

Innovation Diffusion in Bulgaria, North Central Region

A Regional Approach



**Information Note:**

This report was prepared as 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. It is based on data analysis, surveys and workshops among stakeholders and further desk research. 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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1 Introduction

1.1. The concept of innovation diffusion

Innovation is of crucial importance for countries and regions, to strengthen economic growth and find solutions to societal challenges. Innovation does not only take place by “creating” knowledge (for instance through research and development) but also by learning from others. Such learning processes enable the diffusion of innovation, and can help companies, regions or countries to catch-up to higher productivity levels. Innovation diffusion is of particular importance for small- and medium-sized enterprises (SMEs) and start-ups and reflects the process through which these firms gather knowledge, information and innovations from outside and use them to introduce their own innovative products or processes. It refers for instance 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.

1.2. What drives innovation diffusion?

Innovation diffusion is a complex phenomenon that relates to three sets of factors:

- The local and national **framework conditions**, which affect firms’ incentives and capacities to adopt innovations. Examples of framework conditions are the regulatory framework, market conditions, access to finance and skills, and infrastructure.
- The functioning of the **channels** through which the diffusion can take place. These channels include supply chains, workers careers and mobility, academic-business collaboration or knowledge intensive business services.
- The presence and functioning of a variety of **intermediary organizations** that help companies build the capacity for innovation adoption, identify external resources, and share knowledge among peers. Intermediaries include peer-network building intermediaries (e.g. employer associations, chambers of commerce, managed clusters, science & technology parks), partnership-building intermediaries (e.g. technology transfer offices, RTOs, investment promotion agencies), and capacity-building and funding agencies.

Understanding innovation diffusion in a region, and the potential to foster this, requires an assessment of the strengths and weaknesses in these three sets of factors (framework conditions, diffusion channels and intermediaries), and the possibilities for policies to strengthen this.

1.3 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 North Central Region in Bulgaria, in particular with respect to SMEs and start-ups.

This report is divided into four different sections. After the introduction, section 2 discusses the framework conditions that impact the creation and spread of knowledge in The North Central Region in Bulgaria, followed by an overview of the main channels through which innovation diffusion takes place and the main

intermediaries that support innovation diffusion in The North Central Region in Bulgaria. Section 3 brings together relevant suggestions for policy that have been brought forward by the project. Finally, further background on the analytical framework, methodologies and data used can be found in Annex.

1.4. 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-27 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 North Central Region in Bulgaria have been assessed as part of this exercise with the support of regional authorities and stakeholders. The repeated interactions with key stakeholders in the country at the 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 The North Central Region in Bulgaria to design future regional innovation policies based on an evidence-based assessment and stakeholder consultation.

1.5. Process and methodology

A number of consultation meetings, discussions and workshops between the OECD and relevant stakeholders of The North Central Region in Bulgaria took place in the first half of 2021, underpinning this report. Contacted stakeholders include policy makers in the region, representatives of higher learning institutions, cluster organisations, accelerators and incubators, entrepreneurs and business owners. The process included:

- The filling-in of a **background survey** by the regional counterparts, with information on the innovation ecosystem, intermediary organisations and existing policies, in combination with desk research by OECD staff.
- Four **virtual workshops** were held on innovation diffusion in the region: one plenary workshop, focused on the functioning of innovation diffusion at large and the role of framework conditions, channels and intermediaries; and three deep dive workshops at district level: one in Gabrovo, one in Veliko Tarnovo and one with Ruse, Razgrad and Silistra district. The workshops generated valuable insights on innovation diffusion through structured discussion and polls on aspects of innovation diffusion among participants.
- 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. Twelve responses were received. Most respondents indicated that they were either from public sector or academic institutions.

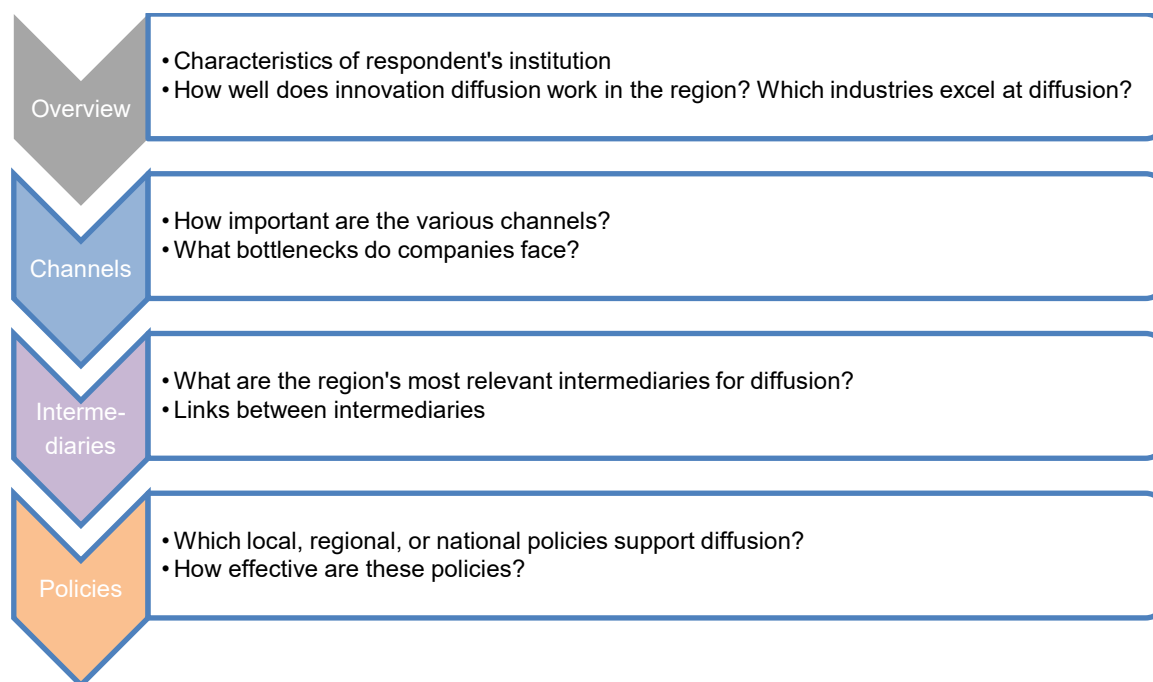
The information collected in this way was processed and scrutinised by analysts of the Centre for Entrepreneurship, SMEs, Regions and Cities (CFE) at the OECD. This report reflects their insights and opinions, complemented by desktop research and independent analysis.

Stakeholder questionnaire

A stakeholder questionnaire was developed and tested during the pilot study. The survey includes questions on the state of innovation diffusion in the region, the functioning of innovation diffusion channels, and views on intermediaries and policies in support of innovation diffusion (Figure 1.1).

Figure 1.1. Survey overview

Questionnaire about innovation diffusion sent to stakeholders in a region



Innovation diffusion indicators

The report shows a variety of indicators related to innovation diffusion. Below is a guide to interpreting the regional-level and national-level graphs, which illustrate the position of the considered region relative to other OECD regions for each indicator. The higher the figure in the circle, the higher (better) the ranking.

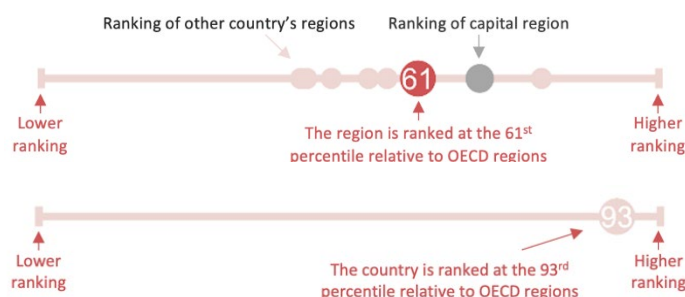
- **Red** plain dot indicates the considered region
- **Light red** dots indicate the other regions of the country
- **Grey** dot indicates the capital region of the country

Regional indicators: one dot per region

The region is in position 3/8 (above the median) of all regions in the country; it is in the top 40% compared to the OECD.

National indicators: one dot only

The country is in the top 10% compared to the OECD. There is no data on the region's position within the country.



2 Measuring innovation diffusion in The North Central Region in Bulgaria

2.1 Background and setting

Economic structure

the EU. ¹ GDP per capita is one third of the average within



¹ <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/north-central-planning-region-bulgaria>

According to the European Commission Regional Innovation Scoreboard 2019, the North Central planning region (BG32) is ranked as a modest innovator, with a relative score of 38.4% in comparison to the EU level in 2019, and 85.8% compared to the country average. Innovation performance has improved in recent years, and the current regional innovation index is set at 40.2%.

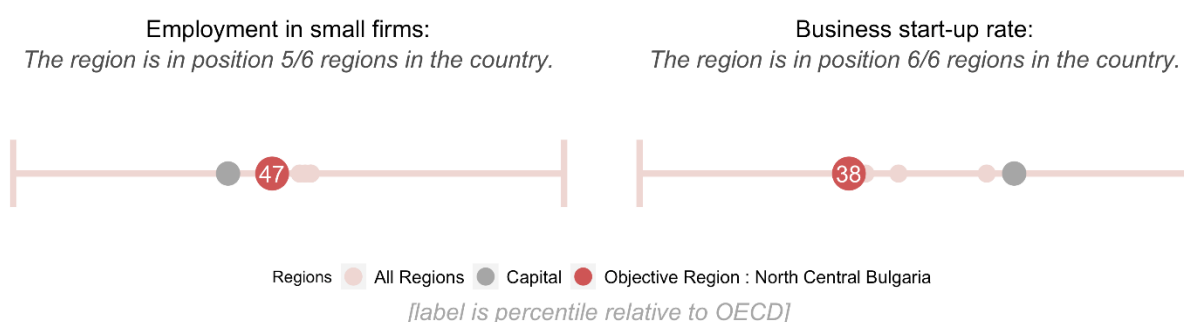
The region's economic structure focuses on manufacturing, in particular on mechatronics, plastics processing, production of packaging, textiles, electric drive control, machines and equipment, and information technologies, industries where large firms play an important role. Several of these industries have links with multinational companies (MNCs) (for instance from Germany), especially those in mechatronics, ICT, and processing industries.

The region harbours several major cities and universities (including Gabrovo Technical University, Ruse University, Svishtov University and Veliko Tarnovo University) and a relatively well-developed innovation infrastructure including business angels, chambers of commerce, various other intermediaries and active district and municipal authorities.

SMEs

All regions of Bulgaria have an active SME culture. In Bulgaria as a whole, SMEs generate two thirds of total value added and three quarters of total employment, far exceeding the respective EU averages of 56.4% and 66.6%. Value added in the SME sector grew significantly from 2014 onwards (50.7% between 2014-2018 and 15% between 2017 and 2018), with employment however rising much more gradually, reflecting an increased productivity of Bulgarian SMEs.² The share of SMEs in employment in the region itself is closer to the OECD average, reflecting the stronger presence of larger firms than elsewhere in Bulgaria (Figure 2.1).

Figure 2.1. Small firms and business start-ups (regional data)



Note: Each dot represents one of Bulgaria's six regions but some dots overlap with each other.

Source: OECD calculations based on Regional Innovation database https://stats.oecd.org/Index.aspx?DataSetCode=REGION_INNOVATION

Start-up rates

Start-ups can embody innovation diffusion because innovative entrepreneurship often brings existing ideas to new places or industries. A higher rate of new business creation can therefore indicate higher innovation in a given region if it involves innovative start-ups.

²SBA Factsheet Bulgaria 2019 (https://ec.europa.eu/growth/smes/sme-strategy/performance-review_en#sba-factsheets)

Bulgaria as a whole has start-up rates around the average of OECD regions. However, according to the 2019 SBA Factsheet by the European Commission, conditions for entrepreneurship in general is the area where Bulgaria scores lowest among EU member States.³

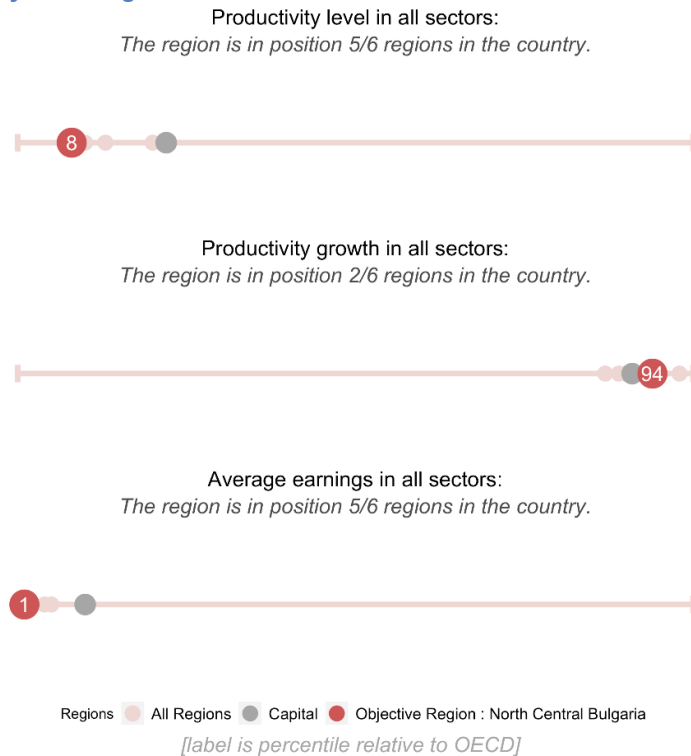
Moreover, start-up rates in North Central Bulgaria are lower than the average region in Bulgaria (Figure 2.1). This evidence suggests a need to strengthen entrepreneurship in the region to support innovation diffusion.

Productivity and wages

Regions in Bulgaria have some of the lowest levels of productivity but some of the highest growth relative to other OECD TL2 regions (Figure 2.2). The North Central region of Bulgaria is thus rapidly catching up, with productivity growth in the top 10% of regions across the OECD and higher than most other Bulgarian regions, but from a low starting point.

Similar to Bulgaria’s low productivity levels, workers’ average earnings in all regions of Bulgaria are lower than most other places in the OECD. For North Central Bulgaria, productivity growth is slightly higher but average earnings are slightly lower than the median region in Bulgaria. Education levels – in particular for workers in SMEs – score average, although worker training lags behind significantly (Figure 2.9 and Figure 2.10). Regional income differences in Bulgaria are larger than in most OECD countries.⁴

Figure 2.2. Productivity and wages



Note: Productivity and wage measures are for 2017 and exclude financial services. Growth is the annualised rate for 2007-2017.
Source: OECD calculations based on Regional Economy database https://stats.oecd.org/Index.aspx?DataSetCode=REGION_ECONOM

³https://ec.europa.eu/growth/smes/sme-strategy/performance-review_en#sba-fact-sheets

⁴https://www.oecd-ilibrary.org/urban-rural-and-regional-development/decentralisation-and-regionalisation-in-bulgaria_b5ab8109-en

2.2 The functioning of innovation diffusion

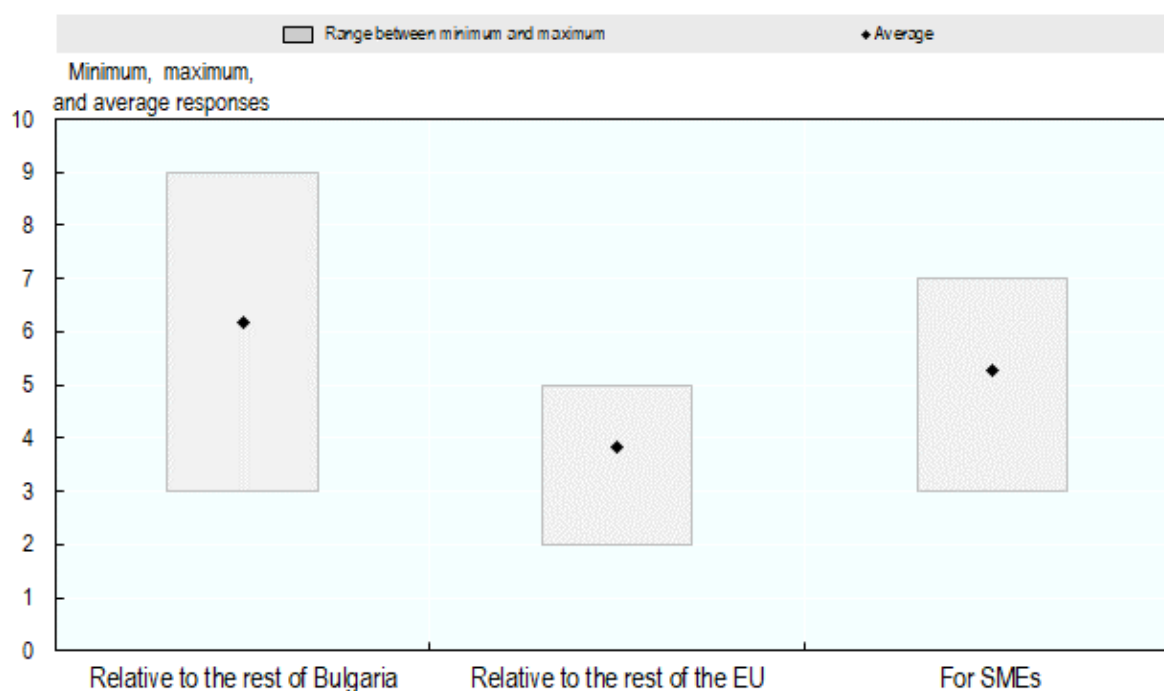
The initial block of survey questions ask respondents about their general views on innovation diffusion. On average, respondents indicated that North Central Bulgaria has good innovation diffusion performance relative to the rest of the Bulgaria (score 6/10) but slightly below-average performance (score 4/10) relative to the rest of the EU (Figure 2.3). The range of answers was larger for North Central Bulgaria's performance relative to the rest of the Bulgaria, with some respondents selecting high scores and others selecting low scores. For SMEs, innovation diffusion was seen as middling (average score 5/10) in North Central Bulgaria, with some variation across respondents. Industries where (in particular large) companies excelled in adopting innovations that were developed elsewhere include machine and tools production, textile, plastics, chemicals, wood processing, and ICT.

Participants in the workshops had mixed views on the question if innovation diffusion in the region works well, although many thought that the region was able to learn from innovation developed elsewhere to address societal challenges for instance regarding digitalisation and sustainability. Many esteemed that local companies benefited from innovation diffusion from large MNCs, but the picture was more mixed for innovation diffusion from universities, although one third of participants still indicated this as a positive factor. The region's strongest asset for innovation diffusion is its digital infrastructure, according participants, followed by the availability of skills.

Respondents to the survey indicated that COVID-19 slowed down the process of innovation diffusion in the region. Many companies limited their budgets to the most necessary expenses to survive the crisis and expenses for innovation, modernisation, infrastructure were reduced. However, at the same time the pandemic was a kind of a challenge for other companies who thrived on innovations connected with distant communication, online services, etc. Chiefly, these are companies in the ICT sector or businesses using ICT as a means for providing services.

Figure 2.3. Stakeholder views on innovation diffusion in North Central Bulgaria

Survey responses to the question, "How well does innovation diffusion work in your region..."



Source: OECD Stakeholder survey

2.3 Framework conditions

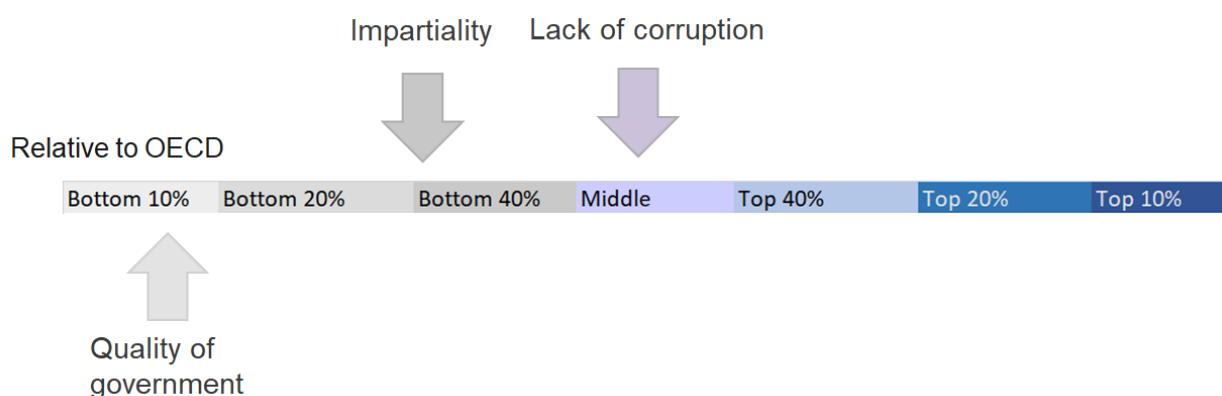
Framework conditions in a region influence the pace and probability of innovations being widely disseminated and adopted by firms. Important framework conditions include the availability of finance for SMEs and start-ups, access to foreign and domestic markets, availability of skilled labour, digital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

Institutions and physical infrastructure

Similar to other parts of Bulgaria, North Central Bulgaria (BG32) has low public confidence in institutions. Its quality of government measure is in the bottom 10 percent of EU regions (Figure 2.4). However, its scores on government impartiality and lack of corruption are better than other regions of Bulgaria (and in the 20th and 50th percentiles of EU regions, respectively).

In the workshops, regulatory bottlenecks were mentioned as an obstacle to innovation diffusion. The 2019 SBA Factsheet lists progress made in reducing red tape for SMEs, but recommends further efforts to produce more tangible results.⁵

Figure 2.4. North Central Bulgaria perceived quality of government relative to other OECD regions



Source: European Regional Competitiveness Index data https://ec.europa.eu/regional_policy/en/information/maps/regional_competitiveness/ (Quality of Government Index, University of Gothenburg)

Regarding transportation, North Central Bulgaria ranks below the median OECD region (but similar to other regions in Bulgaria) for indicators that relate to geography such as market access via roads (Adler et al., 2020_[1]). It is possible that this lack of road connectivity also dampens trade flows.

Access to finance

A lack of finance was clearly seen as the main obstacle to innovation diffusion, although a lack of awareness was underlined as well, in particular for SMEs and start-ups. In the workshops, participants indicated that SMEs were often not aware of support channels and needed financial incentives to seek cooperation with universities. Capacity building in SMEs was also emphasised, also for them to better understand opportunities.

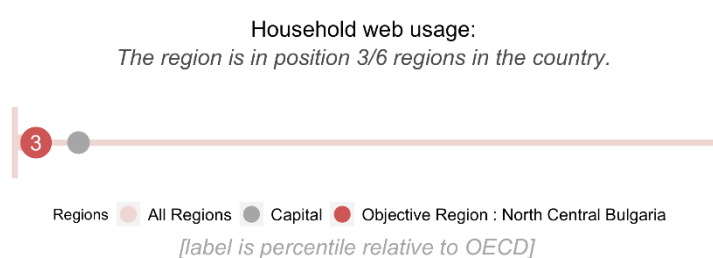
⁵SBA Factsheet Bulgaria 2019 (https://ec.europa.eu/growth/smes/sme-strategy/performance-review_en#sba-fact-sheets)

However, according to the European Commission SBA Scorecard 2019, access to finance is the best performing aspect of the Bulgarian SME ecosystem compared to other EU countries.⁶

Digital infrastructure

Within Bulgaria, the North Central region has better household web usage than most regions, with 75% of residents using the internet (the capital region has usage rates of 80%). The North Central planning region ranks in fourth position with regard to the share of population with broadband access in Bulgaria.⁷ Nevertheless, digitisation rates throughout Bulgaria are very low (in the bottom 5%) relative to other OECD countries (Figure 2.5).

Figure 2.5. Digitisation of households



Note: Each dot represents one of Bulgaria's six regions but some dots overlap with each other.

Source: OECD Regional Statistics <http://dx.doi.org/10.1787/region-data-en>

According to the European Commission DESI index, Bulgaria has an overall connectivity score of 38.5, ranks 26th among EU countries. Fast broadband coverage (NGA) improved from 75% in 2018 to 77% in 2019 and VHCN coverage from 38% in 2018 to 42% in 2019. It ranks at the bottom in overall broadband take-up with only 58% households subscribing and 25th on take-up of high-speed fixed broadband of at least 100 Mbps, with only limited progress year after year: from 7% in 2017 to 11% in 2019. The mobile broadband indicators, on the contrary, are relatively good, having further improved average 4G coverage from 72% in 2017 to 81% in 2019, with a high take-up steadily increasing from 87 subscriptions per 100 people in 2017 to 103 subscriptions per 100 people in 2019. This places Bulgaria slightly above the EU average.⁸

However, in the workshops and survey, the quality of the digital infrastructure was generally appreciated as a positive factor, some seeing this as the region's strongest asset for innovation diffusion. Participants for instance mentioned the high prevalence of internet infrastructure in more remote places. At the same time, the need for investing in digitalisation, for instance for students, was also emphasised.

⁶SBA Factsheet Bulgaria 2019 (https://ec.europa.eu/growth/smes/sme-strategy/performance-review_en#sba-fact-sheets)

⁷ <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/base-profile/north-central-planning-region-bulgaria>

⁸ <https://digital-strategy.ec.europa.eu/en/library/digital-economy-and-society-index-desi-2020>

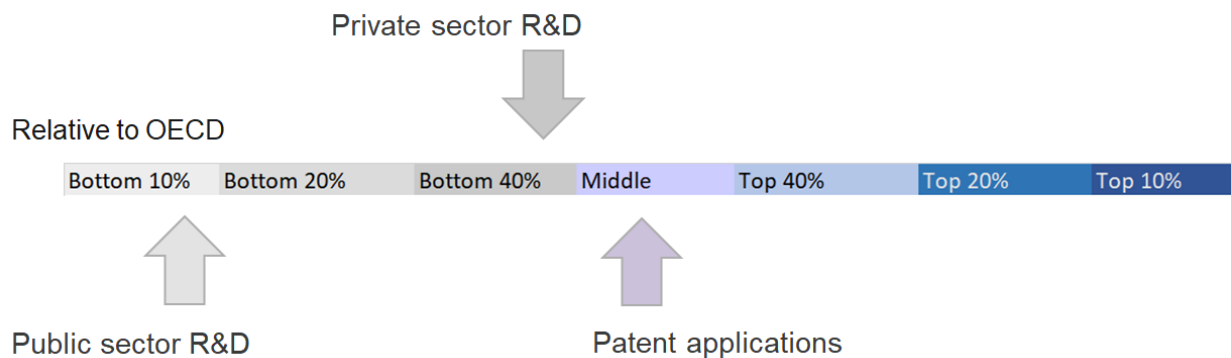
Global value chains

No data were available on direct and indirect trade by SMEs at regional level. For Bulgaria as a whole, the 2019 SBA Factsheet shows that fewer Bulgarian SMEs engage in extra EU exports (8% in Bulgaria compared to 10% for SMEs in the EU as a whole). For imports the percentages are closer (11% for Bulgarian SMEs compared to 12% for SMEs in the EU as a whole).⁹

Innovation assets

R&D spending indicates the extent to which the public and private sector invests in the production and diffusion of innovation. North Central Bulgaria has low public R&D spending, better R&D spending from the private sector and substantial patenting activity (close to the median OECD region) (Figure 2.6). The OECD R&D tax database indicates that subsidies for research and development activities, in both small and large firms, are low in Bulgaria relative to other OECD countries.¹⁰ In other words, there are not many tax incentives provided for R&D activities.

Figure 2.6. Innovation assets in North Central Bulgaria



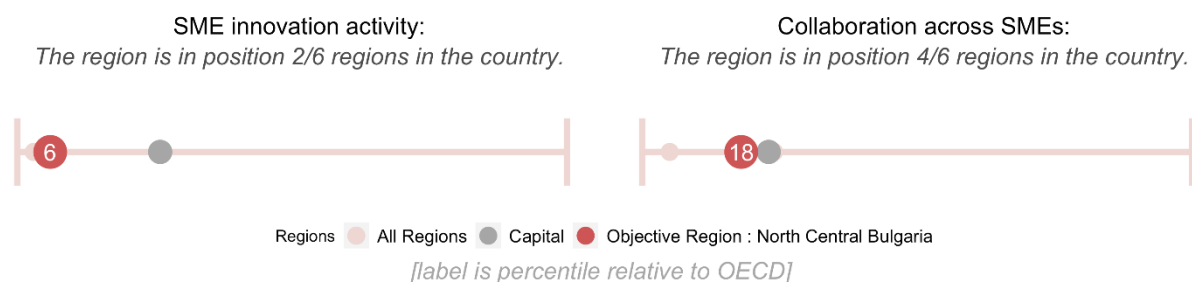
Source: OECD calculations based on Regional Innovation database https://stats.oecd.org/Index.aspx?DataSetCode=REGION_INNOVATION

The Mid Term evaluation of Bulgaria's Smart Innovation Strategy suggests that the share of innovative SMEs is high. However, data suggest that innovation within SMEs is limited and cooperation among SMEs lags behind other regions within the OECD (Figure 2.7).

⁹SBA Factsheet Bulgaria 2019 (https://ec.europa.eu/growth/smes/sme-strategy/performance-review_en#sba-factsheets)

¹⁰ <https://stats.oecd.org/Index.aspx?DataSetCode=RDSUB>

Figure 2.7. SME innovation and collaboration



Note: Each dot represents one of Bulgaria's six regions but some dots overlap with each other.

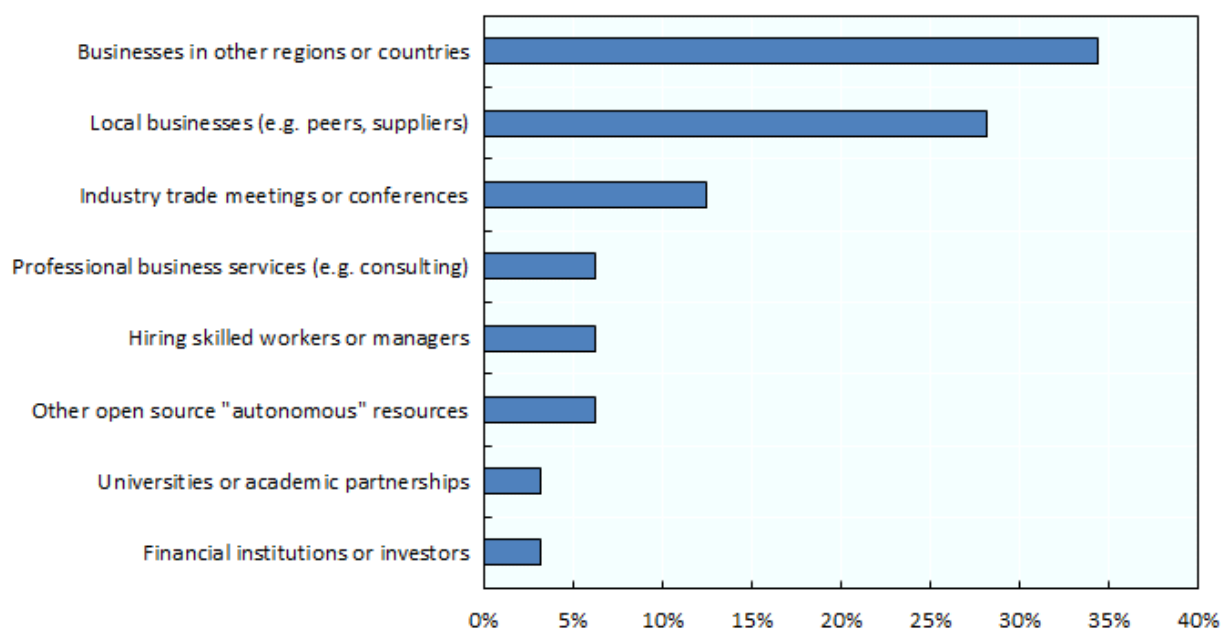
Source: Calculations based on EU Community Innovation Survey RIS data https://ec.europa.eu/growth/industry/policy/innovation/regional_en

2.4 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.

Figure 2.8. Importance of channels in the region

Weighted average of stakeholders' ranked survey responses



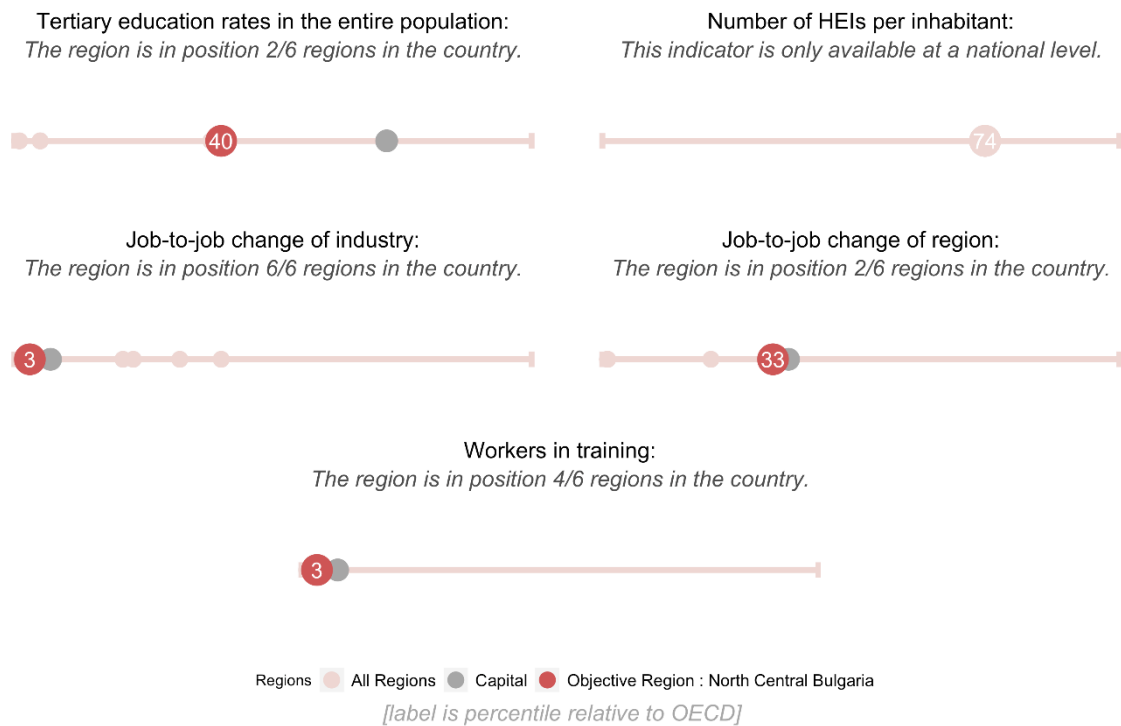
Source: OECD Stakeholder survey

Based on responses to the OECD survey, stakeholders in the region identify businesses in other regions or countries as the most important channel of innovation diffusion in North Central Bulgaria (Figure 2.8). Local businesses were also highly-regarded sources of information, followed by industry trade meetings or conferences.

Hiring skilled workers

Skills is an area where North Central Bulgaria has a number of challenges. Although North Central Bulgaria’s tertiary education rate is close to the median of OECD regions, its worker training rates are very low relative to other OECD regions (Figure 2.9). In terms of worker mobility, inter-regional mobility in North Central Bulgaria is higher than most other regions of Bulgaria but still in the bottom 40% of OECD regions. Worker mobility across industries in North Central Bulgaria is lower than most other regions of Bulgaria and in the bottom 5% of the OECD.

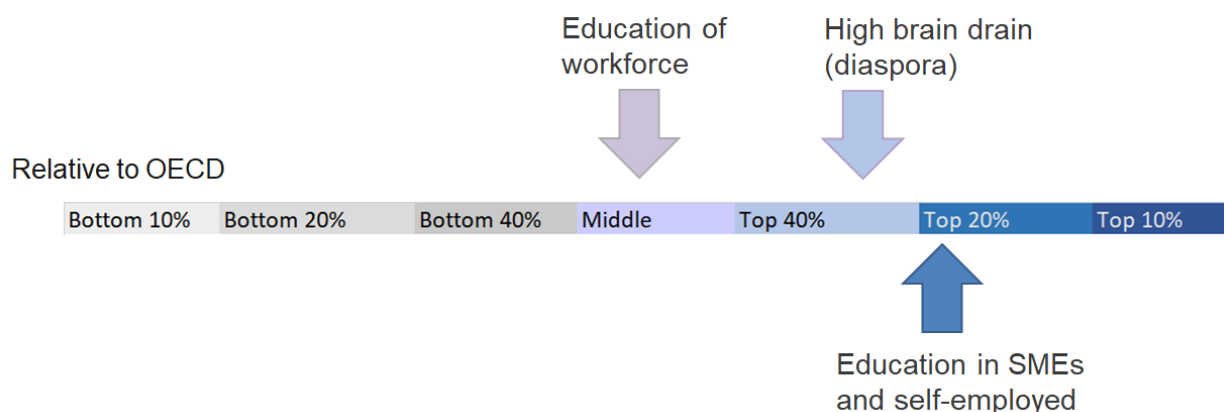
Figure 2.9. Educational attainment; worker training and mobility



Source: OECD calculations from EU Labour Force Survey; HEIs per capita refer to European regions based on ETER data.

Although workers’ education is close to the median OECD region, brain drain (i.e. out-migration of tertiary-educated workers), from Bulgaria is high (Figure 2.10). Education rates of self-employed and SME workers are very strong in North Central Bulgaria, which places them in the top 20% of OECD regions.

Figure 2.10. Education and out-migration



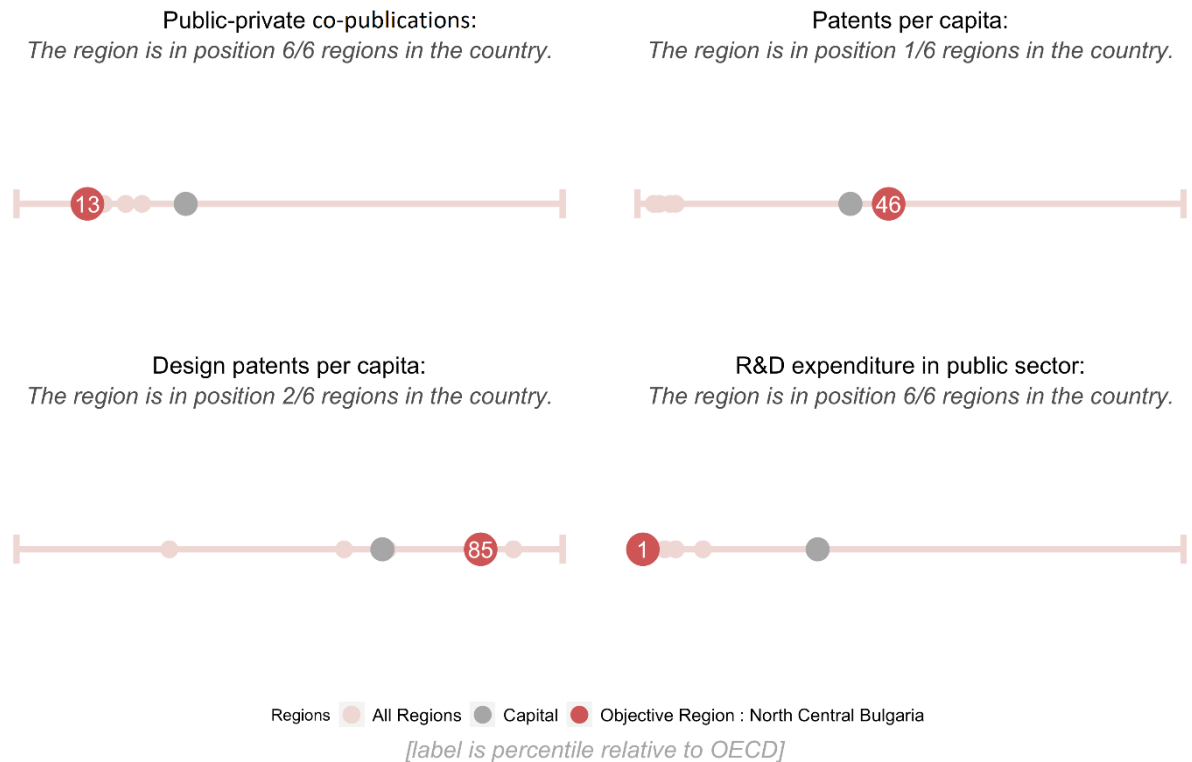
Source: OECD Regional Migration database

Learning from other businesses

While the number of patents per capita reflects a region's frontier innovations, places with effective innovation diffusion also have more patenting activity. Since innovation knowledge is often local, places that produce patents can also help encourage adoption. Moreover, the production of patentable inventions often requires substantial knowledge about previous innovations; thus successful patents indicate spillovers of embodied knowledge from other places.

North Central Bulgaria is one of the best regions in Bulgaria for patenting activity but it is still slightly below the median OECD region. It excels at design patents in particular and is in the top 20% of OECD regions on this measure. However, public R&D expenditure is very low even relative to other regions of Bulgaria (bottom 1% of OECD regions) and public-private publications are lower in North Central Bulgaria than other regions of Bulgaria and in the bottom 20% of the OECD (Figure 2.11).

Figure 2.11. Patenting in North Central Bulgaria



Source: OECD calculations based on Regional Innovation database https://stats.oecd.org/Index.aspx?DataSetCode=REGION_INNOVATION

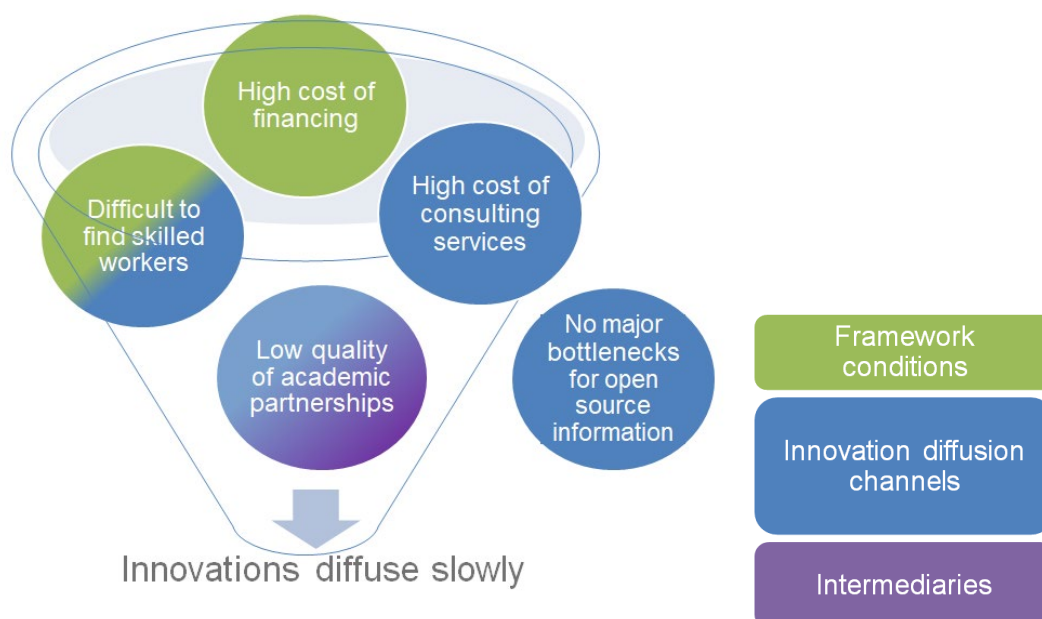
Academics, consulting, and open sources

Nearly all respondents said that there were **bottlenecks** in finding skilled workers in North Central Bulgaria. Some respondents cited high costs of financing and of consulting services as additional bottlenecks to innovation diffusion. On the other hand, respondents indicated that there were few bottlenecks to accessing open sources for innovation information (Figure 2.12).

During the workshops, an example was given of Gabrovo academics giving training courses outside the district as a means of sharing knowledge. Links between university and businesses are established as well, including through student apprenticeships.

Figure 2.12. Main bottlenecks in region's channels

Based on modal survey responses



Source: OECD Stakeholder survey

In the workshops, the need to strengthen academic-business cooperation was widely shared. Ways to do so that were mentioned regard both the demand side (raising SME awareness, access to finance, vouchers) as well as supply (incentives for academics to work with business, partnerships between universities and companies via public funding).

More integration of SMEs with big companies was seen as an important channel for boosting productivity and technological advancements. The workshops also suggested knowledge intensive business services could be strengthened.

2.5 Intermediaries and policies

This section explores the role of innovation diffusion intermediaries, i.e. organisations that are key in facilitating the transfer of innovation, such as business associations, public business support providers, and universities (and in other OECD regions, technology transfer offices, business 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.

North Central Bulgaria has a rich set of intermediaries, detailed in Table 2.1. Nearly all intermediaries are specific to one of the region's five districts and have close links to other intermediaries within their district; some have links to intermediaries outside of the district.

Table 2.1. North Central Bulgaria's intermediaries for innovation diffusion

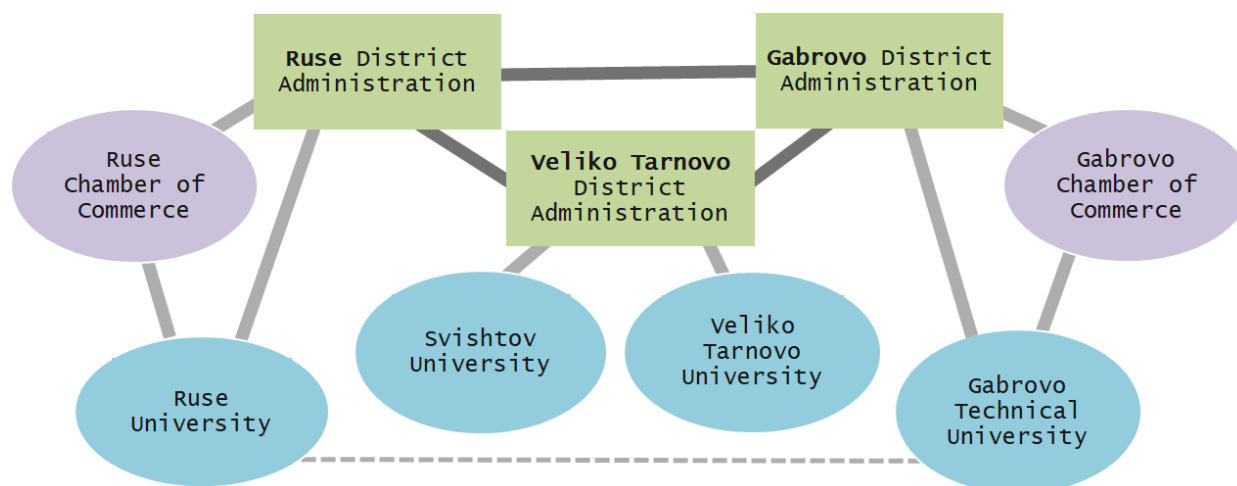
Organisation name	Type	Website
Gabrovo District Administration	District Administration	http://www.gb.government.bg/
Gabrovo Technical University	University	https://www.tugab.bg/
Gabrovo Chamber of Commerce and Industry	Business association	https://www.chamber-gabrovo.com/
Razgrad District Administration	District Administration	http://www.rz.government.bg/
Ruse District Administration	District Administration	https://ruse.bg/
Ruse University	University	https://www.uni-ruse.bg/
Ruse Chamber of Commerce and Industry	Business association	https://www.rcci.bg/
Silistra District Administration	District Administration	http://silistra.government.bg/
Svishtov University	University	https://www.uni-svishtov.bg/
Veliko Tarnovo District administration	District Administration	https://vt.government.bg/
Veliko Tarnovo University	University	https://www.uni-vt.bg/

Note: Each district has a municipality, not listed above.

The stakeholder survey asked about links between the region's intermediaries. Figure 2.13 shows an example for three districts: Ruse, Gabrovo, and Veliko Tarnovo. In these districts, all District Administrations are linked to each other through the formal Regional Councils, while links across universities and the chambers of commerce tend to be informal.

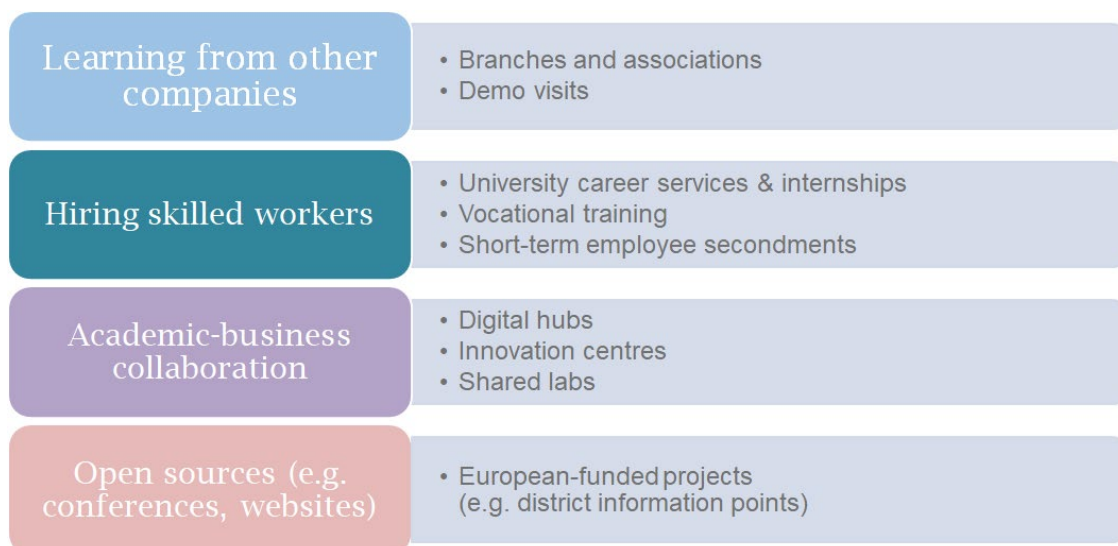
Figure 2.13. Stylised representation of intermediaries in three districts and their links in the innovation diffusion support system

Based on survey responses and district workshops



Stakeholders in North Central Bulgaria identified a variety of policies that encourage innovation diffusion (Figure 2.14). These policies were categorised according to innovation diffusion channels; subsequently, stakeholders were asked about the effectiveness of policies in each category.

Figure 2.14. Policies that support innovation diffusion

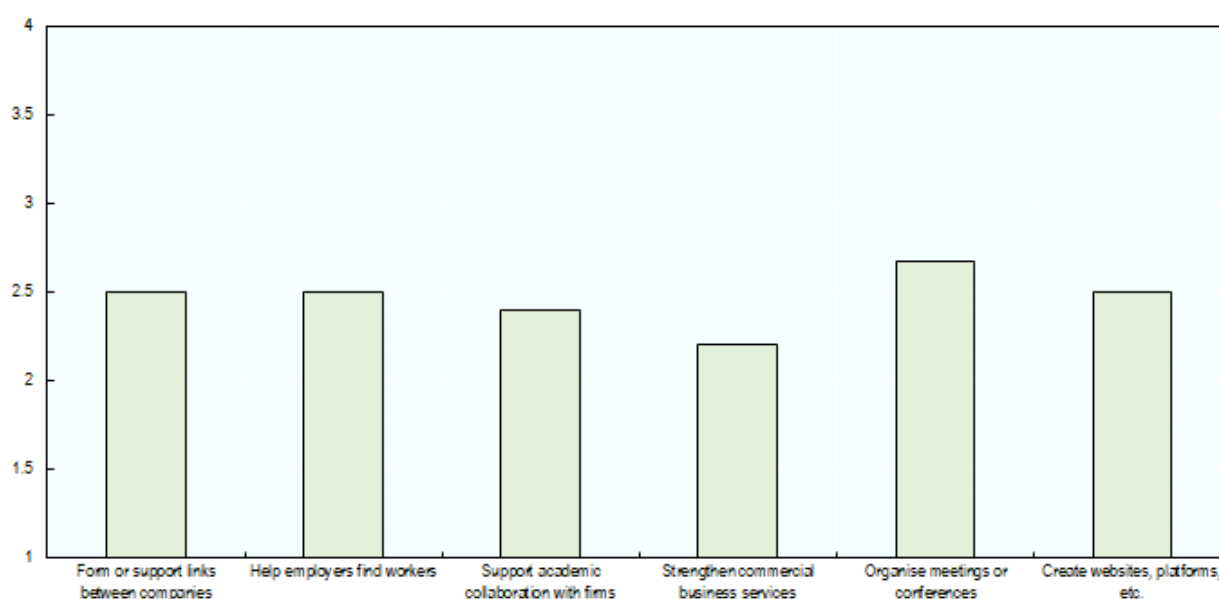


Source: OECD Stakeholder survey

Policies for organising meeting and conference events were rated highly (Figure 2.16) which matches the importance that stakeholders in the region placed on events as a channel for innovation diffusion (Figure 2.8).

Figure 2.15. Stakeholder views of policies

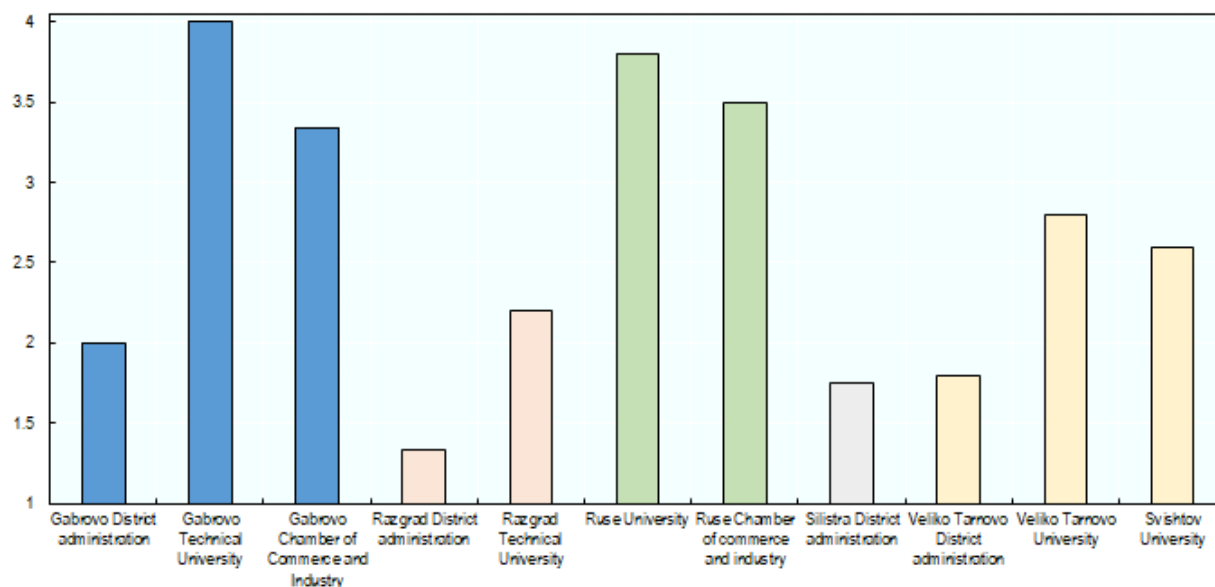
Stakeholders' average assessment of effectiveness of policies *for innovation diffusion*



Note: The minimum score was=1; the maximum score was=4. Source: OECD Stakeholder survey

Figure 2.16. Stakeholder views of intermediaries

Stakeholders' average assessment of relevance *for innovation diffusion*



Note: The minimum score was=1; the maximum score was=4.

Source: OECD Stakeholder survey

Many intermediaries in the region were viewed as relevant to innovation diffusion and Gabrovo Technical University in particular was rated as very relevant (Figure 2.16). It is important to note that not all intermediaries have innovation diffusion in their primary objectives, so a low score in the figure does not reflect an intermediary's functioning in general, but rather its perceived role in innovation diffusion. According to stakeholders, the Gabrovo Technical University's direct links with businesses— both SMEs and larger companies— in a “capacity-building” role appears to be highly effective.

Box 2.1 discusses Gabrovo's Regional Innovation Centre, which in the view of the region could also become an EU innovation and digitalisation hub.

Box 2.1. Ambitious plans: public sector facilitation of business collaboration in Gabrovo

Located along the Danube, Bulgaria's North Central region hosts the country's largest port and specializes in biotech, IT, mechatronics and manufacturing industries. Productivity is growing fast in all six regions of Bulgaria mainly due to catching-up dynamics.¹ In the North Central region, robust growth is supported by an innovative and entrepreneurial culture (30% of youth want to open a business) and an educated workforce (close to the OECD average).

Gabrovo's supports for innovation diffusion

Bulgaria's North Central region has five districts including the centrally located district of Gabrovo. The Gabrovo district has an entrepreneurial spirit along with policymakers that encourage innovation diffusion. In 2021, aligned with its long-term vision, "Gabrovo Municipality – Green, Innovative and Effective", the district was awarded the European Green Leaf title resulting from coordinated policy efforts.² What intermediaries and companies support innovation diffusion in Gabrovo? In addition to national agencies such as the Bulgarian Ministry for the Economy, the district has four local intermediaries – Gabrovo's technical university, district administration, district municipality, and chamber of commerce & industry – and more than three thousand private sector companies.

A new initiative: the RIC

A main challenge remains how to coordinate Gabrovo's innovative and dynamic climate to foster public-private partnerships and business-to-business (B2B) transactions. Gabrovo's Regional Innovation Center "Ambitious Gabrovo" (RIC), created in 2019 tries to fill this gap. The main goal of the Centre is to enhance capacity and collaboration of firms in the region, including SMEs. Together with the District's four main intermediaries, the Ministry for the Economy and a handful of innovative and well-established companies, the Centre provides expert support to projects in traditional manufacturing sectors like machine building, mechatronics and plastics.³

The RIC is mostly financed by the European Structural and Investment Funds. It aims to stimulate collaboration, innovation and R&D activities in firms with various initiatives including,

- Productivity and collaboration: creating co-working spaces, supporting start-ups, funding the adoption of new technologies, providing information about EU standards to enhance exports.
- Innovation support and training: creating an incubator for new entrepreneurs,⁴ providing educational fee waivers for interns who previously worked at RIC companies.
- Events: hosting entrepreneurship workshops, visits to local businesses, etcetera.

The ambition of Gabrovo is to focus on deepening B2B collaborations with the support of public actors. Recent admission to the European Association of Development Agencies in April 2021 shows the RIC's desire to not only strengthen innovation processes in the Gabrovo district, but also learn from and share knowledge with other similar European initiatives. The RIC is one of six centres in Bulgaria that applied for the role of a Digital and Innovation Hub, as launched by the European Commission.

¹ In terms of productivity level, Bulgaria's regions are all ranked in the bottom 5% of OECD regions; in terms of productivity growth, all-but-one of Bulgaria's regions are in the top 5% of OECD regions.

² The title is shared by Gabrovo and Lappeenranta (Finland).

³ The Regional Innovation Center "Ambitious Gabrovo" consists of three intermediaries (Municipality of Gabrovo, Technical University of Gabrovo, Gabrovo Chamber of Commerce and Industry) and six companies (Mechatronics JSC, Elna LTD, Impulse JSC, Technoles LTD, Ecoproject LTD and STS Electronics LTD).

⁴ The so called "Lab'O" is an incubator and an accelerator aimed at supporting young innovators.

In the workshops, views on the role of the government in fostering innovation diffusion were mixed, with a small majority indicating that government support for innovation diffusion works well. A large majority considered that it was primarily the central government's role to foster innovation diffusion, more than regional or local government. Almost all participants agreed that there were currently too few government initiatives to strengthen innovation diffusion. Science and technology policies as well as education and skills were seen as the key policies for innovation diffusion to SMEs and start-ups, with various participants also listing the need to strengthen advisory services to SMEs. At various occasions, participants stressed the importance of the State Agency for Research and Innovation, which is currently being established (see Box 2.2 for an overview of government levels involved in innovation policy and the new agency).

Box 2.2. Innovation policy in Bulgaria: central, regional, local

The central government in Bulgaria plays a central role in innovation policy in Bulgaria via the Ministry of Economy and the Ministry of Education & Science. The main strategic document is the Innovation Strategy for Smart Specialization 2014 - 2020. This strategy outlines the priority thematic areas of each region in which there is capacity for regional specialization. For the North Central region the priority areas of development are mechatronics, healthy lifestyle and biotechnology and informatics and ICT.

Currently, a new State Agency for Research and Innovation is being established within the Council of Ministers, which will be responsible for and coordinate the innovation policy and research and science policy in the country. The new Agency is expected to start its activities soon, and will not replace but complement the role of the Ministry of Economy and Ministry of Education and Science.

Bulgaria has two deconcentrated regional levels with six planning regions and 28 districts, and one decentralised level with 265 municipalities.¹¹ Regions play a less prominent role in innovation policy than in many countries, and do not have their own innovation policy or budget. Regional administrations mostly play a connection role between business and public organizations. Each NUTs II region contains several NUTs III regional administrations that are united with their representatives in the Regional Council. The Regional Council makes the important decisions for the respective region and respectively the development priorities.

District administrations within regions generally have no budget for innovation and very small staffs, but do have two or three innovation policy experts. They organise workshops and discussions among a variety of stakeholders, and bring regional issues to national discussions.

Municipalities have budget for business support, although their mandate in the region includes many other planning functions. Ruse and Sofia municipalities have Smart Specialisation strategies.

¹¹https://www.oecd-ilibrary.org/urban-rural-and-regional-development/decentralisation-and-regionalisation-in-bulgaria_b5ab8109-en

3 Conclusion and policy discussion

Aspects of innovation diffusion in North Central Bulgaria function well...

The pilot use of the EU/OECD Regional Innovation Diffusion Policy Tool in North Central Bulgaria region has shown that a number aspects of innovation diffusion function well. The region has high productivity growth, has substantial patenting activity and high inter-regional mobility of workers. Moreover, the region has a well-developed infrastructure of universities and intermediary organisations that can help support innovation diffusion, including for SMEs, and active policy engagement in innovation at different levels of government. For SMEs, innovation diffusion was seen as middling, whereas aspects of start-up development were generally positive. COVID-19 slowed down innovation diffusion processes across the region, including for SMEs.

...although some aspects need strengthening

However, on a number of aspects the data sources, stakeholder survey and stakeholder workshops identified weaknesses that policy needs to address. In particular, there are weaknesses in SME innovation and start-up development. Strengthening digital capacities (both supporting digital skills and the adoption of digital technologies by SMEs) would benefit all districts in the region.

The results from the data analysis and stakeholder views were not always aligned. For instance, whereas the data used show how the region lags behind in aspects of the digital infrastructure, stakeholders often indicated the digital infrastructure as a strength of the region. Access to finance for SMEs and entrepreneurship was identified as a point for improvement in the survey and workshops, although according to other data it can be considered as an aspect that functions relatively well in Bulgaria. Further reflection on these issues could be warranted.

In the survey and workshops, which were organised at the level of districts, various suggestions were made to improve the functioning of innovation diffusion in the region.

Strengthening science and technology policies and research intermediaries

Participants were generally satisfied with how the government supports innovation diffusion, and in particular underlined the importance of national policy initiatives. Science and technology and education policies were regarded as most effective for SMEs and start-ups. The vast majority of participants think that more policy initiatives are needed. In particular, there is a need for an intensification of policies on education and skills, science and technology and advisory services for SMEs. The development of the State Agency for Research and Innovation is expected to strengthen innovation diffusion. This could help coordinate the regional innovation efforts.

Strengthen academic-business cooperation

In the workshops, the need to strengthen academic-business cooperation was widely shared. Ways to do so that were mentioned regard both the demand side (raising SME awareness, access to finance, vouchers) as well as supply (incentives for academics to work with business).

Strengthening linkages SMEs with larger companies

More integration of SMEs with large companies could help boost production and technological advancements. The workshops also suggested knowledge-intensive business services could be strengthened. Chambers of Commerce, as currently exist in the Ruse and Gabrovo districts, can play an important role in connecting (larger and smaller) companies and could be considered in other districts as well.

Improving the functioning of intermediary organisations

Intermediaries in the region could promote innovation diffusion further by a greater focus on capacity-building activities – for instance through technical support, business strategy and translation services – and could support connections to public and private funding. More resources and more common projects were identified as important. Improved coordination and communication across intermediaries could help foster awareness of support available and strengthen innovation diffusion. Furthermore, in various districts the workshops suggested that companies (particularly SMEs) have trouble identifying and applying for (EU) grants; one-stop shops and well-functioning support hubs could provide assistance in this process; voucher schemes at regional or district level could also help ease financing constraints in specific domains like technological adoption.

Joint objectives

In the survey, various stakeholders suggested that developing common projects and working towards joint objectives by public and private stakeholders would be important to strengthen innovation diffusion. This should go beyond alignment of objectives; there should also be common expertise, finance, and collaboration, as well as proper structures and channels for communication. The development of an innovation or smart specialisation at district level – as currently exists for instance in the Ruse district – can be instrumental for this.

A better understanding of collaboration/linkages between universities and business was deemed of particular interest. The workshops indicated that the strengthening of these linkages should be a first priority for policy. Traineeships of students to SMEs and other companies and tech transfer could play a role here. The linkages often rely on personal contacts, with SMEs having less networks and awareness to access these.

4 Annex: Methodology and data sources

Methodology and analytical framework

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).

Innovation diffusion is a complex phenomenon that relates to three sets of factors:

- The local and national **framework conditions**, which affect firms’ incentives and capacities to adopt innovations.
- The functioning of the **channels** through which the diffusion can take place.
- The presence and functioning of a variety of **intermediary organizations** that help companies build the capacity for innovation adoption, identify external resources, and share knowledge among peers.

Framework conditions

Local and national framework conditions shape the environment for innovation diffusion. These conditions affect firms’ incentives and capacities to adopt innovations. The six framework conditions for innovation diffusion are:

1. The **institutional and regulatory framework** (e.g. judicial system, patents, taxes, administrative rules) for business investment.
2. **Market conditions**, such as product demand (domestic and foreign), along with uncertainty and interest rates.
3. **Access to financing** for firms in general and start-ups and SMEs in particular (e.g. loans, debt, various forms of equity).
4. Physical and digital **infrastructure** (e.g. transportation and logistics networks; fast, reliable internet connections, and digital assets such as retailing platforms and cloud computing).
5. **Access to skills**, which includes managerial skills, technical and digital skills and entrepreneurial know-how.

6. Presence of **innovation assets** such as R&D and innovative businesses that contribute to an entrepreneurial culture.

The first three framework conditions characterise the business or regulatory environment; the other three conditions describe infrastructure and innovation assets. The business/regulatory environment affects firms' costs and benefits of adopting innovations. Infrastructure and innovation assets are another important factor for innovation diffusion, as they shape firms' technological capacity and define the quality of their interactions with other companies, workers, and markets. These framework conditions all form a region's innovation ecosystem that determines firms' ability and willingness to learn about and adopt existing innovations.

Channels

Innovation diffusion channels are sources of information that firms may encounter in their normal business operations. Channels expose companies to new ideas and help them develop (or find) the know-how to source and implement the innovations. They represent direct ways through which businesses acquire ideas from outside and use them to adopt innovations.

This report highlights five channels:

1. **Workers' career mobility** through which workers and managers changing jobs or firms can draw upon the knowledge acquired in previous jobs to the benefit of their new firms.
2. **Supplier relationships** through which firms exchanging products or services can share their knowledge with each other to increase the competitiveness of the supply chain. Customers can also provide critical feedback that make firms aware of innovations at the frontier.
3. **Academic-business collaboration (ABC)** that helps firms source the knowledge needed for R&D.
4. **Knowledge-intensive services** (e.g. consulting, IT, accounting), which can help firms identify and adopt innovative practices.
5. **Autonomous learning**, which relies on open knowledge, and as such does not typically require direct interaction with other firms or innovating entities. It could be websites, publications, or indirect observation and imitation of competitors.

Intermediaries

The final pillar of innovation diffusion, intermediaries, consists of entities that facilitate the diffusion of innovation without being directly involved in its production or adoption. Instead, intermediaries facilitate connections between companies and diffusion channels and also support collaboration. The three types of intermediaries are:

- a) **University and research-related intermediaries** facilitate knowledge transfer from higher education institutions (HEIs) and public research institutions (PRIs) to businesses and other actors in the surrounding innovation ecosystem. Indeed universities and HEIs perform a variety of functions for innovation diffusion; some host incubators or accelerators that play all three roles in supporting diffusion. Governments can use policy to encourage the formation and success of university and research-related intermediaries.
- b) **Public sector innovation and local development agencies** aim to increase the innovation output and uptake of technologies by the business sector. A survey of innovation agencies in ten different countries finds that the main tasks of innovation agencies are providing support to other intermediaries such as business incubators or science and technology parks, and organising capacity- and institution-building activities. In Europe these agencies are often partly or jointly responsible for administering innovation vouchers aimed at encouraging academic-business collaboration (ABC) partnerships.

- c) **Private sector-led intermediaries** include many types of “enterprise-led” networks. These networks include chambers of commerce, science parks and cluster associations. Large “anchor” firms can also serve as intermediaries that coordinate private sector businesses within the regional innovation system.¹² Industry clusters and science and technology parks often play multiple roles in diffusion.

Intermediaries help connect firms to innovation channels but they are not institutions that companies necessarily encounter during their normal business operations. Unlike individual businesses, intermediaries may be very responsive to policy interventions because their missions are usually connected to innovation creation and diffusion. Their roles in diffusion include:

- a) **Funding.** Some intermediaries specialise in mediating academic-business or business-business investment relationships for small and large businesses. Other intermediaries administer public funding to promote innovation production and diffusion.
- b) **Capacity building.** Many public agencies and higher education institutions provide advice and workshops to support business development, especially for smaller businesses.
- c) **Networking.** Employer associations and chambers of commerce often help businesses learn about innovations and share knowledge with their peers. In addition, public sector and academic institutions and even individual firms — ranging from small entrepreneurs to large established “anchor” firms — can serve as intermediaries.

Sources of data

The analysis relies on different sources of data that are all available at the subnational level, using NUTS2 (also known as TL2) regional classifications.

Framework conditions

A broad range of indicators can be used to measure the strength of framework conditions at the regional level (Table 4.1). These indicators reflect the business and regulatory environment and a variety of infrastructure and innovation assets that are relevant for innovation diffusion at a regional level. Measures of regulations are generally based on survey responses while the other measures are based on economic indicators such as trade patterns, labour force characteristics, financing conditions, and R&D expenditures.

Table 4.1. Indicators measuring framework conditions in regions

Name of indicator	Notes	Data sources (see table note)
Institutional and regulatory framework		
Institution fairness and quality	Regional indicators of governance quality. Measures are based on surveys administered by the University of Gothenburg and include (1) Lack of corruption; (2) Quality and accountability; and (3) Impartiality.	RCI
Administrative burdens on start-ups*	Component of the composite index "Barriers to domestic and foreign entry". Covers the administrative burden on joint-stock companies and personally-owned enterprises, as well as administrative burden related to licenses and permits procedures. Higher values indicate lower administrative burdens.	PMR

¹² The presence of a large, R&D-intensive “anchor” firm helps the regional innovation system better absorb university research output and stimulate local R&D.

Complexity of regulatory procedures*	Composite index that captures the government's efforts to reduce and simplify the administrative burden of licenses and other administrative procedures. Higher values indicate less complexity.	PMR
Quality of judicial process*	The quality of judicial processes index measures whether each economy has adopted a series of good practices in its court system in four areas: court structure and proceedings, case management, court automation and alternative dispute resolution. Higher values indicate a more sophisticated and streamlined court structure.	DBI
Market conditions		
Trade openness	(Imports + Exports)/ GDP	Reg
Share of exports by SMEs**	Exports by SMEs/Total exports	TBE
Barriers to trade facilitation*	The barriers to trade facilitation index captures the extent to which a country recognizes foreign regulations, uses international standards and has international transparency of domestic regulation. Scores from most to least restrictive.	TFI
Services Trade Restrictiveness*	Composite index that quantifies restrictions on trade in services across five standard categories: 1) restrictions on foreign entry, 2) restrictions on the movement of people, 3) barriers to competition, 4) regulatory transparency, and 5) other discriminatory measures. Scores from completely closed to completely open.	STR
Public procurement market**	Expenditure on public procurement/GDP	GG
Infrastructure		
Population accessible via highways	Total population residing in the neighbouring regions of a given region where regions count in a way that is inversely related to their reciprocal distance. See (Adler et al., 2020 ^[69]) for details.	Adler
GDP accessible via highways	Ibid.	Adler
Employment accessible via highways	Ibid.	Adler
Share of population ...		
...with internet broadband access	Population with internet broadband access/Total population	Reg
... with download speed greater than 200mbps	Population with download speed greater than 200mbps/Total population	Reg
... using internet	Population using internet /Total population	Reg
Access to skills		
Share of prime-age population with tertiary education	Population between 25 and 64 years old with tertiary education/Population between 25 and 64 years old	Reg
Share of young adult population with tertiary education	Population between 25 and 34 years old with tertiary education/Population between 25 and 34 years old	Reg
Share of population within 10km of a higher education institution	Population near a higher education institution (within 10km)/Population	ETER
Share of workers with tertiary education	Workers with tertiary education/Total employment	LFS
Share of workers that received training in the past four weeks	Workers that received training in the past four weeks/Total employment	LFS
Difference between SMEs (including self-employed) and the entire economy in...		
... the share of workers with tertiary education	SMEE Employment with tertiary education/SMEE Employment - Employment with tertiary education/Employment	LFS
... the share of workers that received training in the past four weeks	SMEE Employment that received training in the past four weeks/SMEE Employment - Employment that received training in the past four weeks/Employment	LFS
Shortage of digital workers	Ratio between the number of vacancies in digital occupations and employment in digital occupations	BG & LFS
Access to financing		

Difference between small and large firms in...		
... the implicit tax subsidy rate on R&D expenditure**	Model-based estimates of implied marginal R&D tax subsidy rates	RDTI
... the interest rate on loans	Exact definitions differ by country.	SMEE
Share of total business lending going to SMEs**	Business lending to SMEs/Total business lending (amounts in local currency)	SMEE
Share of total loan applications going to SMEs**	Loan applications by SMEs/Total number of SMEs	SMEE
Access to innovation assets		
R&D expenditure...		
... in the business sector	R&D expenditure in the business sector/GDP	Reg
... in higher education institutions	R&D expenditure in higher education institutions/GDP	Reg
... in the business sector	R&D personnel in the business sector/Total employment	Reg
R&D personnel in higher education institutions	R&D personnel in higher education institutions/Total employment	Reg

Note: (*) = indicator available at national level, (**) = indicator available at national level, could be constructed analogously at the regional level, (***) = not existing indicator, could be constructed – better if at regional level. Labour force survey indicators refer to workers aged between 25 and 64.

Data sources: (Adler et al., 2020_[69]) (**Adler**), Burning Glass Technologies (**BG**), World Bank Doing Business Indicators (**DBI**), **ETER** Database, OECD Government at a Glance (**GG**), OECD **ICT** Access and Usage by Businesses Database, Labour Force Survey (**LFS**), **PATSTAT**, OECD Product Market Regulation Indicators (**PMR**), European Regional Competitiveness Index (**RCI**), OECD R&D Tax Incentive Indicators (**RDTI**), OECD **Regional** Database, Regional Innovation Scoreboard (**RIS**), OECD **SMEE** Financial Scoreboard (**SMEE**), OECD Services Trade Restrictiveness Indicators (**STR**), OECD Trade by Enterprise Characteristics Indicators (**TBE**), OECD Trade Facilitation Indicators (**TFI**)

Innovation diffusion channels

A variety of indicators can be used to measure the functioning of innovation diffusion channels across regions. These indicators measure trade linkages, worker flows, and the presence of academic institutions and business services that could help companies learn about and adopt innovations (Table 4.2). Most of the measures are available at the regional level.

Table 4.2. Indicators measuring the strength of innovation diffusion channels

Name of indicator	Notes	Data sources (see table note)
Supplier relationships		
Domestic value added content of gross exports	Value added embodied in gross exports of the region divided by total gross exports of the region	Los
Participation in GVC – backward linkages	Intermediate inputs produced abroad embodied in the region's exports	Los
Participation in GVC – forward linkages	Value added produced in the region embodied in trading partners' exports	Los
Inter-regional trade patterns	Export shares and trade in intermediate goods by industry sector. Each region is viewed as independent from other domestic and foreign regions.	Regl-O
FDI penetration in terms of GDP***	Ratio between FDI turnover and total turnover in the region	***
FDI penetration in terms of employment***	Ratio between FDI employment and total employment in the region	***
Local linkages with MNE affiliates/subsidiaries***	Share of turnover of SME located in the region exported to local MNE affiliates/subsidiaries	***

Worker and researcher mobility		
Job-to-job transitions***	Share of workers having changed job since the last period	***
Job-to-job transitions from large to small firms***	Share of workers having moved during the last period from a large to a small firm	***
Job-to-job transitions from MNE affiliates/subsidiaries to local firms***	Share of workers having moved during the last period from a MNE affiliate/subsidiary to a small firm	***
Geographical and cross-industry mobility	Share of workers working in year y in a different region (within the same country) or different industry from the one where they used to work in year y-1	LFS
Share of mobile academics	Share of academics who do not have the nationality of the higher education institution in which they work.	ETER
Share of mobile researchers	Share of researchers who do not have the nationality of the higher education institution in which they work.	ETER
Share of mobile students	The share of students who have physically crossed a national border for their tertiary degree studies (see notes for Figure 3.4).	ETER
Academic-business collaboration		
Access to higher education institutions	Number of HEIs per capita	ETER
Access to higher education institutions with high student mobility	Number of HEIs with high student mobility (per capita). Mobile students are those studying in a different country than their previous residence.	ETER
Share of university-industry patent applications	Number of patent applications filed jointly by (at least) a university and (at least) a business/Total number of patent applications	PATSTAT
Public-private co-publications per capita	Number of public-private co-authored research publications (excluding medical and health industries) divided by total population.	RIS
Share of academic start-ups**	Number of start-ups with at least an academic among its co-founders/Total number of start-ups	
Knowledge-intensive business services		
Share of employment in knowledge-intensive services	Number of employees in knowledge-intensive services divided by total employees	Reg

Note: (*) = indicator available at national level, (**) = indicator available at national level, could be constructed analogously at the regional level, (***) = not existing indicator, could be constructed – better if at regional level.

Sources: European Tertiary Education Register (ETER), Labour Force Survey (LFS), (Los and Chen, 2016_[21]), PATSTAT, OECD Regional Database, Regional Innovation Scoreboard (RIS), Regional Input-Output Data for Europe (RegI-O)

Innovation diffusion outcomes

A number of indicators can be used to measure the extent of regional growth and sustainable progress (Table 4.3) and the strength of innovation diffusion at the regional level (Table 4.4).

Table 4.3. Indicators measuring the extent of regional growth and sustainable progress

Name of indicator	Measures	Data sources (see note)
Productivity		
Productivity level	Total economy; Manufacturing; Services (all ex-finance)	Reg
Productivity growth rate (ten-year annualised)	Total economy; Manufacturing; Services (all ex-finance)	Reg
Wages and earnings		
Average wages (Total compensation per employee)	Total economy; Manufacturing; Services (all ex-finance)	EUROSTAT

Environmental progress		
Renewable energy generation	% capacity used of renewable energy generation	Reg
Greenhouse gas emissions	GHG from generated electricity per capita	Reg

Data sources: EUROSTAT SBS, OECD Regional Database

The table below shows indicators of innovation production and adoption of existing innovations. It uses the Oslo Manual definition to group innovation adoption indicators into those that are: (a) not at the frontier but (b) build on outside knowledge. Finally, many of the outcome indicators relate to the activity of SMEs because smaller firms play important roles in a region's innovation diffusion ecosystem and typically have a great need to catch up to larger firms.

Table 4.4. Indicators measuring the extent of regional innovation diffusion, especially for SMEs

Name of indicator	Does it capture (1) innovation that is (a) not at the frontier but (b) builds on outside knowledge?	Data sources (see table note)
Adoption of products or processes with no or little modification		
Average share of small and medium enterprises...		
... selling orders via computer networks**	a, b	ICT
... with broadband speed at least >100 Mbit/s**	-	ICT
... purchasing cloud computing services**	a, b	ICT
... using electronic SCM systems**	a, b	ICT
... selling orders via computer networks**	a, b	ICT
Innovation building on but differing substantially from products or processes offered or used by other firms		
Number of patents per capita	1, b	Reg
Share of SMEs introducing a product or process innovation	1	RIS
Share of SMEs introducing a marketing or organisation innovation	1	RIS
Share of workers in digital occupations	-	BG
Difference between the share of workers in digital occupations among SMEs and self-employed and the share of workers with tertiary education across the entire economy	-	BG & LFS
Share of SMEs collaborating in research and innovation	1, b	RIS
Share of patent applications...		
... filed together with other patent applicants	1, b	Reg
... filed together with applicants located outside of the region	1, b	Reg
... filed together with applicants located outside of the country	1, b	Reg
... citing other patents	1, b	PATSTAT
... citing other patents filed also outside of the region	1, b	PATSTAT

... citing other patents filed also outside of the country	1, b	PATSTAT
Number of patents per capita in specific high-tech fields (biotech, nanotech, medical, ICT, pharmaceuticals)	1, b	Reg
Entrepreneurship		
Birth rate of employer firms	1	Reg
Growth rate of young firms	-	Reg

Note: (*) = indicator available at national level, (**) = indicator available at national level, could be constructed analogously at the regional level,
Data sources: Burning Glass Technologies (BG), OECD ICT Access and Usage by Businesses Data, Labour Force Survey (LFS), PATSTAT

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