the Czech Republic. Contrary to the share of jobs, the share of advertised jobs in digital occupations in the combined region of South Bohemia and Plzen ranks in the bottom 10% among OECD region.



D. Innovation diffusion performance

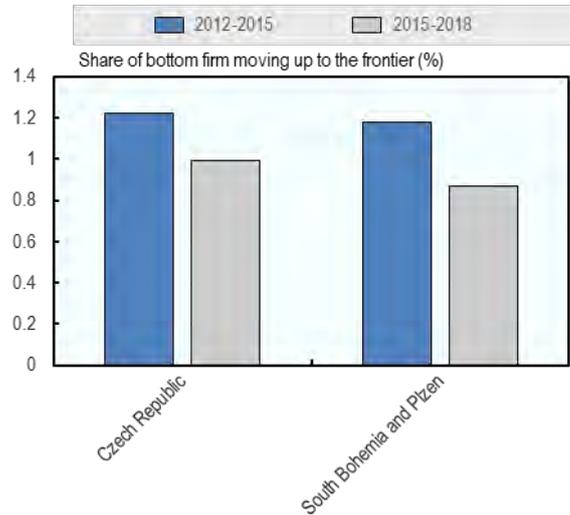


D1. Productivity differences with the rest of the country

Firms active in South Bohemia and Plzen are on average slightly more productive than those active in an average Czech region.

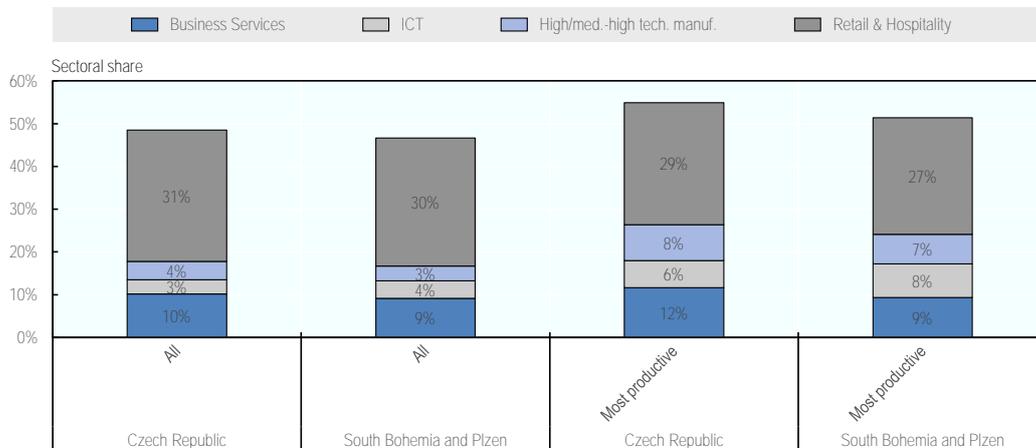
D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

The decline in the probability of a bottom firm moving up to the frontier between 2015 and 2018 in the combined region of South Bohemia and Plzen has been the same as in the rest of the country, thus signalling that this region faces issues in terms of both average productivity of its firms and the growth prospects of less productive firms.



D3. Sectoral composition by firm productivity

Sectoral composition for all firms in South Bohemia and Plzen is broadly in line with the rest of the country. A lower (higher) share among the most productive firms in these two regions operates in business services (ICT) compared to the rest of the country.



4. Karlovy Vary and Usti nad Labem

A. Innovation performance

The region of Severozápad combining the NUTS 3 regions of Karlovy Vary and Usti nad Labem is a moderate - innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

Non R&D innovation expenditure in SMEs (% turnover)

Sales new-to-market and new-to-firm in SMEs (% turnover)

Weaknesses

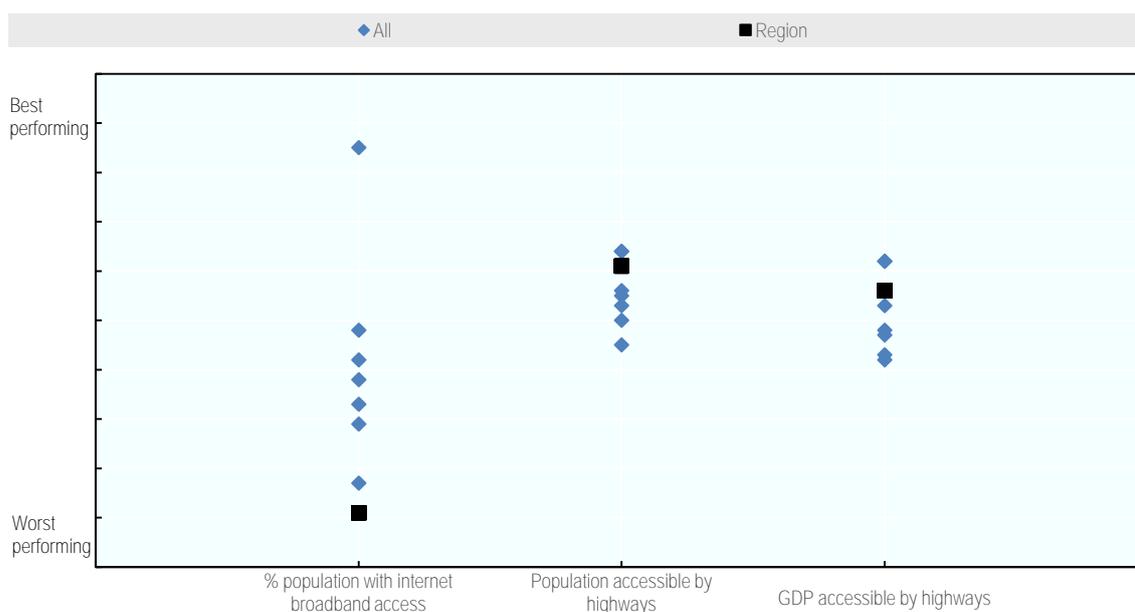
Share of population with tertiary education

R&D expenditure in the public sector (% GDP)

B. Framework conditions

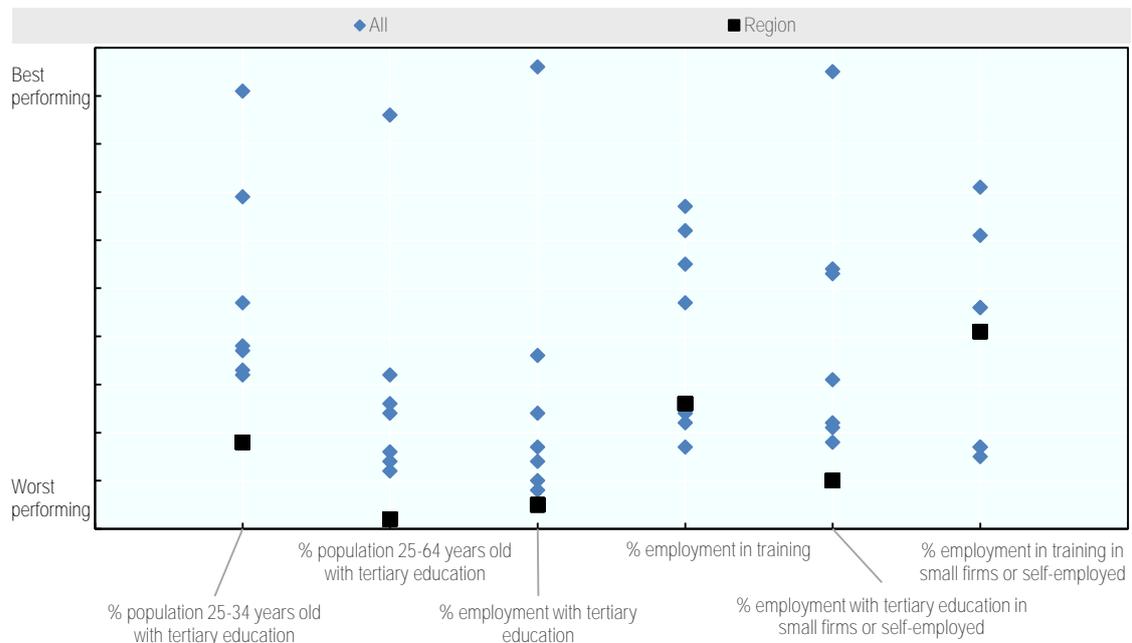
The combined region of Karlovy Vary and Usti nad Labem benefits from good access to economic activity via its highways thanks to its proximity to Germany. However, it ranks last in the country in terms of digital infrastructure.

B1. Access to digital and physical infrastructure



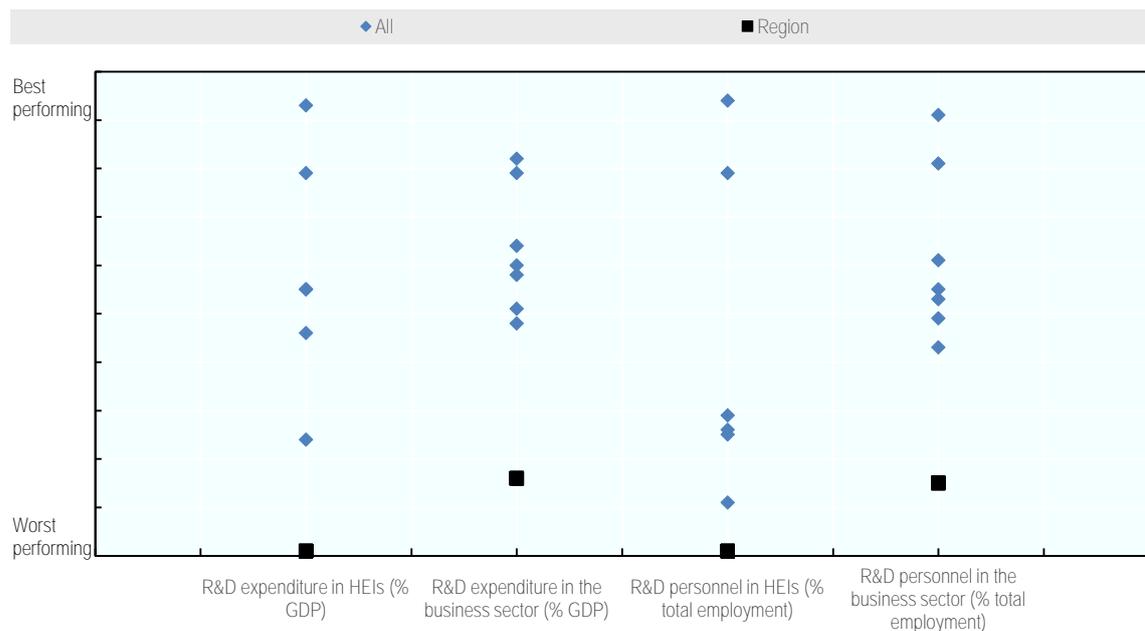
The combined region of Karlovy Vary and Usti nad Labem suffers from a deficit of tertiary education. The share of employment that received training in the past four weeks is better than the one with tertiary education. The level of skills, as measured by tertiary education or in training, is especially low among SMEs and self-employed, thus placing these actors in an ill position in terms of benefiting from the spread of ideas and knowledge flows.

B2. Access to skills



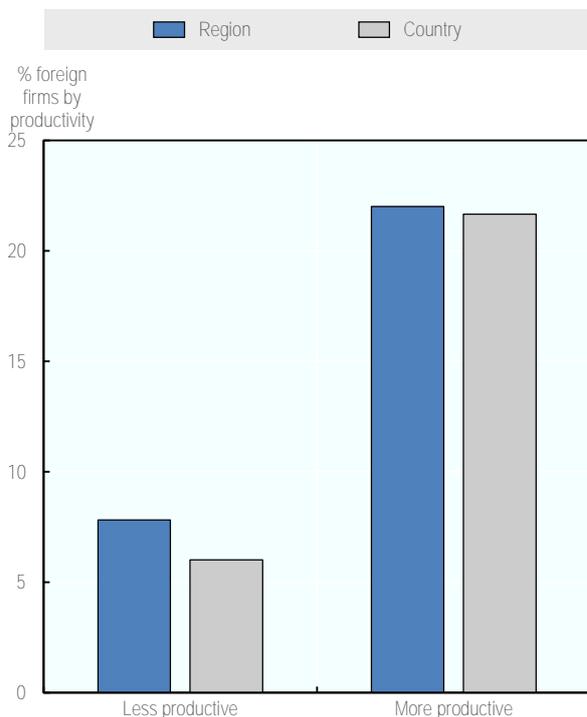
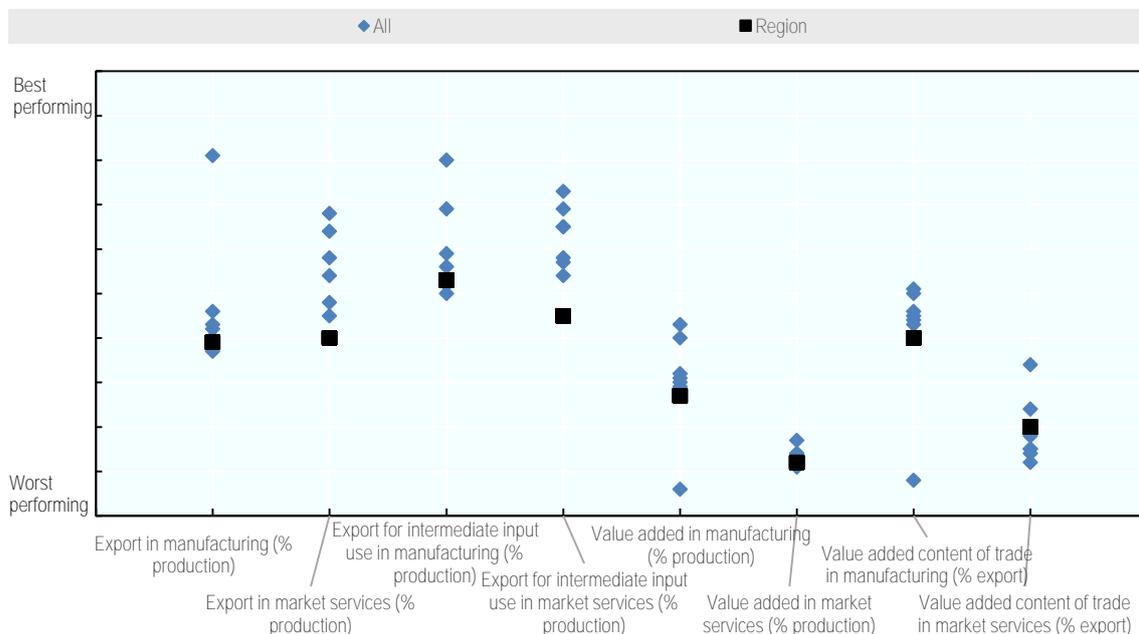
R&D activity lags behind in Karlovy Vary and Usti nad Labem, both in the business sector and in higher education institutions.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI



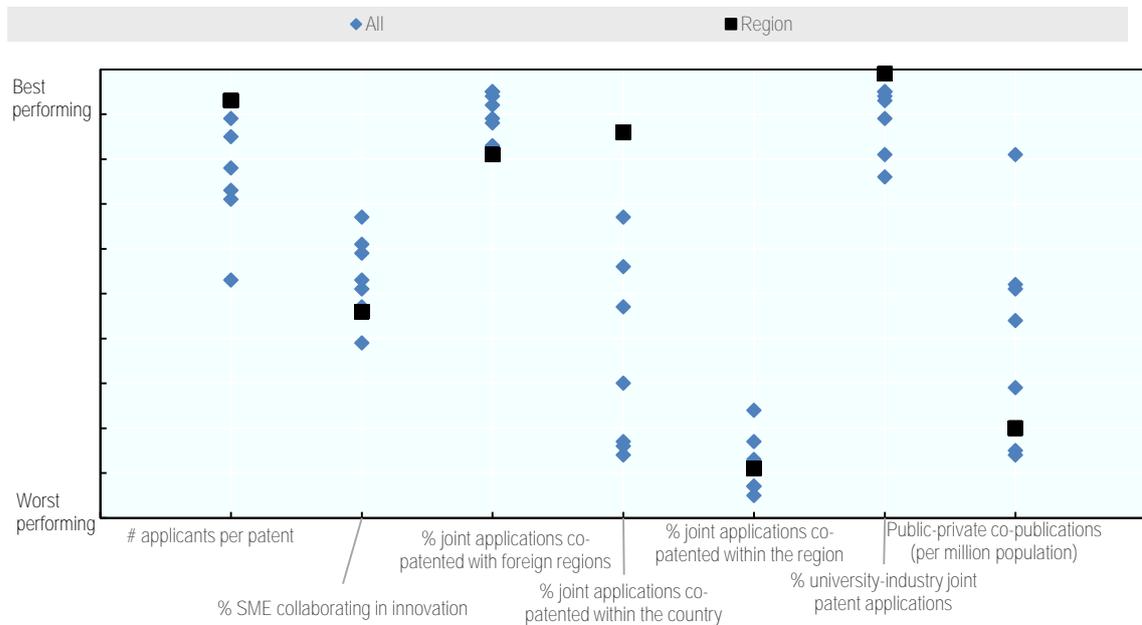
The degree of internationalisation in Karlovy Vary and Usti nad Labem is on average lower than in the rest of the country.

The value added content of trade is also lower than the already low – in comparison with other OECD regions – Czech average. The reduced value added content of trade might impair internationalisation as a diffusion channel being low value added industries also typically less innovation-oriented.

Relative to the rest of the country, foreign-owned firms in the combined region of Karlovy Vary and Usti nad Labem occupy especially the low productivity segment. Innovation diffusion in the region might therefore benefit from the implementation of policies seeking to attract high-productivity foreign firms, whose presence tends to be associated with higher productivity growth for local firms.

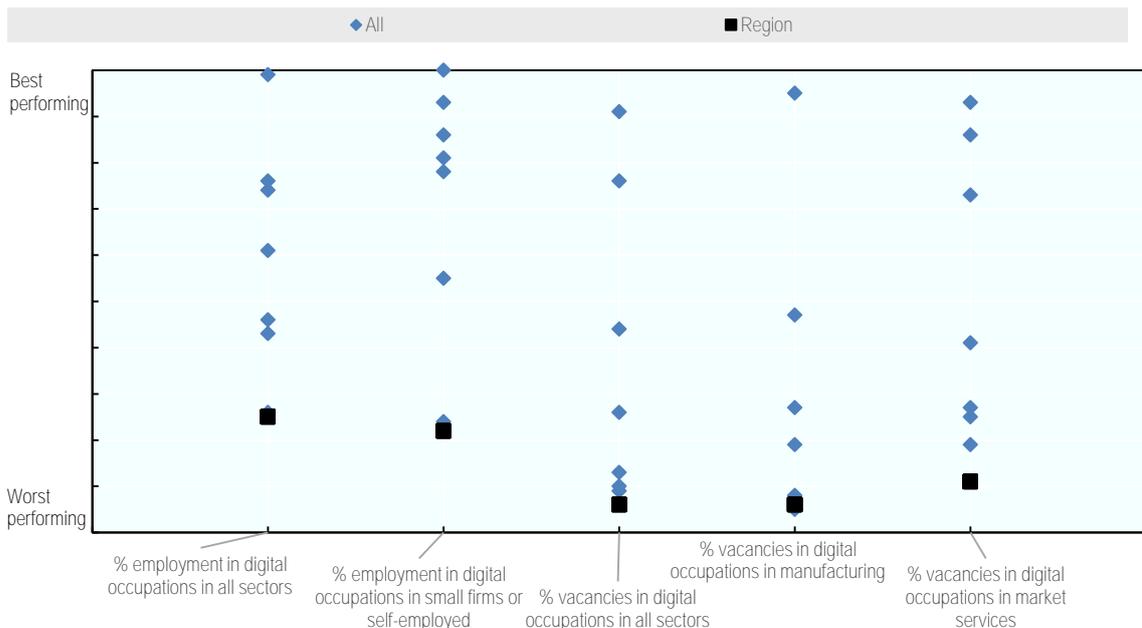
C2. Collaboration in research and innovation

The combined region of Karlovy Vary and Usti nad Labem ranks quite low compared to other Czech regions in terms of collaboration in research and innovation. Few SMEs collaborate in innovation among themselves. Co-patenting is not particularly frequent, but when it happens the chance that it involves a higher education institution and the private sector jointly is high. A greater effort could be made at fostering the international linkages of the region in terms of research activity in order to allow local actors to pick from knowledge produced abroad.

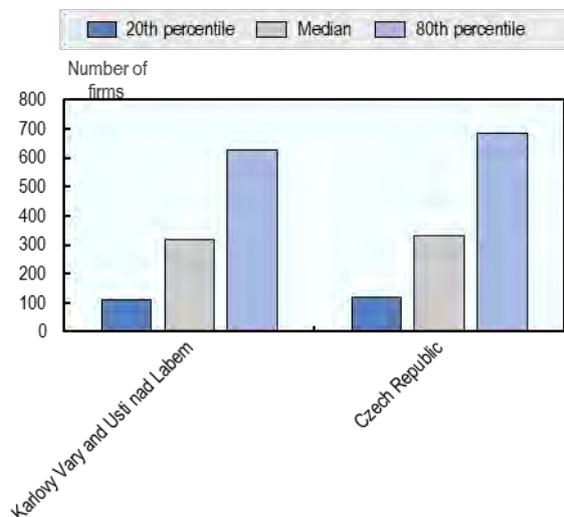


C3. Technology adoption

The share of jobs in digital occupations in Karlovy Vary and Usti nad Labem is low both compared to the rest of the OECD and other Czech regions, thus signalling a low level of digital skills in the region that might be an impediment to firms willing to adopt newer technologies.



D. Innovation diffusion performance

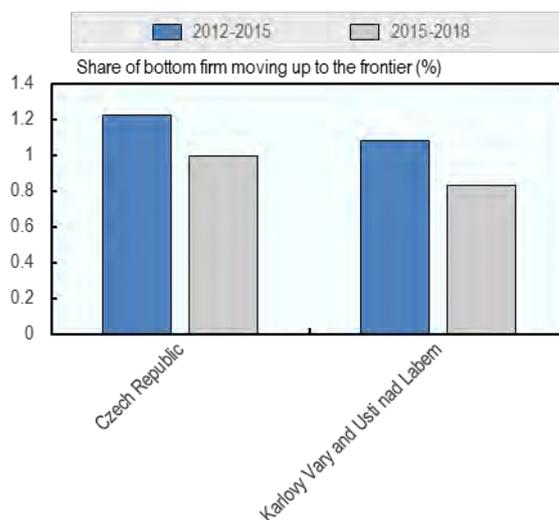


D1. Productivity differences with the rest of the country

Firms active in Karlovy Vary and Usti nad Labem are on average less productive than those located in the rest of the country.

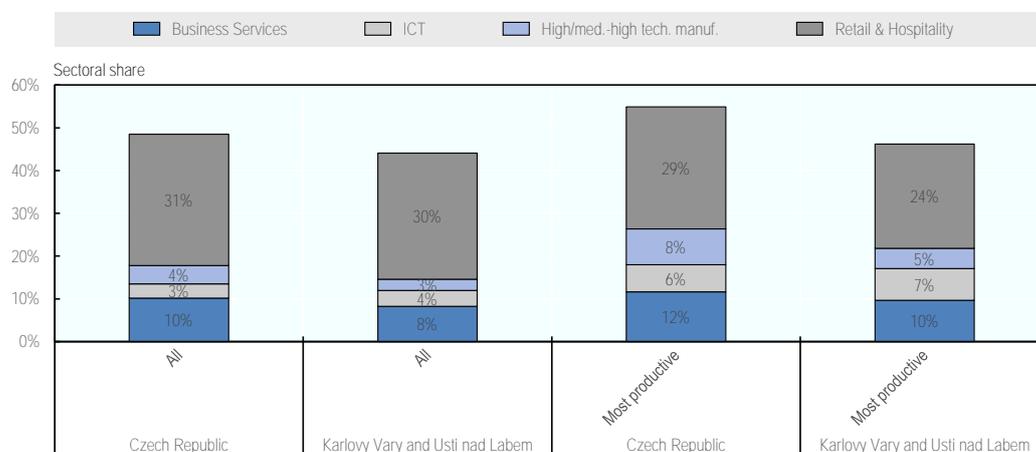
D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

The decline in the probability of a bottom firm moving up to the frontier between 2015 and 2018 in the combined region of Karlovy Vary and Usti nad Labem has been the same as in the rest of the country.



D3. Sectoral composition by firm productivity

Economic activity in Karlovy Vary and Usti nad Labem is less oriented towards innovative-sectors such as business services, ICT or high-technology manufacturing than the rest of the country. This discrepancy is also evident in the pool of most productive firms. These are underrepresented also in the retail and hospitality sector that contains among the others the tourism industry, which is particularly important for several areas of the region.

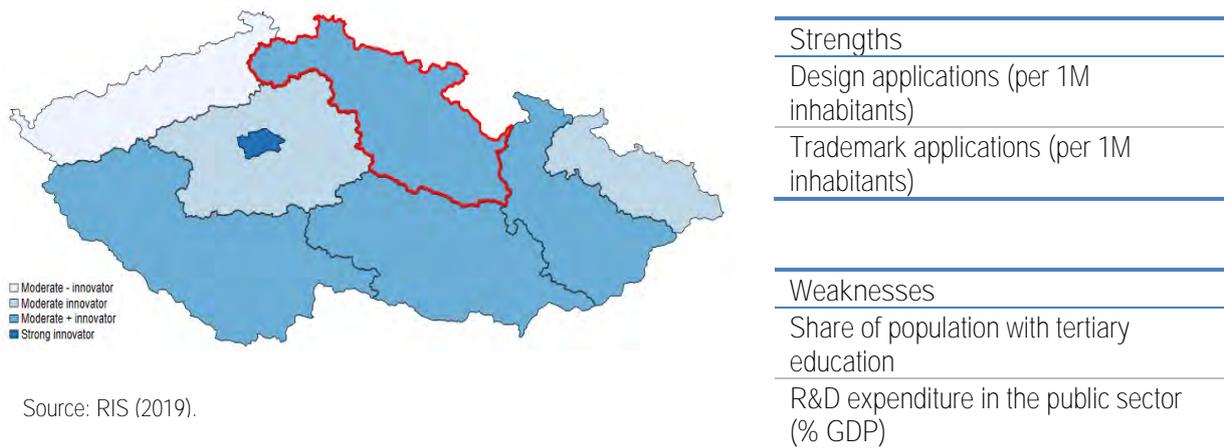


5. Hradec Karlove, Liberec and Pardubice

A. Innovation performance

The region of Severovýchod combining the NUTS 3 regions of Hradec Kralove, Liberec and Pardubice is a moderate + innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance

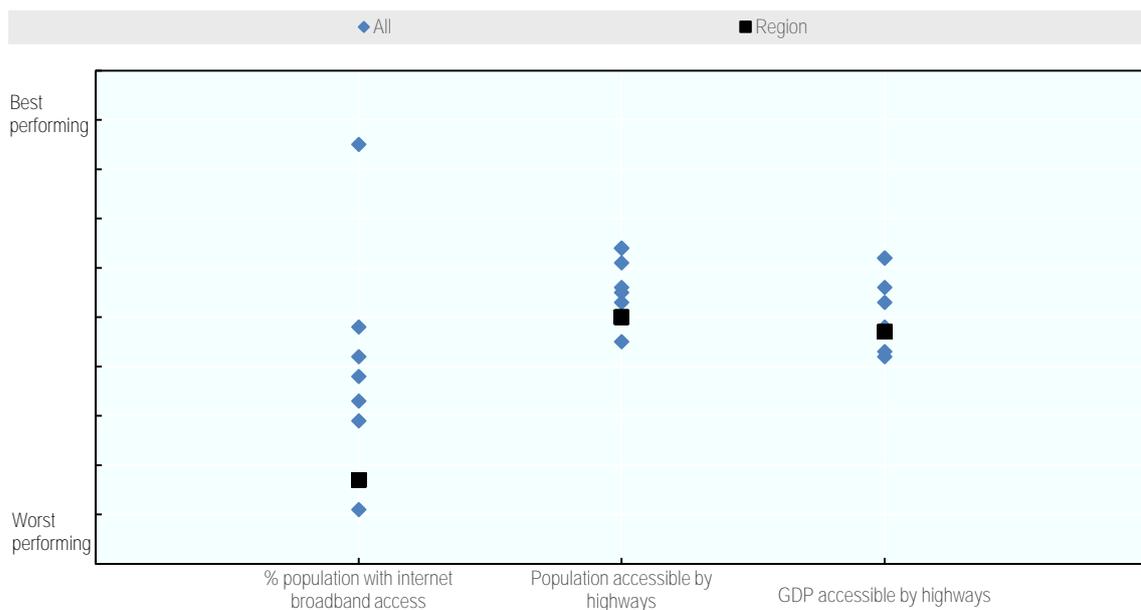


Source: RIS (2019).

B. Framework conditions

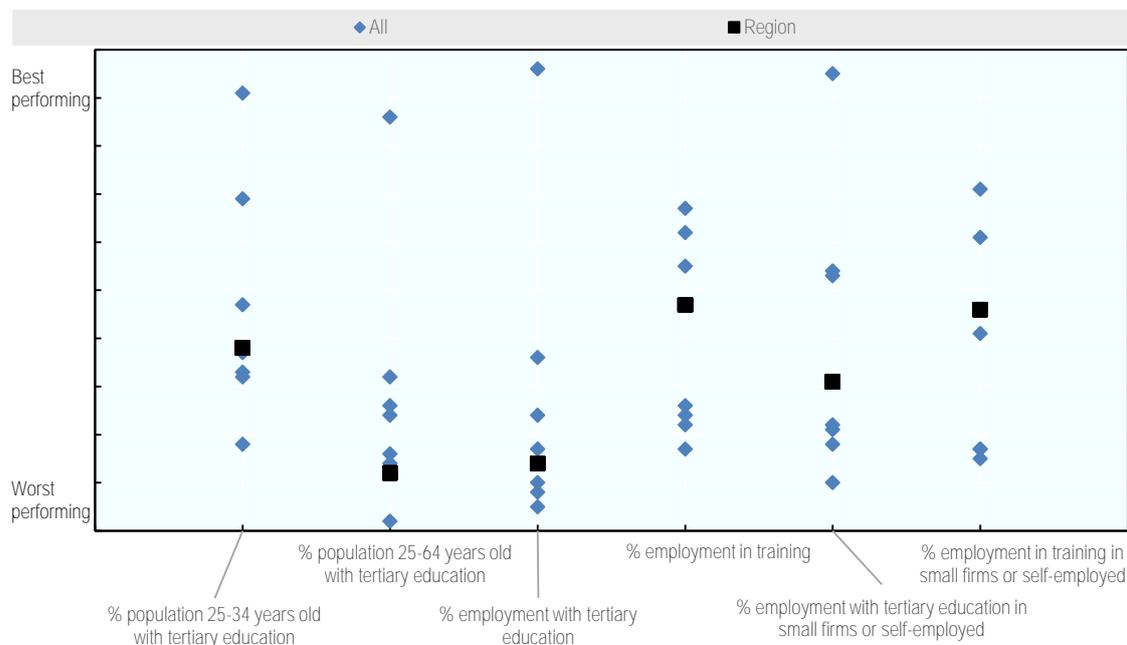
The combined region of Hradec Kralove, Liberec and Pardubice ranks in the bottom 25% among OECD region in terms of access to digital infrastructure. The extent of economic activity accessible from the region by highways is also lower than the rest of the country.

B1. Access to digital and physical infrastructure



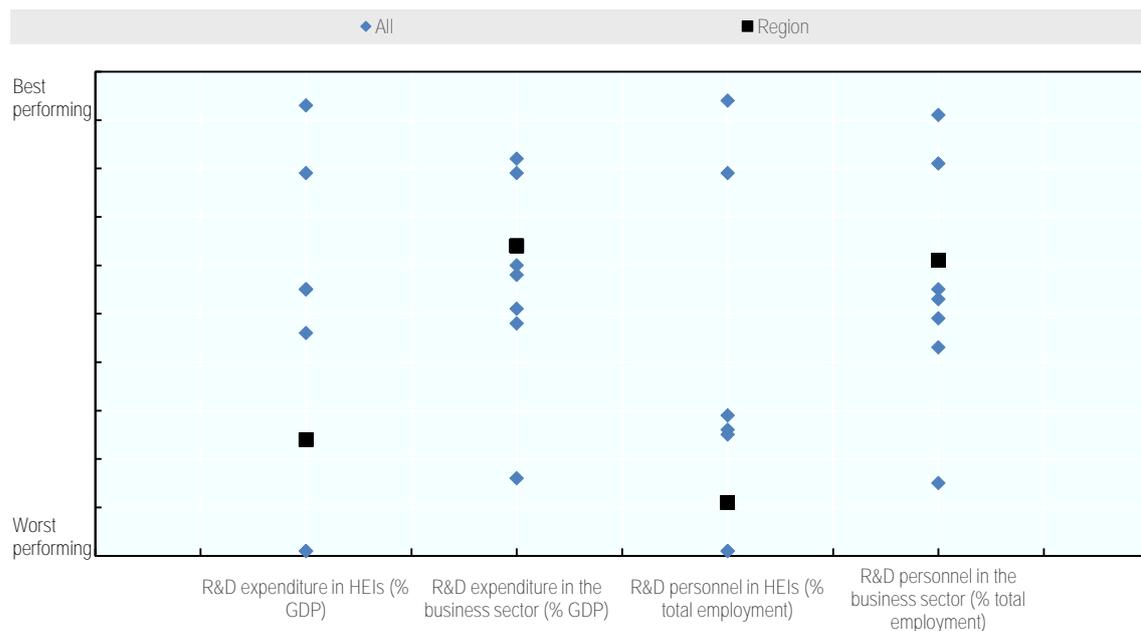
The combined region of Hradec Kralove, Liberec and Pardubice ranks below the average OECD region when it comes to measuring access to skills, but its performance is substantially in line with the average Czech region. The level of skills in the region is better among SMEs and self-employed than among the whole population of firms when compared to the average Czech region.

B2. Access to skills



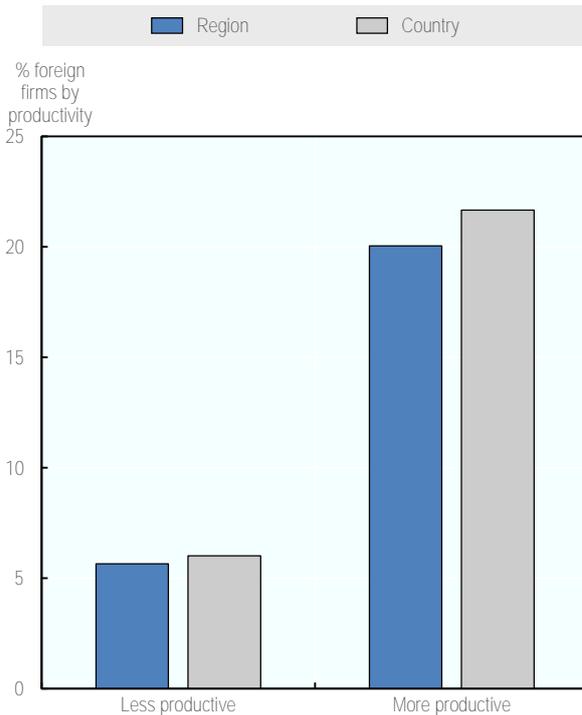
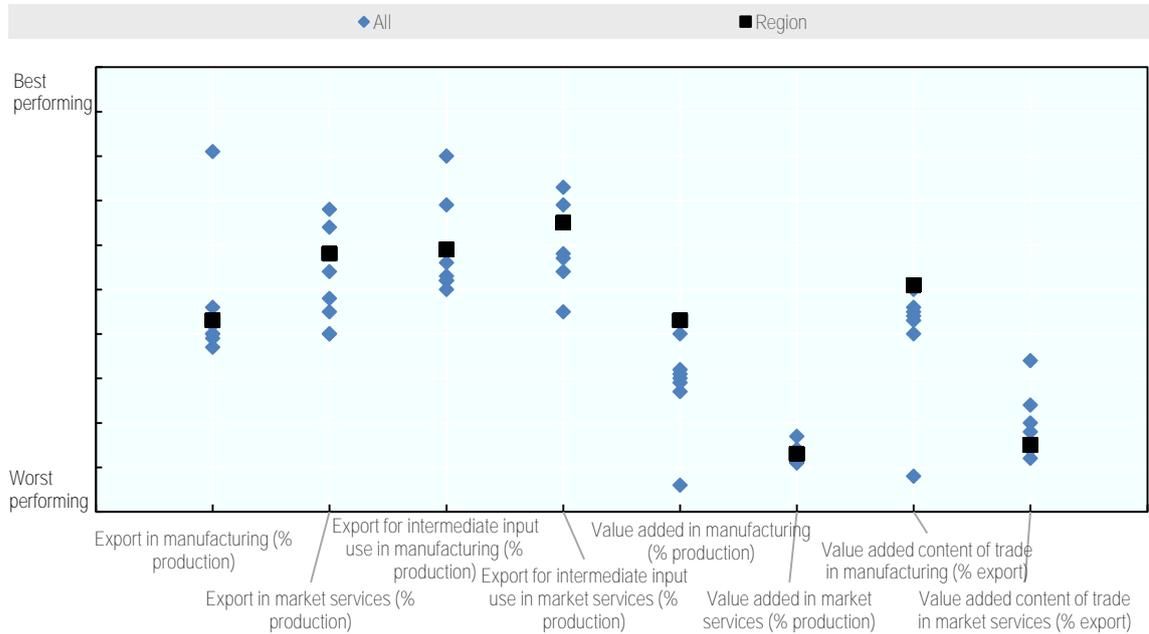
R&D activity lags behind in Hradec Kralove, Liberec and Pardubice, especially among higher education institutions.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI

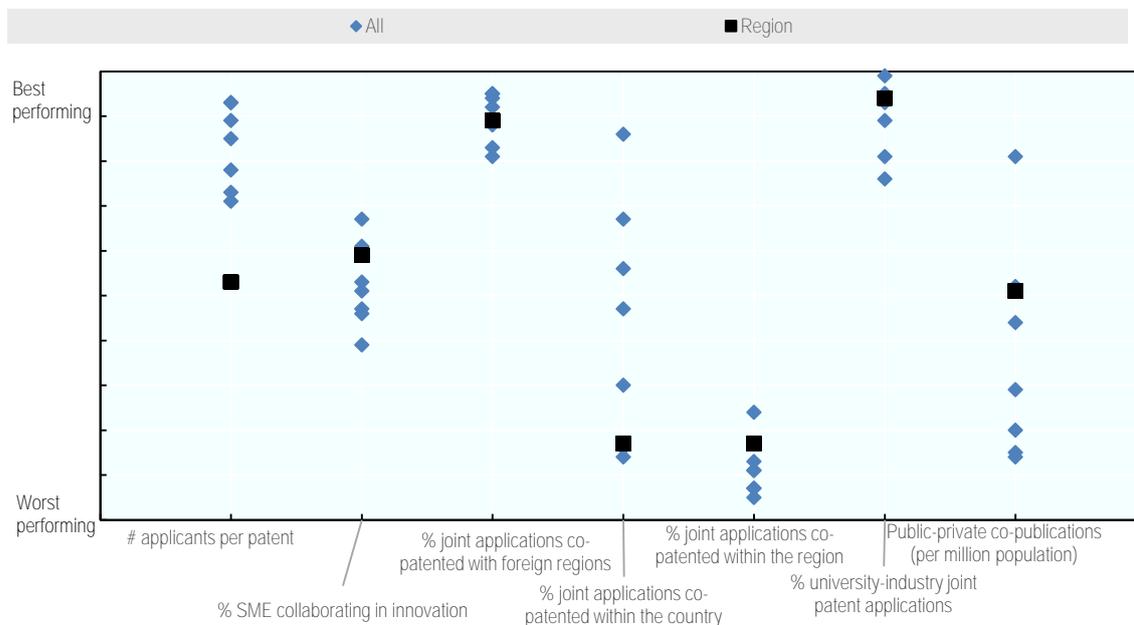


The degree of internationalisation as measured by the share of production going into exports in Hradec Kralove, Liberec and Pardubice is in line with the rest of the country. While still low compared to the average OECD region, the region's manufacturing exports boost a high value added content in comparison with other Czech regions. This places the region in a good position to learn from exports and supply chain relationships being high value added industries also typically more innovation-oriented.

Relative to the rest of the country, however, the share of foreign firms operating in the upper productivity segment is lower, thus suggesting that greater investments should be made to attract quality FDI in this region and make the most of the potential productivity spillovers associated with it.

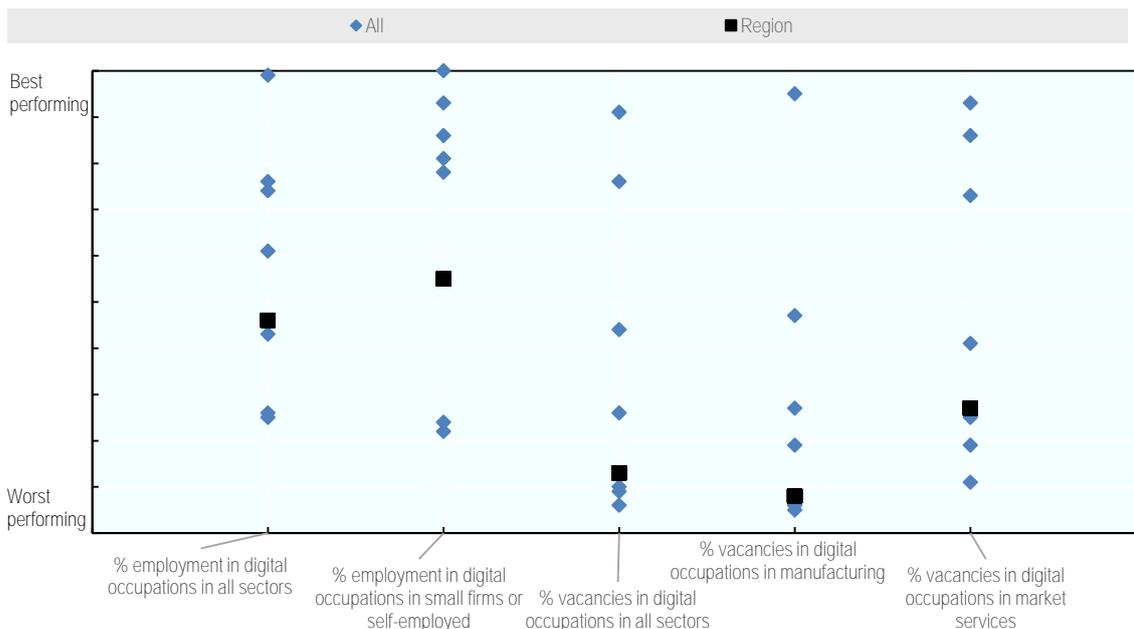
C2. Collaboration in research and innovation

Collaboration in research and innovation in the region of Hradec Kralove, Liberec and Pardubice has several strengths, such as the relatively high number of public-private co-publications or SMEs collaborating in innovation, but also some weaknesses, such as the subpar performance in the extent of co-patenting. The benefits of linkages established via co-patenting go beyond the innovation content of patents: they allow to liaise with other entities, learn best practices, and lay the ground for other collaborations.

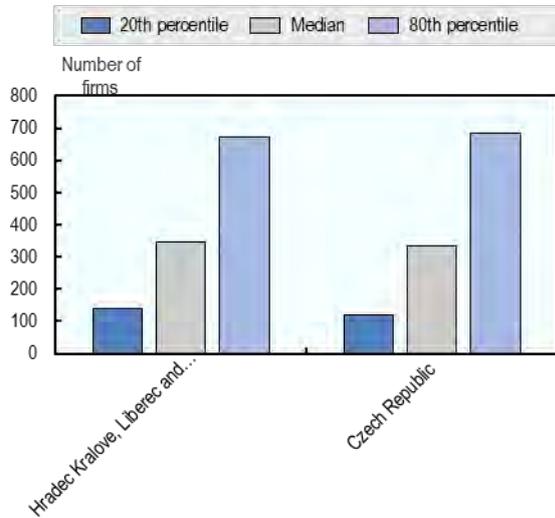


C3. Technology adoption

The share of jobs in digital occupations in Hradec Kralove, Liberec and Pardubice is in line with the country average and the OECD average. However, job postings for occupations requiring digital skills is low overall, thus suggesting subpar growth in demand for digital skills. For the overall economy, the share of vacancies posted in digital occupations ranks in the bottom 20% among OECD regions.



D. Innovation diffusion performance

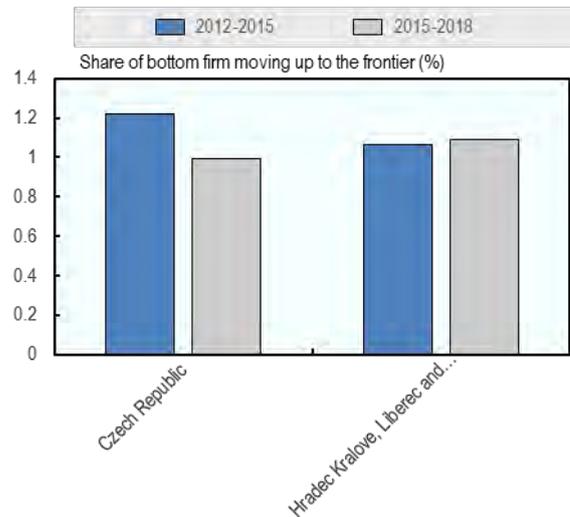


D1. Productivity differences with the rest of the country

The productivity distribution of firms active in Hradec Kralove, Liberec and Pardubice essentially mirrors the one of firms located in an average Czech region.

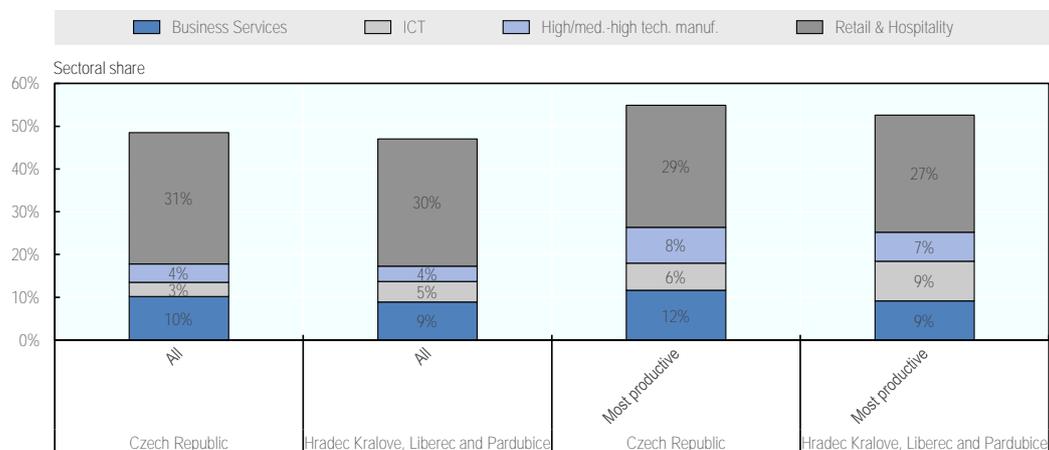
D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

Unlike in the rest of the Czech Republic, in the combined region of Hradec Kralove, Liberec and Pardubice the probability of a bottom firm moving to the frontier has substantially stayed the same between 2015 and 2018. The same way as a decline in this probability is a symptom of deteriorating innovation diffusion, lack thereof is a symptom that the innovation diffusion ecosystem in this region if anything did not recently deteriorate.



D3. Sectoral composition by firm productivity

Top productive firms are concentrated in the fast-growing and innovation-oriented ICT sector beyond what would sectoral composition for the rest of the economy suggest.

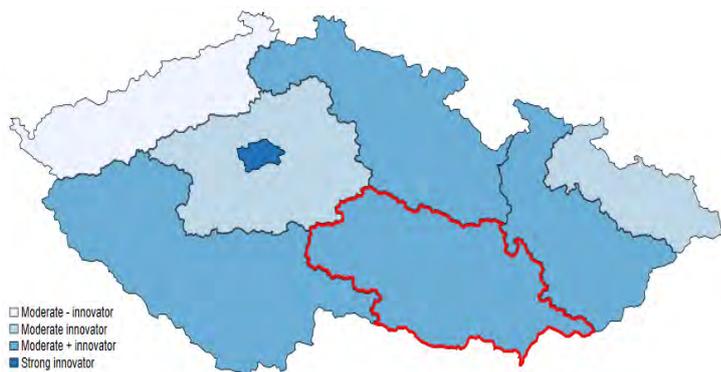


6. Vysocina and South Moravia

A. Innovation performance

The region of Jihovýchod combining the NUTS 3 regions of Vysocina and South Moravia is a moderate + innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

R&D expenditure in the private sector (% GDP)

R&D expenditure in the public sector (% GDP)

Weaknesses

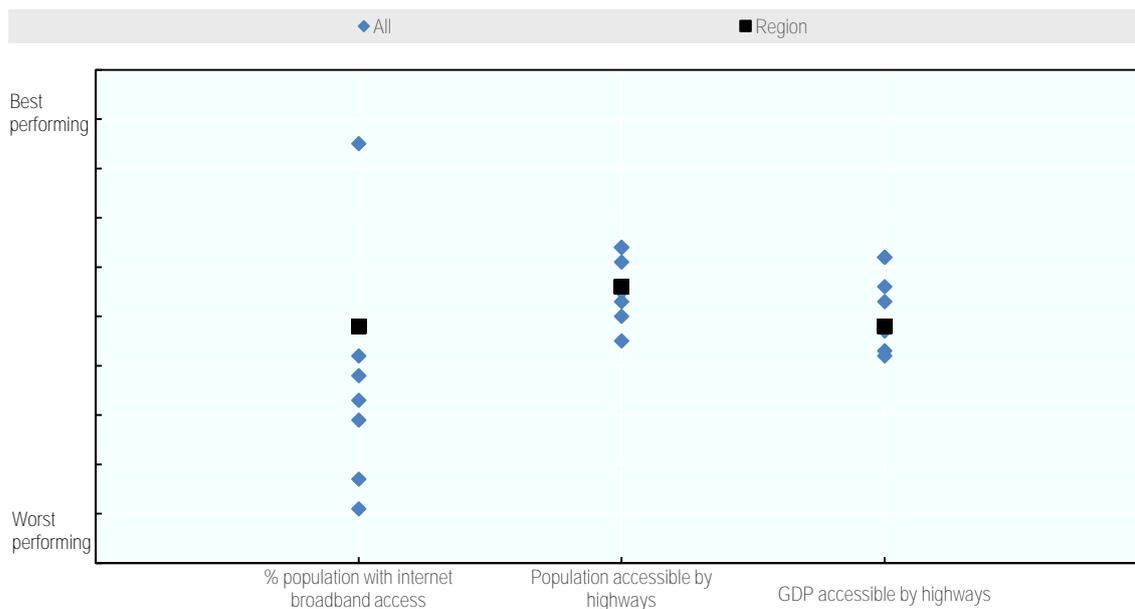
Patent applications (per 1M inhabitants)

Trademark applications (per 1M inhabitants)

B. Framework conditions

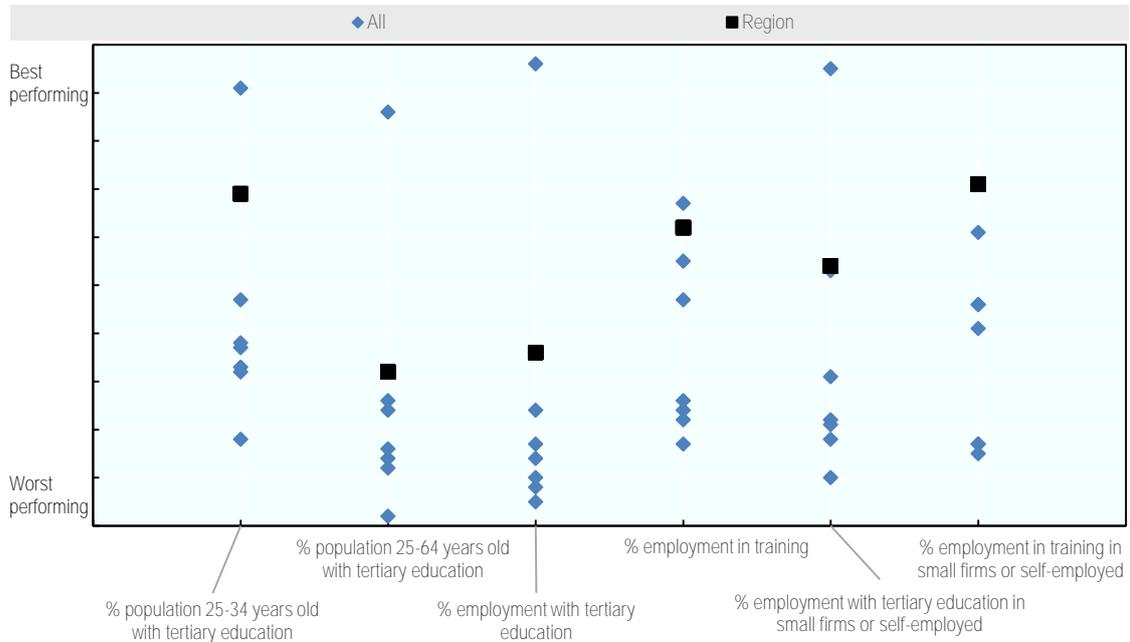
The combined region of Vysocina and South Moravia benefits ranks second in access to digital infrastructure within the Czech Republic. The extent of economic activity accessible by highways is in line with the average OECD region.

B1. Access to digital and physical infrastructure



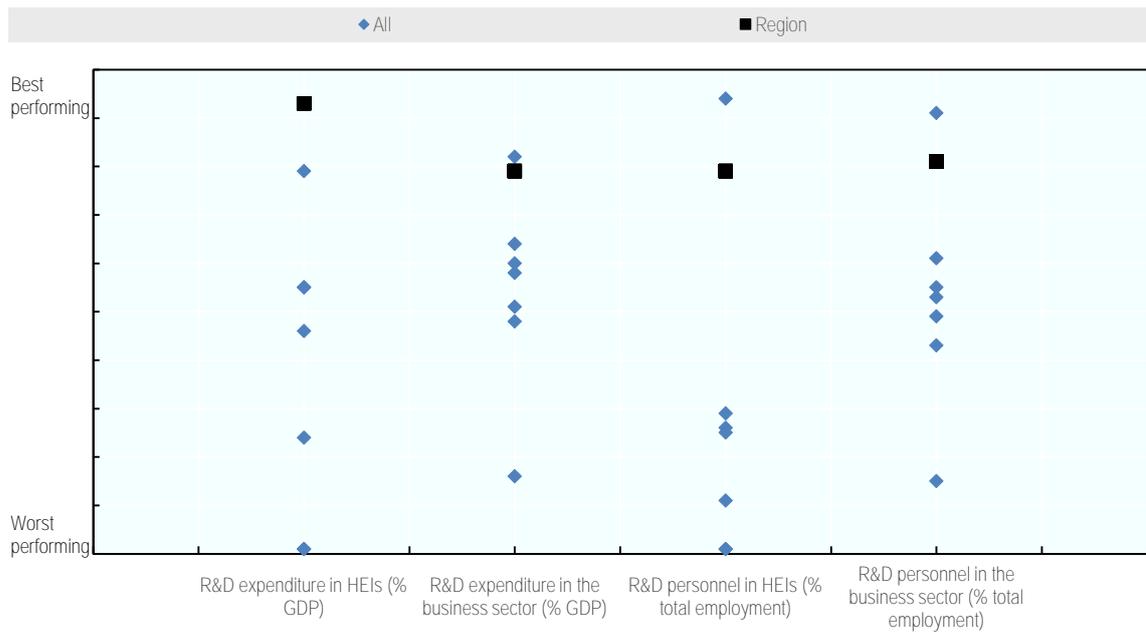
The combined region of Vysocina and South Moravia provides features very good access to skills, especially within the Czech Republic. Tertiary education has been increasing substantially. The extent of training provided by companies in the past four weeks, is the second highest in the Czech Republic, and the highest when narrowing the focus to SMEs and self-employed is good.

B2. Access to skills



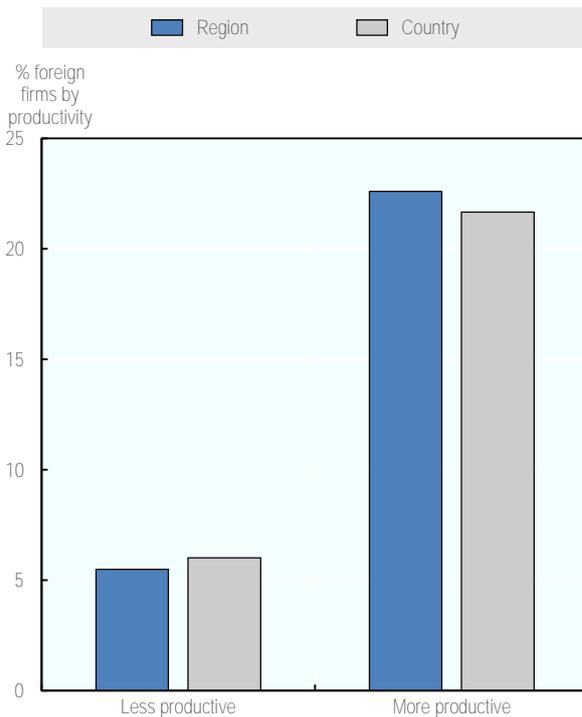
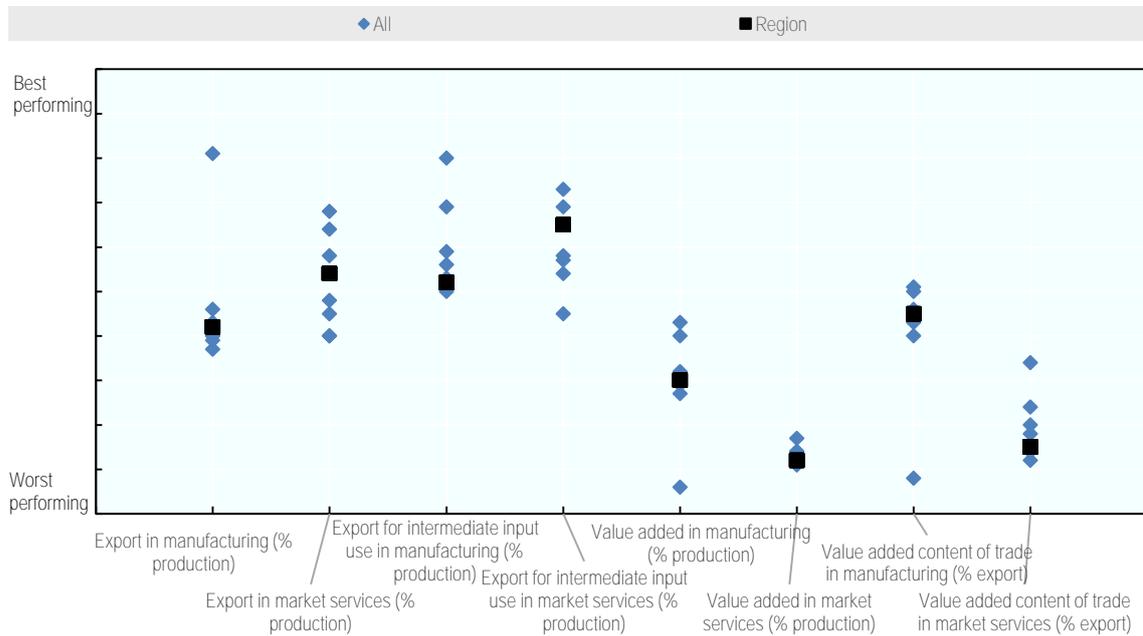
Vysocina and South Moravia is a top performing player concerning R&D activity, especially among universities, for which it rivals the capital Prague.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI



The degree of internationalisation in Vysocina and South Moravia is aligned with the rest of the country.

Given the excellent access to skills and R&D assets that the region provided, the region struggles to capitalise this potential in terms of competitiveness in the export market.

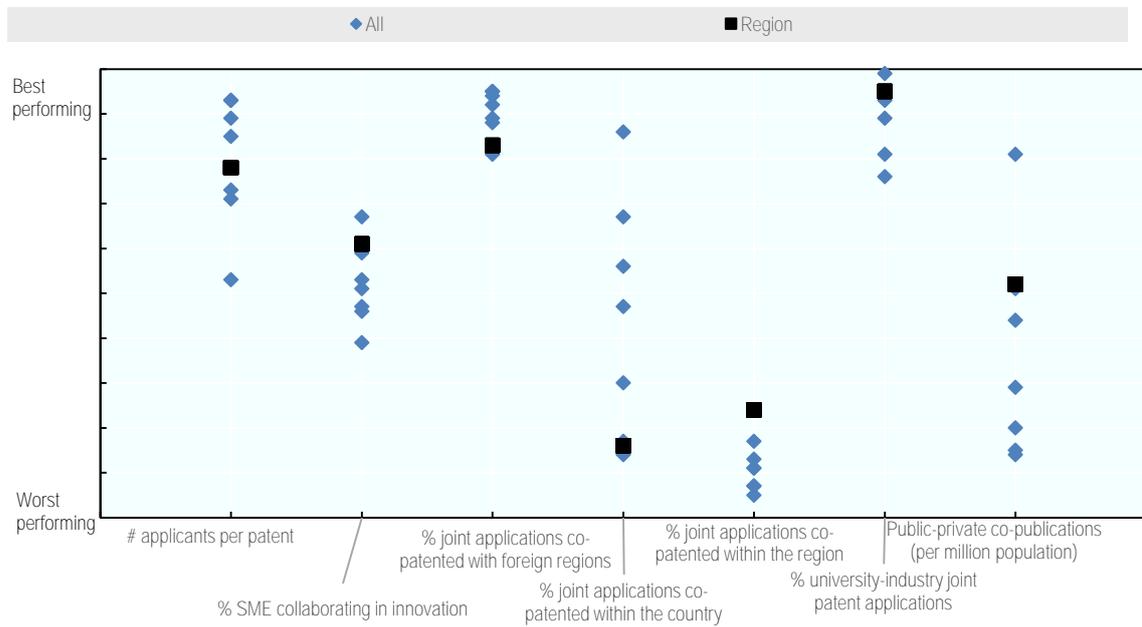
When it comes to presence of foreign-owned firms in the upper productivity segment, this share is just above the country average.

Framework conditions in the combined region of Vysocina and South Moravia are very good with the sole exception of access to nearby economic activity via physical infrastructure, which often associated with higher trade volumes. In order to improve its performance in terms of internationalisation, the region should consider expanding its investments in physical infrastructure, starting from its connections with the capital of Prague.

C2. Collaboration in research and innovation

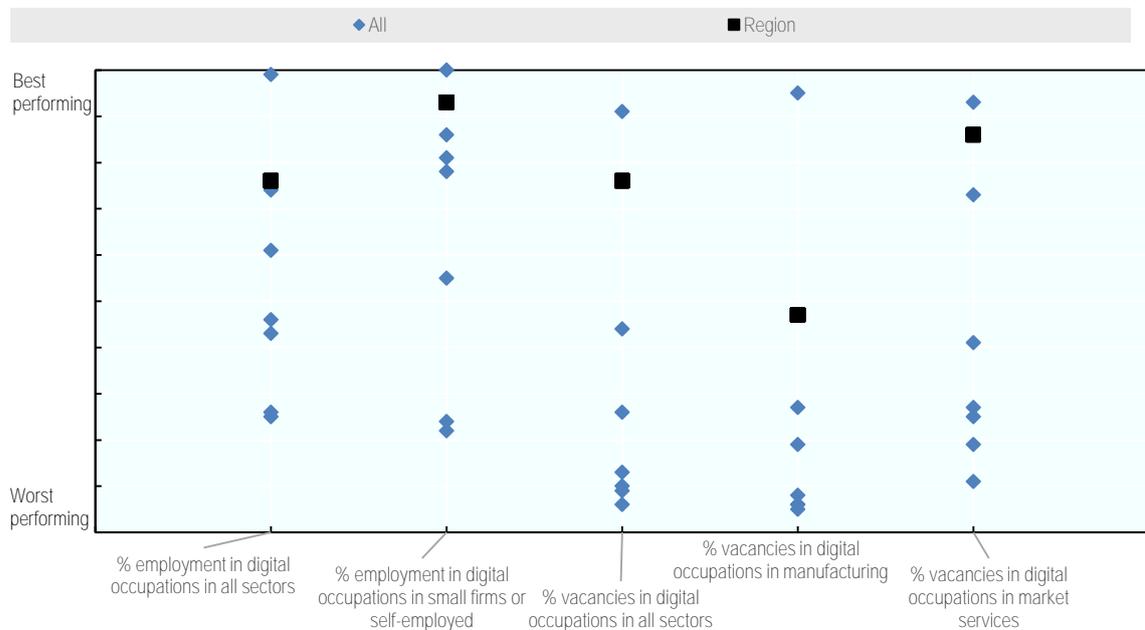
The combined region of Vysocina and South Moravia features overall a performance in terms of collaboration in research and innovation in line with the country average. Most of the collaboration however seems to be concentrated within the boundaries of the region. Making the most of regional assets and linkages is a first important and easier to implement step in the path towards improving the extent of innovation diffusion in the region. However, the next step

should consist of developing linkages within the rest of the country and the foreign community of researchers and inventors.

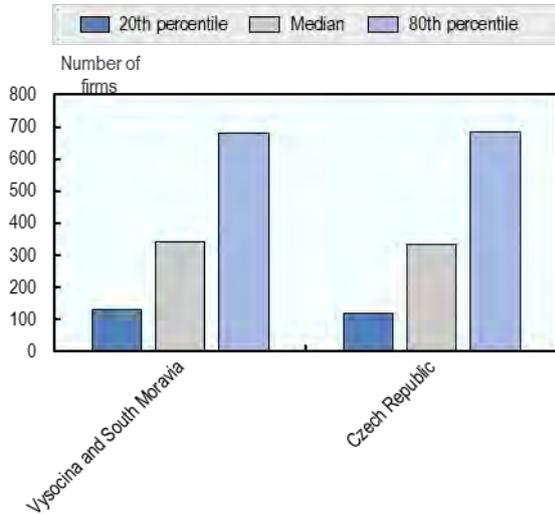


C3. Technology adoption

The combined region of Vysocina and South Moravia outperforms most other Czech regions when it comes to the share of jobs in digital occupations. The region boasts also a good level of demand for digital tasks in the manufacturing sector, which is instead lagging in most of other regions, in spite of representing an important share of economic activity. The share of jobs in digital occupations among SMEs and self-employed ranks in the top 10% among OECD region, thus witnessing overall a good level of digitalisation of firms and SMEs located in the region.



D. Innovation diffusion performance

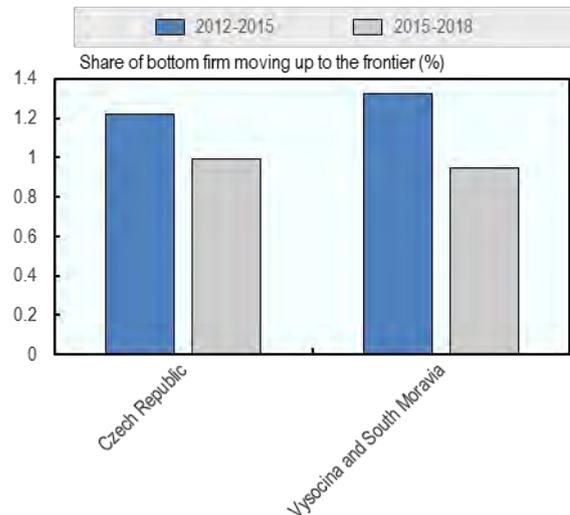


D1. Productivity differences with the rest of the country

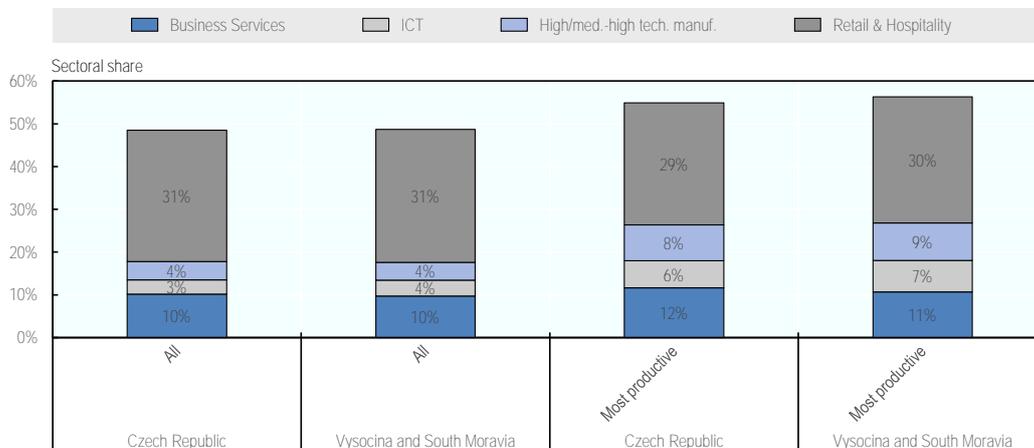
The productivity distribution of firms active in Vysocina and South Moravia essentially mirrors the one of firms located in an average Czech region.

D2. Differences with the rest of the country in the probability for bottom productive firms to become top productive

The decline in the probability of a bottom firm moving up to the frontier between 2015 and 2018 in the combined region of Vysocina and South Moravia has been the same as in the rest of the country.



D3. Sectoral composition by firm productivity
The combined region of Vysocina and South Moravia boosts a specialisation of top-productivity firms into fast-growing and innovation-oriented sectors beyond what suggested by the overall sectoral composition of all firms. The disproportionate presence of top-productivity firms in more technologically advanced sectors is particularly evident in ICT and high-technology manufacturing.



7. Olomouc and Zlin

A. Innovation performance

The region of **Střední Morava** combining the NUTS 3 regions of Olomouc and Zlin is a moderate+ innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

Design applications (per 1M inhabitants)

R&D expenditure in the private sector (% GDP)

Weaknesses

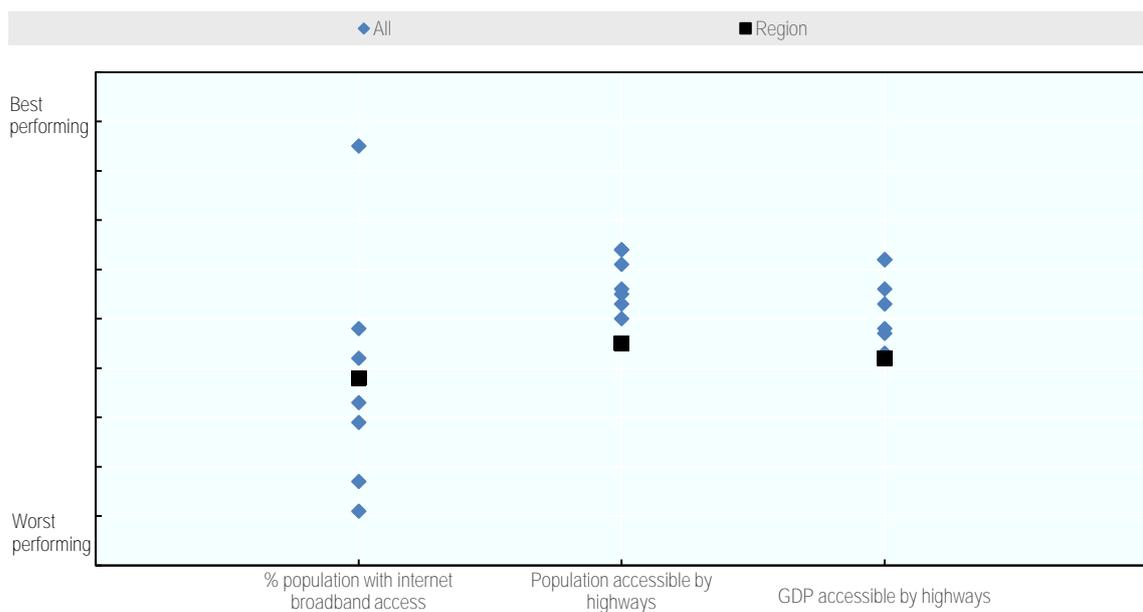
Patent applications (per 1M inhabitants)

Share of population with tertiary education

B. Framework conditions

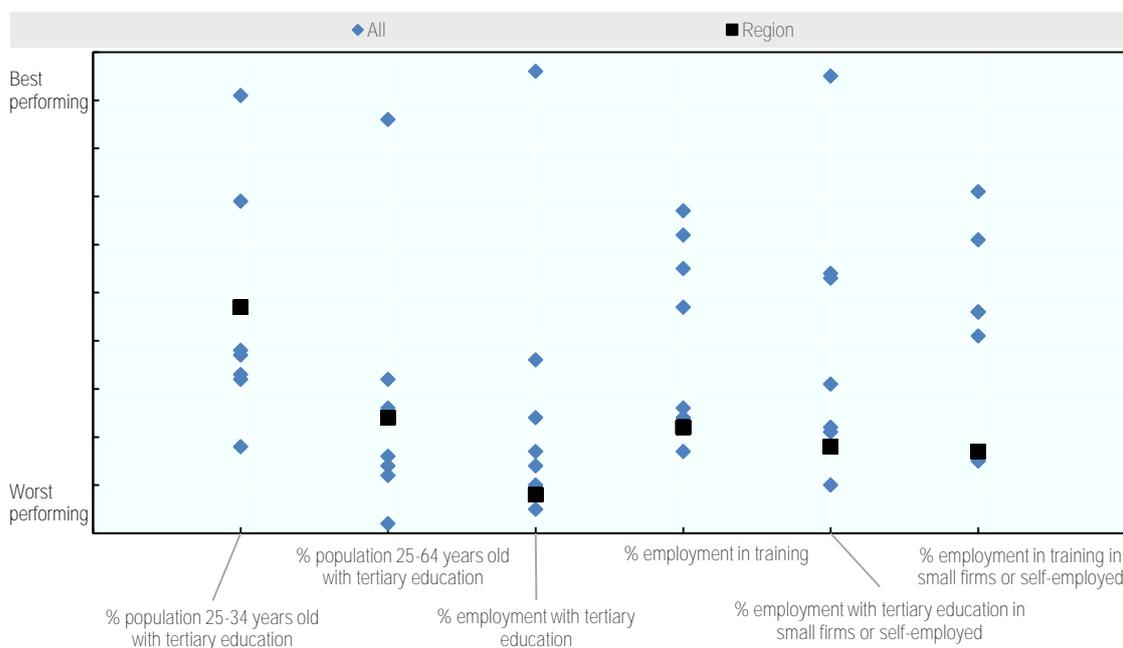
The combined region of Olomouc and Zlin has the worst physical connections among Czech regions. The combined region has low access to surrounding economic activity given the available physical infrastructure due to its greater distance from more populated central European cities. Access to digital infrastructure is in line with the average Czech region, but below the average OECD region.

B1. Access to digital and physical infrastructure



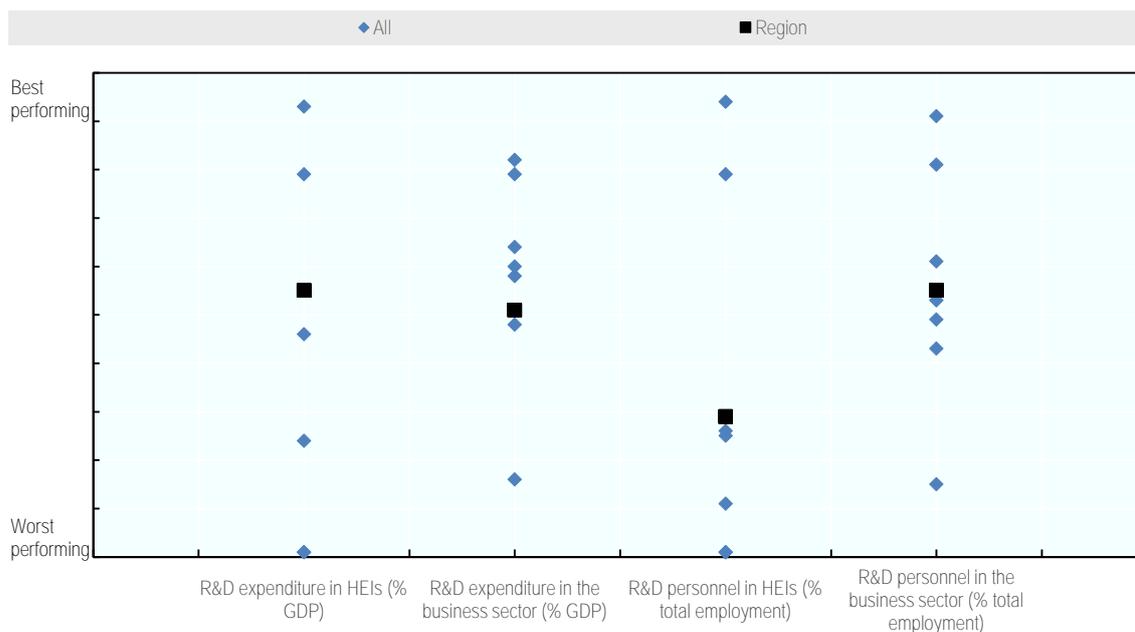
The combined region of Olomouc and Zlin lags behind the average Czech region in terms of access to skills. The most prominent lags invest especially human capital in SMEs and among self-employed, as measured both in terms of training received by workers and in terms of attainment of tertiary education.

B2. Access to skills



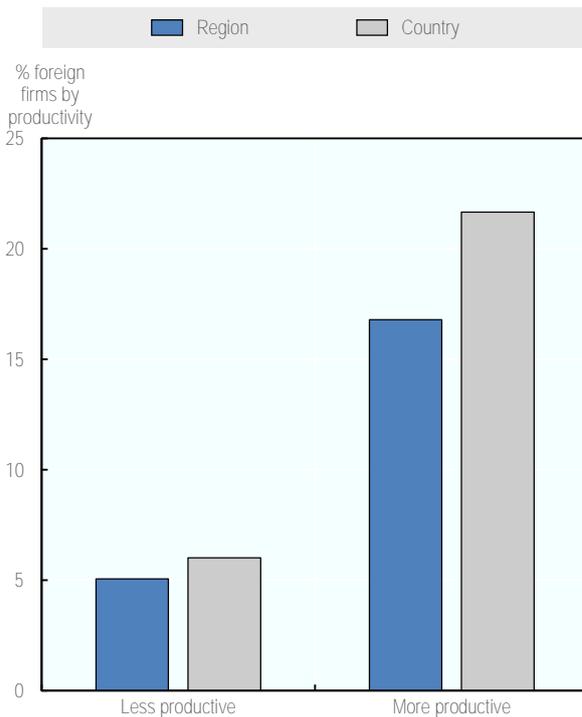
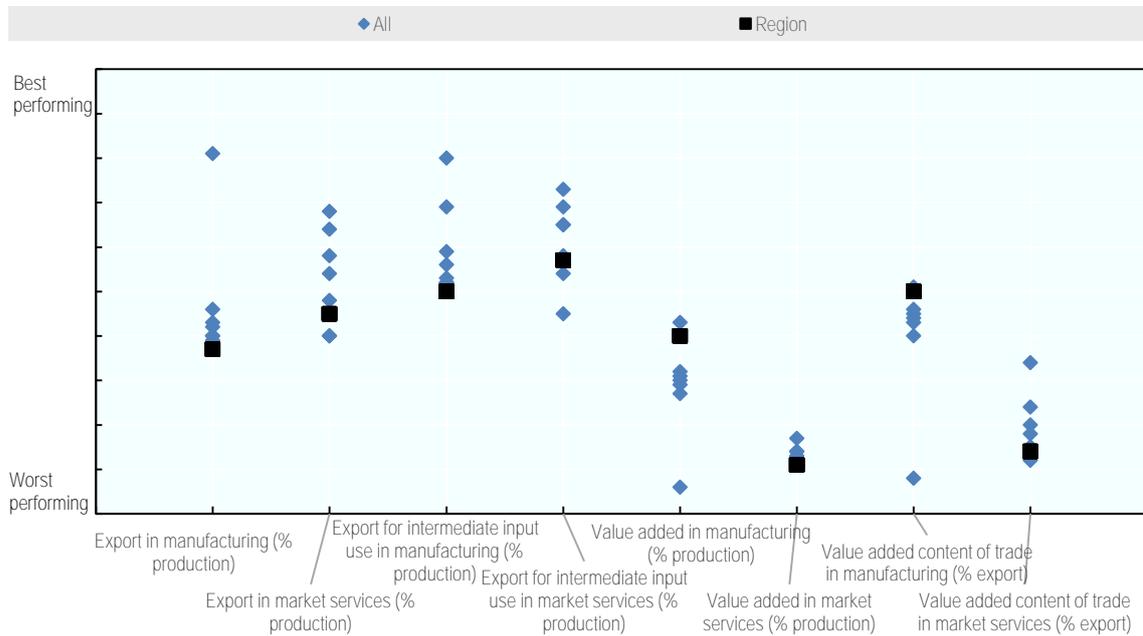
The combined region of Olomouc and Zlin registers R&D activity broadly in line with the average Czech and OECD region, except for the share of personnel in higher education institutions employed in R&D activity, where the region ranks among the bottom 30% OECD regions.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI

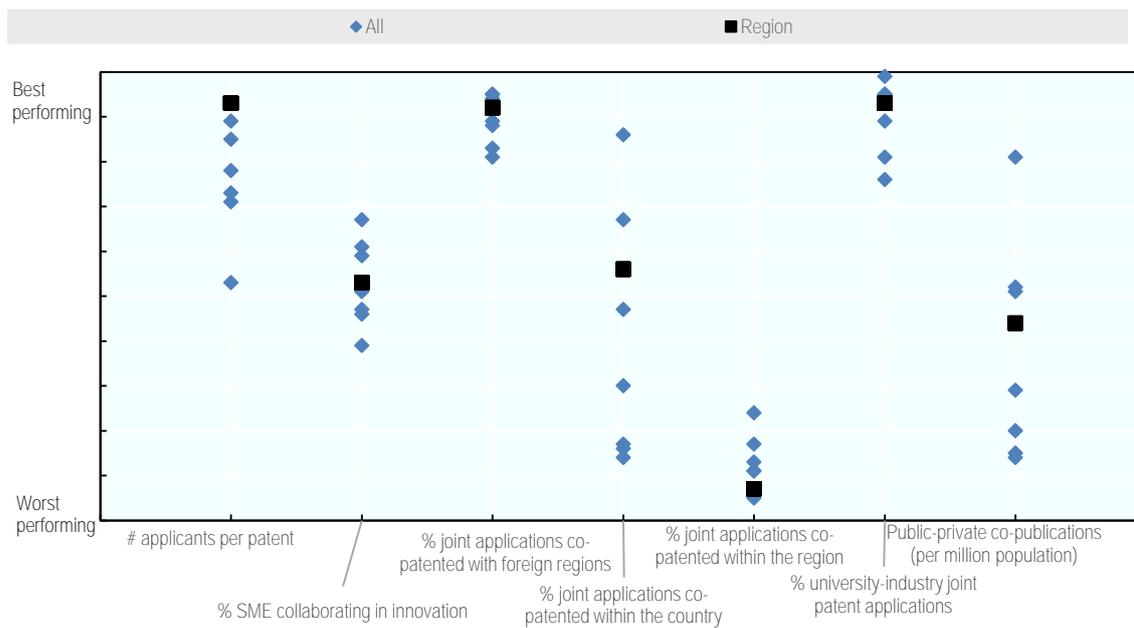


The degree of internationalisation as proxied by the share of production going into exports in the regions of Olomouc and Zlin is lower than in the rest of the country. However, the value added content of trade especially in manufacturing is higher than in the rest of the country, thus suggesting that the region is in a good position for its firms to potentially learn from supply-linkages and have the right incentives to implement investments to increase their competitiveness.

Relative to the rest of the country, the share of foreign firms however is lower, both in the upper and in the lower productivity segment, where the differences are most pronounced in the upper productivity segment. This represents a factor of weakness since most productive foreign firms are the ones more likely to be associated with positive productivity spillovers on the surrounding local firms.

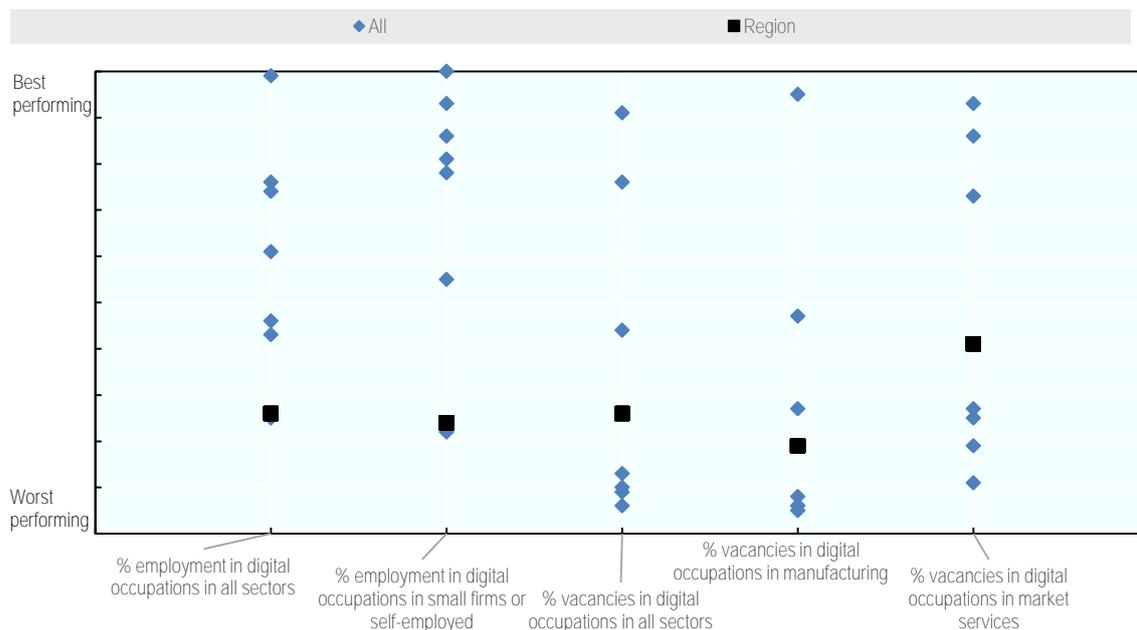
C2. Collaboration in research and innovation

The performance of Olomouc and Zlin with respect to collaboration in research and innovation is in line with the rest of the country. While the region ranks first within the Czech Republic and in the top 10% among OECD regions, concerning the extent of co-patenting as proxied by the number of applicants per patent, the innovation diffusion channel captured by collaboration in patenting activity within the country and the region could be exploited further.



C3. Technology adoption

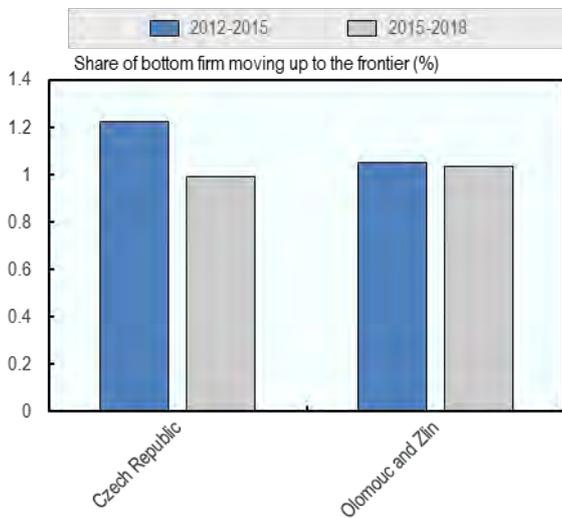
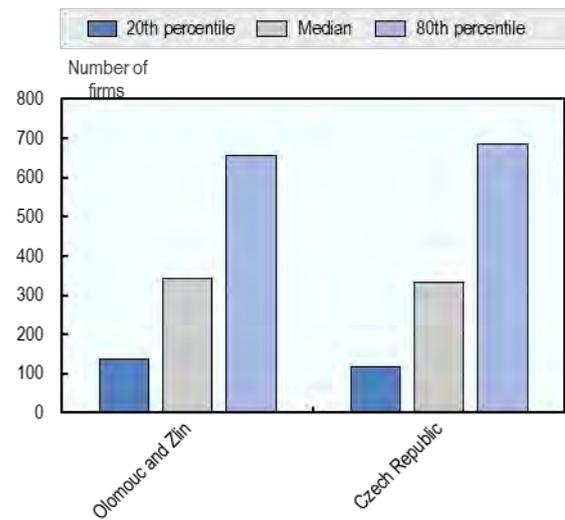
The combined region of Olomouc and Zlín registers a substantial lag in terms of technology adoption and digitalisation, as measured by the share of employment in digital occupations. The share of vacancies, hence labour demand, for digital occupations is substantially in line with the rest of the country, and tanks in the bottom 25% among OECD regions, thus pointing towards possible shortages of specialised competences.



D. Innovation diffusion performance

D1. Productivity differences with the rest of the country

Firms active in Olomouc and Zlin region – especially the most productive ones – are on average less productive than those active in an average Czech region.

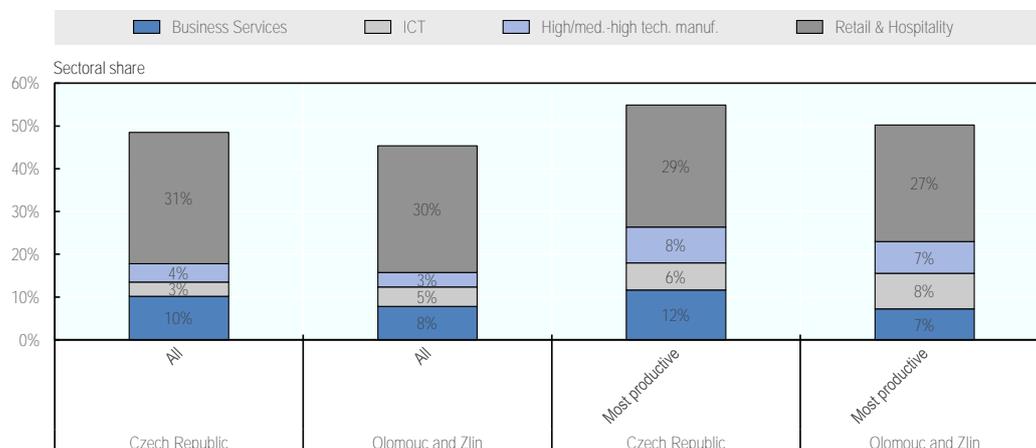


D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

Unlike in the rest of the Czech Republic, in the combined region of Olomouc and Zlin the probability of a bottom firm moving to the frontier has substantially stayed the same between 2015 and 2018. The same way as a decline in this probability is a symptom of deteriorating innovation diffusion, lack thereof is a symptom that the innovation diffusion ecosystem in this region if anything did not recently deteriorate.

D3. Sectoral composition by firm productivity

Sectoral composition for the combined region of Olomouc and Zlin is substantially in line with the rest of the country, both for the pool of all firms and for the pool of just most productive firms.



8. Moravian-Silesian region

A. Innovation performance

The Moravian-Silesian region is a moderate innovator within the Czech Republic. There exists four types of innovators in the Czech Republic: strong, moderate +, moderate and moderate - innovators.

A1. Innovation performance



Source: RIS (2019).

Strengths

Non-R&D innovation expenditure in SMEs (% turnover)

Design applications (per 1M inhabitants)

Weaknesses

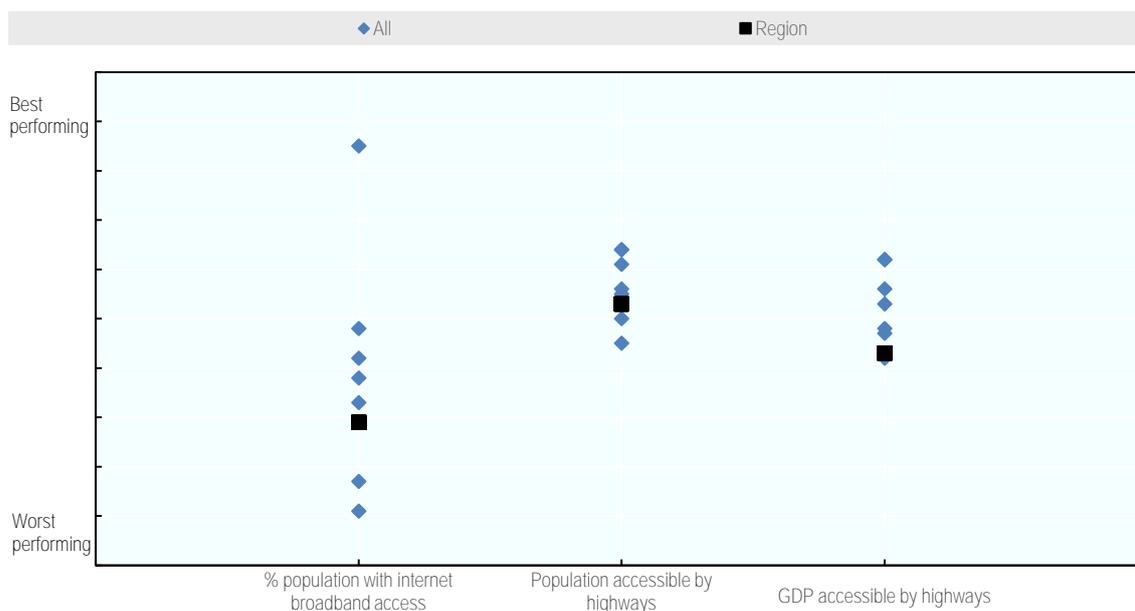
Public-private co-publications (per 1M inhabitants)

Patent applications (per 1M inhabitants)

B. Framework conditions

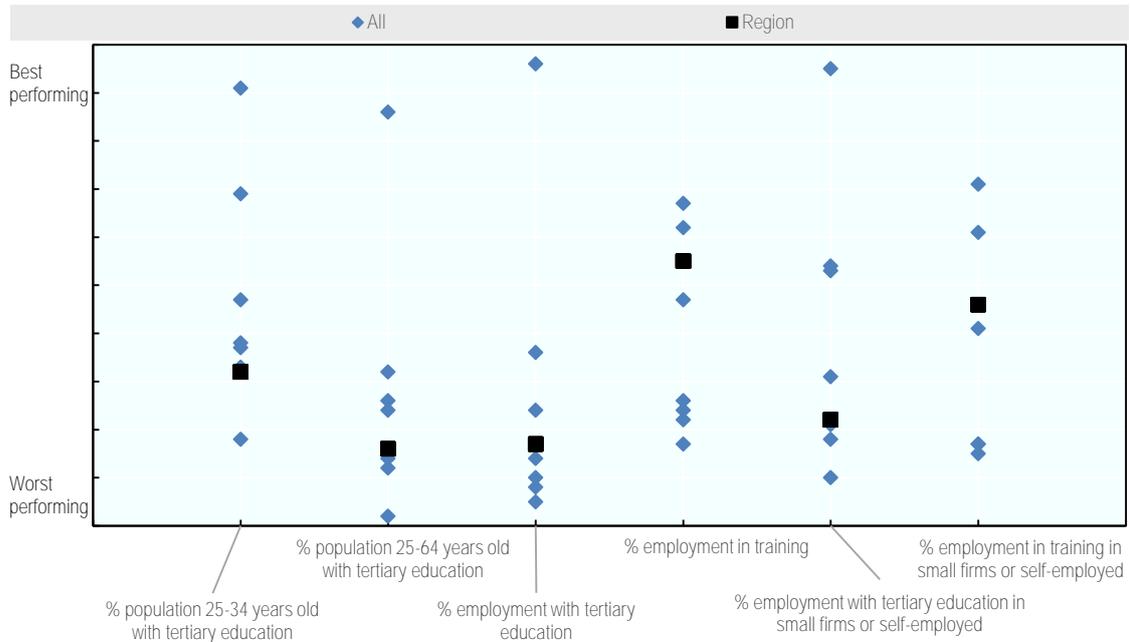
The Moravian-Silesian region benefits from subpar access to digital infrastructure compared to the rest of the country. The extent of economic activity in the surroundings accessible by highways is also lower than in the rest of the country, especially with respect to GDP, a result due to the proximity of the region to regions with not very high GDP per capita.

B1. Access to digital and physical infrastructure



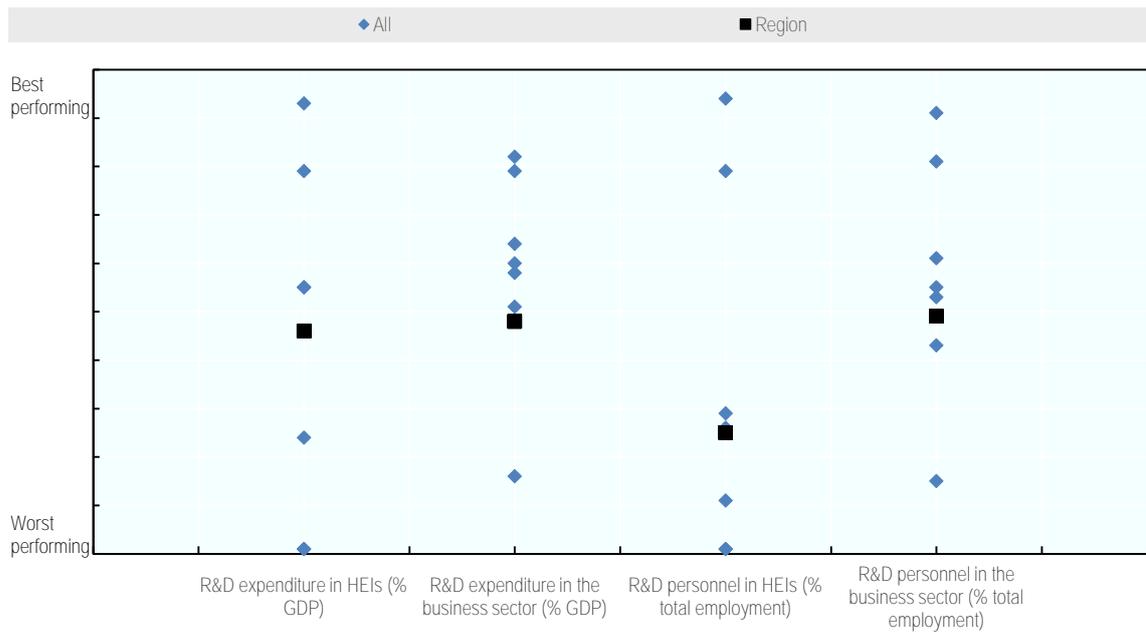
In spite of having been improving, the Moravian-Silesian region still has below average educational attainment as measured by the share of population with tertiary education. Its overall performance in terms of access to skills is around the average, suggesting that, given the presence in this region of the third largest city in Czech Republic, more could be done to improve the share of high-skilled workers in the population.

B2. Access to skills



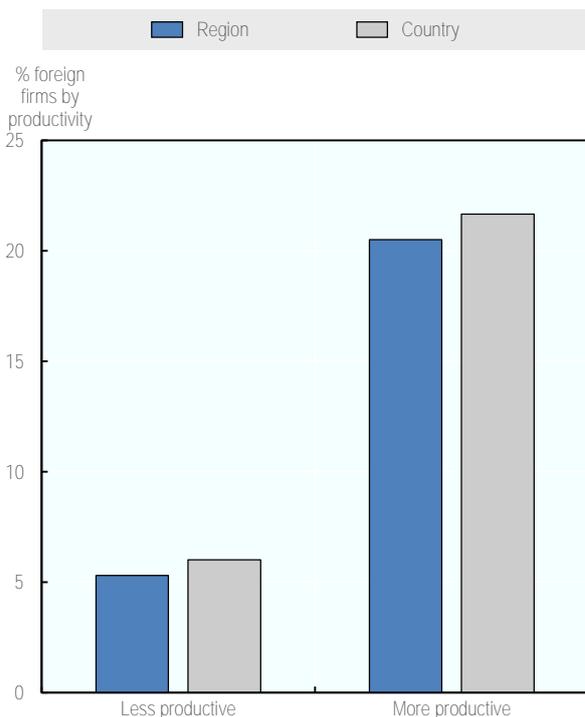
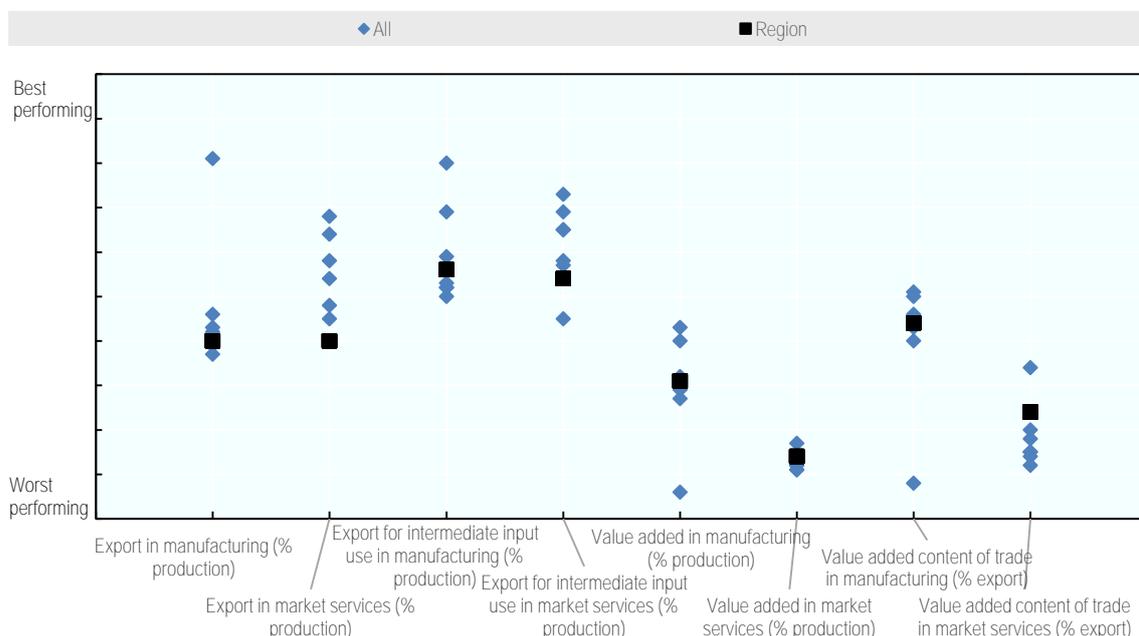
R&D activity lags behind in the Moravian-Silesian region relative to other Czech regions, especially in the business sector.

B3. Access to R&D



C. Innovation diffusion channels

C1. Internationalisation, GVCs and FDI



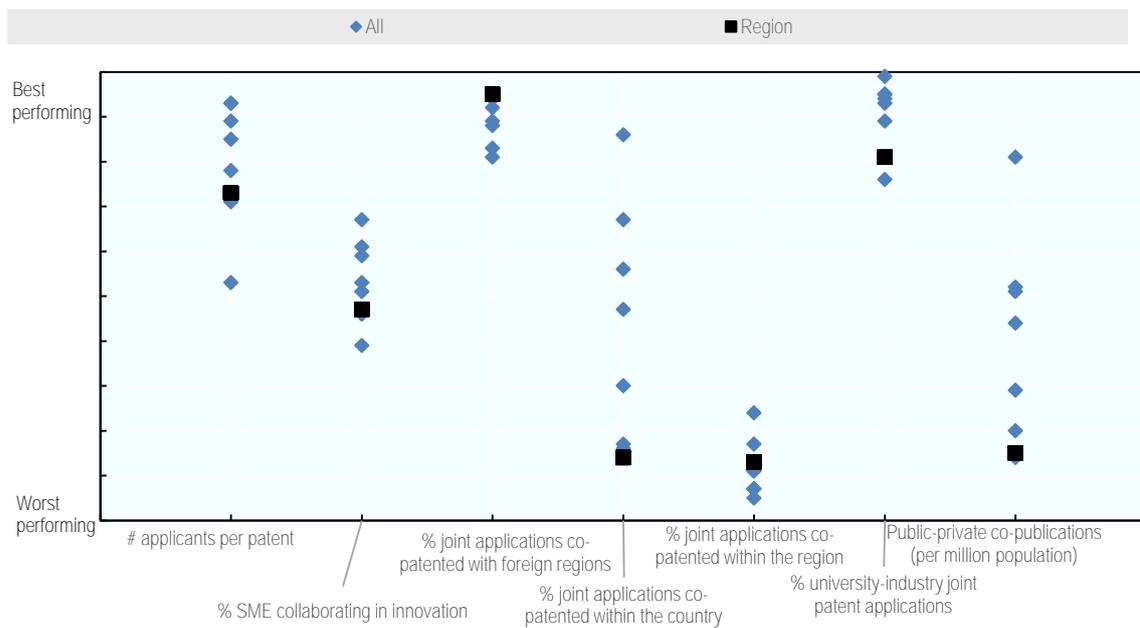
The degree of internationalisation as proxied by the exports share of production in the Moravian-Silesian region is on average lower than in the rest of the country. Conversely, the value added content of trade is in line with the rest of the country.

Relative to the rest of the country, the share of foreign firms is lower, both in the upper and in the lower productivity segment.

The Moravian-Silesian region does not seem to capitalise enough on the fact of hosting the third largest city in the country. Cities tend to be more productive than other places, attract more high-skilled individuals and foreign direct investment. The region could benefit from investing into the urban environment of its capital Ostrava to make it a more solid engine of economic growth in the region, while at the same time cultivating the urban-rural linkages allowing knowledge and ideas to spread to the region.

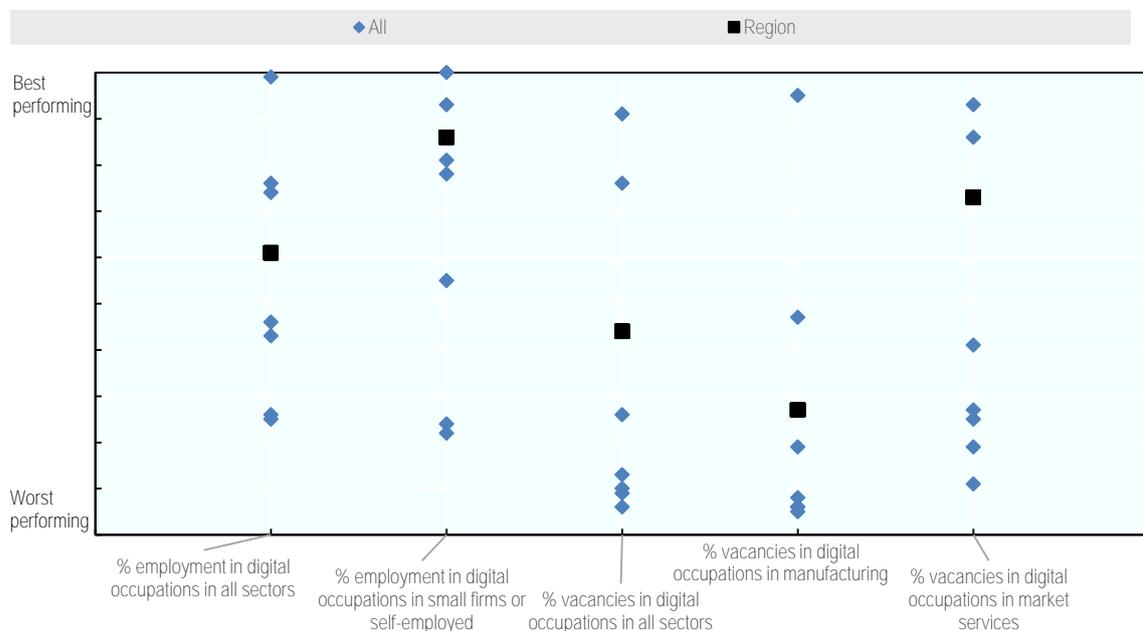
C2. Collaboration in research and innovation

The Moravian-Silesian region ranks in the second half of Czech regions concerning almost all the indicators capturing the extent of collaboration in research and innovation in the region. It ranks high in terms of the percentage of patent applications submitted together with inventors located in foreign regions. It features however a low score concerning the number of public-private co-publications (per 1M inhabitants), and the share of university-industry patent applications, thus signalling that the extent of collaboration with higher education institutions might improve.

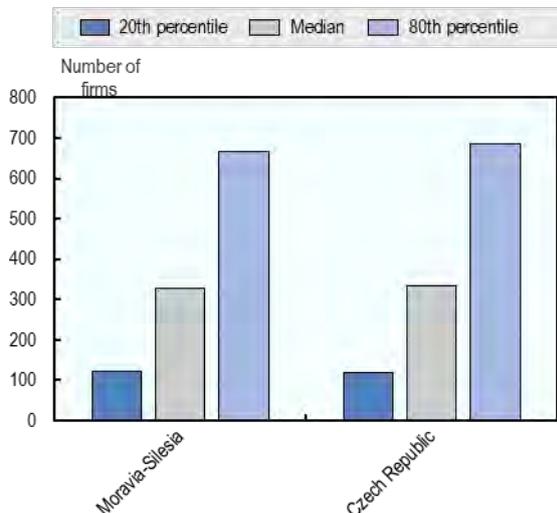


C3. Technology adoption

The share of jobs in digital occupations in the Moravian-Silesian region tends to be above the country average. It is especially high among SMEs and self-employed, for which the region ranks in the top 20% among OECD regions, thus signalling a good degree of digitalisation among SMEs. The share of employment accounted by SMEs in this region is however lower than in other regions: the economic structure of the Moravian-Silesian region is mostly characterised by the presence of large manufacturing firms, for which the share of posted vacancies in digital occupations well below the OECD average.



D. Innovation diffusion performance

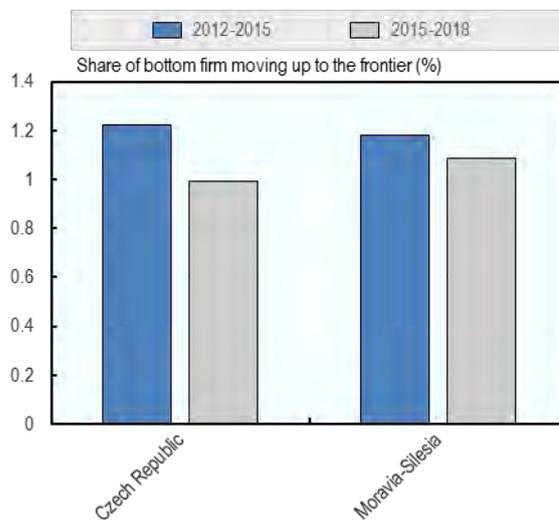


D1. Productivity differences with the rest of the country

Firms active in the Moravian-Silesian region are on average slightly less productive than those active in an average Czech region. The difference is driven by firms with productivity located above the 80th percentile of the productivity distribution in the region.

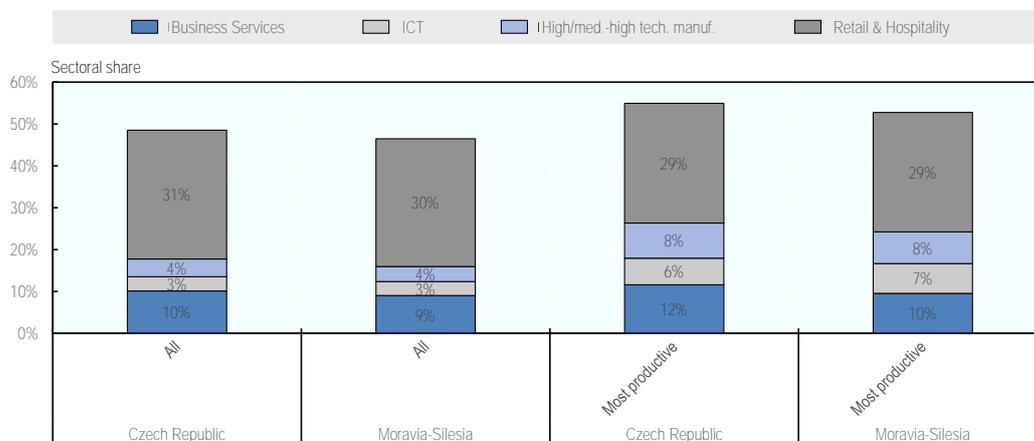
D2. Differences with the rest of the country in the probability for bottom 20% productive firms to move to the top 20% productive ones

The decline in the probability of a bottom firm moving up to the frontier between 2015 and 2018 in the Moravian-Silesian region has been less pronounced than in the rest of the country.



D3. Sectoral composition by firm productivity

Sectoral composition in the Moravian-Silesian region is analogous to the one for the rest of the country, both for the pool of all firms and for the pool of most productive firms only



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