

COUNTRY BRIEFING SLOVAKIA

Vienna Institute for International Economic Studies

Toward Innovation-driven Growth

Innovation Systems and Policies in EU Member States of Central Eastern Europe

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About the authors

Vienna Institute for International Economic Studies (wiiw):

Zuzana Zavarová, Economist at wiiw

Alexandra Bykova, Economist and Deputy Head of Statistics Department and
Economist at wiiw

Richard Grieveson, Economist and Deputy Director of wiiw

Francesca Guadagno, Economist at wiiw

EXECUTIVE SUMMARY

The EU member states of Central Eastern Europe (EU-CEE) – Poland, Czechia, Slovakia, Hungary, Slovenia, Croatia, Romania, Bulgaria, Estonia, Lithuania and Latvia – have undergone an impressive economic catch-up process since the early 2000s. However, the previously successful model of adopting labour-intensive production steps as an 'extended workbench' for Western corporations is increasingly reaching its limits, as we demonstrated in a previous study (Grieveson et al., 2021). The fundamental problem is that the key technological competencies and the segments of production with the highest added value are situated in the 'headquarter economies' of Western Europe. In contrast, the EU-CEE countries continue to specialise in labour-intensive production. Coupled with major structural changes such as decarbonisation and digitalisation, this growth model must therefore be replaced by a new one, more strongly driven by innovation. Only then will these countries be able to catch up with Western Europe in terms of productivity and living standards.

In a follow-up study (Zavarská et al., 2023), we investigated how a customised industrial policy could help EU-CEE countries to escape their 'middle-income trap'. The main finding: industrial policy needs to be stepped up in the region, all the more so at a time when countries around the world are rediscovering its significance. In this necessary effort to climb the technological ladder, there is much for EU-CEE to learn from the East Asian tiger states. They share a similar starting-point, namely the dominance of multinational corporations and a highly export-oriented nature, which the East Asian tigers have successfully leveraged to their advantage. With a highly successful industrial policy, these countries have managed to take the technological lead in some areas and create world-class companies, for instance in electronics or semiconductors.

Having established the need for a new growth model and made the case for industrial policy, we turn to innovation, the other 'missing piece' that will be required to achieve the next stage of convergence in EU-CEE. We explore how these countries could establish innovation systems at the national level, enabling them to catch up technologically and economically with the front-runners in Western Europe.

In this endeavour, EU-CEE countries face several challenges. For one, they do not spend enough on research and development (R&D), which undermines their innovation

activities. R&D expenditure is, however, slowly rising, particularly in Poland, Czechia and Croatia. Nevertheless, all countries in the region fall far short of the official EU target of 3% of GDP for R&D. Only Slovenia and Czechia record R&D expenditure of 2% of GDP, while Slovakia, Bulgaria, Latvia and Romania are below 1%. Although some countries excel in exporting medium and high-tech products, in many cases this is driven by foreign direct investment (FDI) and historical industrial strengths, rather than contemporary domestic innovation. As a result, high-level technological expertise mainly resides within large multinational companies that maintain extensive production sites in these countries, while R&D is carried out primarily in their Western European headquarters. This means that cutting-edge expertise and technology are only available on the 'islands' of the production plants of these companies in the EU-CEE countries. Because of this isolated existence, local companies, especially small and medium-sized ones, struggle to benefit from cutting-edge technology. Exports of innovative services are currently very limited.

Although the region has quite a high share of graduates in science, technology, engineering and maths (STEM subjects), the education system struggles to achieve quality and universities are underfunded. The region has a long way to go in green innovation, hampering its competitiveness in this crucial area of the EU's envisaged 'twin' (digital and green) transformation. By contrast, the region appears better positioned for the digital transformation. In particular, there are a number of emerging innovative enterprises in EU-CEE countries in digital technologies. However, many of them lack strong connections to the broader innovation system and tend to operate as isolated success stories.

Reflecting these challenges, the innovation performance of the region is not particularly promising, although there are some positive developments. With the exception of Estonia, all EU member states in Central Eastern Europe are below the EU average and outside the global top 30. However, the innovation performance is generally in line with the economic development of each country, albeit with some exceptions. Estonia clearly outperforms, while Poland, Slovakia and Romania underperform.

From the policy side, despite recent progress, an overarching problem is the lack of co-ordination and financial

support for innovation and R&D activities by national governments. The disconnect between FDI policies and innovation policies further complicates the implementation of strategies to enhance industrial innovation and upgrade EU-CEE's position in value chains. Although EU membership provides opportunities for collaboration and learning, the current innovation policy approach of the EU, which is focused more heavily on the needs of advanced countries, hinders active participation by EU-CEE countries. Only a few EU-CEE countries utilise their national policy space to engage more actively in EU initiatives.

IRELAND AND SINGAPORE AS ROLE MODELS

In this context, Ireland and Singapore can serve as an inspiration for EU-CEE, as they each successfully transitioned from an FDI-dominated to a more balanced innovation system, in which domestic firms actively contribute to the generation of innovations. Like the EU-CEE countries, their early economic growth was mainly driven by large multinational enterprises (MNEs) – similar to the 'extended workbench' model in EU-CEE. Later in their development stage, however, Ireland and Singapore changed their growth strategies. One notable element was the focus on a highly selective investment promotion approach (called 'innovation by invitation' in Ireland), which involved specifically attracting investments that corresponded to the country's own industrial strengths and potential. Additionally, a systematic and highly focused approach was taken to connect foreign companies with local firms and suppliers to establish industrial clusters in promising niches. Incentives were also created to encourage foreign companies already operating in the country to carry out more R&D locally, thus bringing in more added value.

A critical factor here was well-trained skilled labour. Both Ireland and Singapore have made great efforts to orient vocational training and, above all, university education in STEM subjects as closely as possible to the needs of their own economies. Other success factors included significant government funding of R&D through grants and tax breaks, the strengthening of scientific research at universities, the creation of government research funding agencies, the networking of university and commercial research, good framework conditions for start-ups, and easier immigration of highly qualified people from abroad.

POLICY RECOMMENDATIONS

Considering the specific innovation landscape of EU-CEE countries and building on the success stories from other parts of the world, this study articulates a series of recommendations aimed at guiding the EU-CEE region's next growth phase, advocating for a transition from imitation to innovation.

1. FACILITATE EFFECTIVE CO-ORDINATION OF THE INNOVATION SYSTEM

- Encourage the establishment of a long-term innovation strategy that provides stability and planning security and is not subject to the electoral cycle. This is linked to the creation of a central innovation agency to co-ordinate the various elements of a coherent innovation policy at the national level.
- Improve the utilisation of EU funds and provide more money at the national level for the promotion of innovation. From a converging country's perspective, the reality that EU-CEE can lean on EU finances is a substantial advantage, which needs to be leveraged more strongly.
- Improve the public administration and its institutions. In addition to expanding the pool of innovation policy experts within the public sector, this includes a shift towards a culture of evidence-based policy making, establishing and strengthening in-house capacities to analyse different policies and their interactions.

2. ENABLE COMPANIES TO CLIMB UP THE TECHNOLOGICAL LADDER

- Strengthen the innovative potential of domestic companies, helping them to upgrade and grow. Key strategies in this direction involve fostering local supplier development, offering targeted R&D incentives, as well as promoting clusters. Avoiding an arbitrary over-emphasis on high-tech sectors is also crucial, ensuring that innovation policies are locally relevant for realistic and effective outcomes in the region.
- Select FDI in a targeted way and focus on areas that align with the country's traditional industrial strengths in order to build upon them. Create incentives for foreign MNEs operating in the country to conduct more R&D locally, thereby bringing additional value.
- Connect MNEs operating in the country with local companies so that the latter can benefit from their technological expertise and know-how. Eventually, industrial clusters should emerge that reflect the country's strengths and specialisations.
- Identify and develop promising industrial niches. Facilitate a targeted specialisation of the economy in the most promising areas that offer the greatest comparative advantage. The EU-wide approach, known as 'smart specialisation', can be especially useful, as it seeks to achieve intelligent, inclusive and sustainable growth within the given economic conditions.
- Move away from tax incentives as the main instrument to stimulate R&D spending by companies towards more direct grants, especially in EU-CEE countries with fewer fiscal constraints.

3. STRENGTHEN UNIVERSITIES AND RESEARCH INSTITUTIONS

- Increase the exchange and improve networking between science and business. This includes making collaboration between universities and industry a prerequisite for certain types of funding, reviewing the regulatory frameworks governing publicly funded institutions, and establishing and actively using technology transfer offices, as well as participating in EU-wide initiatives that encourage the commercial application of research.
- Promote international partnerships and create opportunities for the cross-border mobility of researchers. There are various means of stimulating such partnerships, such as making research collaboration grants more widely available, negotiating various fellowship programmes (also within the EU-CEE region), and simplifying work permits and visa procedures for international researchers.
- Stimulate internationally outstanding scientific excellence. This should, however, be relevant to the local economy and its industrial base and take their needs into account.

4. DEVELOP HUMAN CAPITAL

- In order to have enough well-trained specialists available for an innovation-based growth model, vocational training and university education need to be expanded, especially in the STEM subjects of science, technology, engineering and mathematics.
- Talented workers from abroad should be recruited in a targeted manner, and skilled citizens who have emigrated should be enticed with special incentives to return home. It is well known that the EU-CEE countries are grappling with a pronounced 'brain drain' and, consequently, a significant shortage of skilled labour. This situation is often linked to challenging living conditions, ranging from expensive housing to a lack of childcare and inadequate healthcare. This also necessitates a new social policy to improve living conditions.
- Vocational training and apprenticeships should be made more attractive so that young, talented people follow these pathways, especially in technical and scientific fields. EU-CEE countries can build on the presence of MNEs to advance apprenticeship and internship programmes, career exploration programmes, and mentorship initiatives to ensure that students get hands-on experience from a relatively early age. The aim is to also ensure a more balanced talent distribution, so that high-achieving students are more drawn to, and can excel in, vocational pathways.

5. IMPROVE ACCESS TO FUNDING FOR INNOVATIVE COMPANIES

- In order to offer innovative companies better access to suitable financing from the outset, a legal framework and market conditions that reward innovation and risk-taking need to be cultivated. In particular, simplifying regulations, encouraging new fund creation, and promoting regional funds for smaller markets can be useful. Governments should cautiously explore co-investment mechanisms, avoiding disruption to private funding.

COUNTRY BRIEFING SLOVAKIA

INNOVATION LANDSCAPE

Slovakia ranks rather low in international rankings of innovation performance. In the Global Innovation Index, Slovakia, in 45th place, lags behind all EU-CEE countries except for Romania. This represents an outcome below expectations for the country's development level.¹ In the European Innovation Scoreboard, the country is classified in the lowest category as an 'emerging innovator'; the gap with the EU has widened over time (below the EU increase overall, with a strong decrease in environment-related technologies). There are significant regional disparities, however, with the Bratislava (capital city) region performing better than other parts of the country.

The core strength of Slovakia when it comes to innovation performance relates to one output indicator, the share of medium and high-technology exports in total exports. Fuelled by the country's strong FDI-led value chain integration, Slovakia performs well above the EU average in this regard. This is because of the automotive industry (classified as a medium-high-technology industry), which plays a huge role in the country. Although large original equipment manufacturers (OEMs) have not invested in Slovakia with the primary aim of conducting research and development (R&D) activities, some car parts companies in the sector have started to locate their R&D departments in Slovakia (e.g. Adient Slovakia, HELLA Slovakia Lighting). Large OEMs contribute to process innovation,² and share best practices within other plants of the group. Volkswagen, for example, launched its own dual education facility with other companies. Even so, domestic supplier networks are not well developed and there are only weak spill-overs outside the multinational enterprises (MNEs).

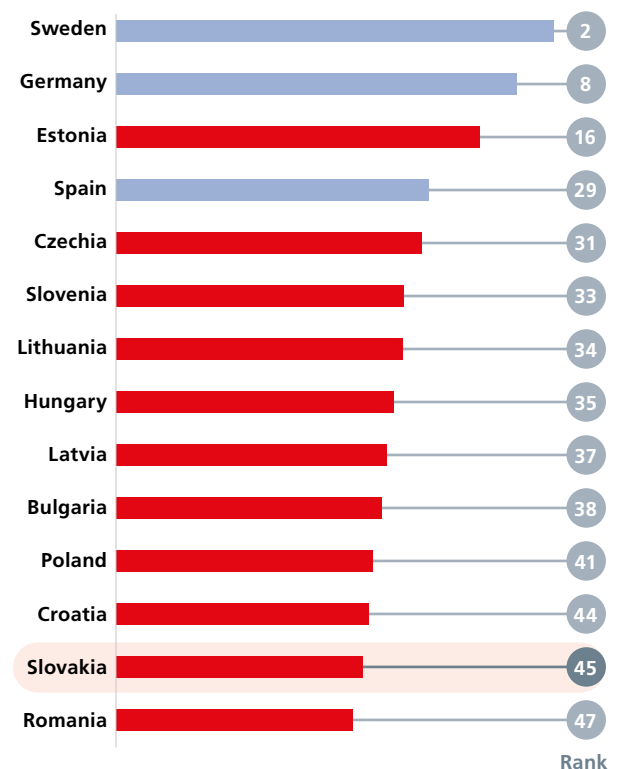
Looking at the company landscape, Slovakia has no 'unicorn', but does have several notable innovative firms in the fields of e-mobility, waste management and social innovations.³ A number of Slovak companies participate in Important Projects of Common European Interest (IPCEI, an EU policy initiative) related to green innovations, pointing to some advancements in this area. In IPCEI hydrogen value chain (IPCEI-

¹ According to GII's expected vs. observed innovation performance.

² <https://spectator.sme.sk/c/22536781/process-innovations-allow-slovak-innovators-to-shine.html>

³ <https://spectator.sme.sk/c/23189835/slovakia-closing-in-on-first-unicorn.html>

Global Innovation Index – Rank 45 out of 132 countries



Source: GII 2023.

Hy2Tech), Slovak company NAFTA participated in the field of storage, transportation and distribution technology. In IPCEI hydrogen value chain (IPCEI HY2Use), the EU approved funds for projects recently, one participant is from Slovakia. A project by the RONA company aims to apply hydrogen in industry. The IPCEI European battery innovation includes three Slovak companies (ENERGO-AQUA, InoBat Energy, ZTS).

Košice and the surrounding area in the economically lagging east of Slovakia is gradually evolving into an up-and-coming region: it hosts a strong IT cluster (as do Bratislava and Žilina also), ambitions for a space cluster emerged in September 2023, and the new Volvo plant creates the opportunity for an e-mobility hub there. Currently, the European Commission grants a Cluster Management Excellence gold label certificate to the Košice IT Valley, a silver certificate to the Slovak Plastic Cluster, and 18 clusters hold an active bronze label, with activities including energy and environment, creative industries, production and engineering, the food industry, ICT

and biotechnology.⁴ Two important examples are the Slovak National Hydrogen Association Cluster (since 2015) and the Slovak Battery Alliance (since October 2019).

⁴ <https://www.cluster-analysis.org/benchmarked-clusters/listing?country=f4a697f2429d43bbafced4fee8fec23>

The Recovery and Resilience Fund (RRF) is a great opportunity for Slovakia to improve its lagging innovation landscape, as it includes substantial efforts to advance the policy agenda in the country. As part of the RRF, the National Research, Development & Innovation Strategy 2030, endorsed in March 2023, represents a very promising development and is a quite a well-rounded innovation policy document.

National Innovation System Indicators				
Priority areas	Indicator	Slovakia	EU	EU-CEE
Education system	Tertiary education graduates in STEM, share in % (UNESCO)	21.3	24	24.2
	Spending on tertiary education per student, in EUR at PPP (Eurostat)	7,590	7,990	6,600
	PISA scales in reading, maths and science (GII)	469	484	480
Technological capacities of enterprises	R&D (GERD) financed by business, share in % (Eurostat)	45.7	57.7	43.5
	R&D expenditures (GERD) in % of GDP (Eurostat)	0.9	2.3	1.3
	SMEs with product innovations, share in % (EIS)	14.1	27.0	22.8
	SMEs with business process innovations, share in % (EIS)	26.1	41.6	32.4
	Finance for start-ups and scale-ups, average perception scores from 0 to 10 (GII)	4.7	4.3	4.5
Collaborations and linkages	Innovative SMEs collaborating with others, share in % (EIS)	7.5	11.7	10.1
	University-industry R&D collaborations, average perception scores from 0 to 7 (GII)	3.2	4.2	3.8
Innovation outcomes	Granted patents per million inhabitants (WIPO)	56	586	86
	Exports of medium and high-technology products, in % of total product exports (EIS)	70.5	61.2	49.5
	Knowledge-intensive services exports, in % of total services exports (EIS)	46.3	63.6	48.6

Sources: EIS 2023; Eurostat; GII 2023; UNESCO; WIPO; World Bank, WDI .
 Note: data for EU and EU-CEE are simple averages, except for EIS and Eurostat, with original data for EU.
 Data for 2021 or the most recent available year; more details on the methodology and data availability to be found in the Annex.

Mapping innovation policy initiatives			
	Yes/No	Name of the initiative/programme	Comments
Innovation agency	Yes	Research and Innovation Authority (VAIA) at the Government Office www.vaia.gov.sk Government Council for Science, Technology and Innovation Slovak Innovation & Energy Agency (SIEA) www.siea.sk (under the Ministry of Economy)	National Research, Development & Innovation Strategy 2030 endorsed in March 2023; part of the Recovery and Resilience Plan; 91 specific measures; aims to simplify burdensome regulation and improve the labour force. The new innovation policy seeks to reduce the fragmentation of the support ecosystem. However, there still appear to be many actors in this field.
Programmes for human capital development	Yes	Reforms and investments under the Slovak Recovery and Resilience Plan	Reform of pre-primary education. New curriculum for primary and lower-secondary education. Introduction of performance contracts in higher education. Launch of several calls for support for research and innovation.
Programmes for human capital attraction and retention (e. g. reverse brain drain)	Yes	National Research, Development & Innovation Strategy 2030	Including diaspora engagement, fellowships for skilled professionals/researchers, Martin Filko Scholarship for post-graduate students abroad.

Start-up programmes (incubators, dedicated financing, etc.)	No	No explicit, stand-alone programmes targeting start-ups	For an overview of sectors and success stories, see: https://innovateslovakia.sk/en/startup-insights/sectors/
Venture capital programmes	Yes	(1) Venture to Future Fund (2) Microloan programme: for small businesses employing up to 50 people (3) Slovak Business Agency provides venture capital through a specialised subsidiary company – the National Holding Fund (Národný holdingový fond s.r.o.).	(1) Joint initiative of the EIB, the Ministry of Finance of the Slovak Republic and the Slovak Investment Holding (it is the first VC fund of its kind in the CEE region that has attracted EIB's capital). (2,3) See Slovak Business Agency . Several active VC funds are based in Slovakia.*
Cluster programmes	Yes	Subsidies for cluster development	Support for increasing the competitiveness of clusters, intended at new clusters. Administrated by SIEA.
Technology-specific policies	Yes	National Hydrogen Strategy and Action Plan	Public funds allocated to support hydrogen technologies in Slovakia.**
Tax incentive schemes	Yes	(1) Special R&D tax regime: R&D Superdeduction (2) Patent Box	(1) Companies located in Slovakia can deduct additional 100% of their R&D costs from their corporate income tax base. (2) Special tax regime for intellectual property rights related income. Patent Box exempts income resulting from intellectual property acquired through companies' own R&D activities.
Others	Yes	1) Voucher support scheme under RRF (2) Matching grants support to augment participation in EU-wide initiatives (3) Investment aid according to regions, in order to decrease regional disparities	(1) Differentiation between innovation voucher, a digital voucher and a patent voucher. (3) Aid intensities depend on the GDP per capita of the respective region (30% for Western Slovakia; 40% for Central Slovakia, 50% for Eastern Slovakia; Bratislava region excluded).

* For an overview on funding opportunities in Slovakia, see: <https://innovateslovakia.sk/en/resources-tools/startup-guide/#funding-and-investors>
 ** <https://www.mhsr.sk/nvs>

COUNTRY-SPECIFIC POLICY PRIORITIES AND RECOMMENDATIONS

Slovakia significantly lags in its innovation performance and needs to improve its innovation landscape to reach at least the level of performance expected for its development level. The new National Research, Development & Innovation Strategy 2030 provides a good starting-point and opportunity; its effective implementation should be carefully monitored.

- **Reduce innovation policy fragmentation.** The Slovak innovation support ecosystem has long been highly fragmented, and the new National Research, Development & Innovation Strategy 2030 aims at its improved integration. A new governance structure was recently set up: The Research and Innovation Authority (VAIA) at the Government Office has been defined as a ‘single cross-ministerial owner and co-ordinator’. The Government Council for Science, Technology and Innovation serves as an advisory body. Nevertheless, numerous agents with partly overlapping agendas continue to ex-

ist, which has several negative effects. One of these is the low disbursement of EU funds. In the last funding periods of the EU’s Multiannual Financial Framework, Slovakia’s absorption rate lagged significantly behind that of its peers. Therefore, the continued implementation of the National Research, Development & Innovation Strategy should be overseen, and the innovation strategy and industrial strategy of the country should be consolidated and more closely aligned. Greater emphasis on the smart specialisation framework is called for, particularly at the regional level (see also Recommendations 1.1, 1.2 and 1.3 in the main report). In less developed parts of the country, capacity-building and technical support need to be made widely available, so that these locations have the ability to design and implement successful development strategies.

- **Dedicate more policy attention to spill-over creation and linkages between foreign and domestic companies.** Large foreign OEMs dominate the automotive sector, with foreign ownership also prominent in other sectors. Yet the transfer of technology and

knowledge between foreign companies and domestic ones remains weak, and there is much potential to be found in supplier development. Hence, beyond the promotion of new ventures that the current innovation strategy skews towards, greater emphasis on secondary forms of innovation is recommended (see Recommendations 2.1 and 2.3 in the main report). Best practice cases could provide new ideas in this respect: For example, more investment support could be provided to a foreign investor when a domestic partner is involved or when effective co-operation with a research institute is created.⁵ Building on the matchmaking platform of the Slovak Investment and Trade Development Agency (SA-RIO), more networking platforms between foreign enterprises and domestic enterprises should be integrated into the innovation strategy, entailing co-ordination and collaboration on innovation and FDI policy between SA-RIO and VAIA. In addition, grants or innovation vouchers targeted at foreign enterprises collaborating with domestic universities could be considered, as well as training schemes aimed at enhancing the organisational and management capabilities of domestic suppliers.

- **Adapt all levels of the education system to meet current market needs.** Setting the education system in a way that allows the country to absorb imported knowledge and capacities is particularly important in the Slovak context. The skills and needs of the market should be considered more closely via greater work-based learning in vocational training. Slovakia can build on the presence of MNEs to strengthen apprenticeship and internship programmes, career exploration programmes, and mentorship initiatives, to ensure that students get hands-on experiences from a relatively early age. Incorporating industry representatives into the dialogue on the development of curriculum frameworks can further align labour market needs with the skills being taught at schools. An example for best practice is the bilateral co-operation between Slovakia and Austria in vocational training, which started in 2014. Greater promotion of such cross-border learning would be beneficial. Meanwhile, the higher education system should also be brought closer to ‘reality’. The establishment of technology transfer offices at universities should be promoted, and regulatory frameworks reviewed in a way that encourages commercialisation of intellectual property. Beyond pushing for international excellence, it is important to simultaneously motivate more locally embedded research, inducing downstream collaboration of universities, closer to the stages of technology or innovation application (see also recommendations in Sections 5.3 and 5.4 of the main report).

⁵ See, for example, the new ‘Tecxport-Tailored Innovation Initiative’ in Austria: <https://www.ffg.at/ausschreibung/TecxportTailoredInnovation-2023>

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1056 Budapest | Fővám tér 2–3.

Email: budapest@fes.de

Responsible for content and editing:

Dr. Ernst Hillebrand

ernst.hillebrand@fes.de

Orders/Contact: budapest@fes.de

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Toward Innovation-driven Growth: Innovation Systems and Policies in EU Member States of Central Eastern Europe

This country briefing contains a short summary of a much broader study that deals with the perspectives of innovation policies in Central Eastern and Southern Eastern Europe.

Twenty years after EU enlargement, the economies of Central and South Eastern Europe have become important components of Europe's industrial production system. Now, these countries are faced with the task of taking a new step towards a more sustainable and productive growth model.

This step can only be taken if the countries succeed in becoming innovating economies with national companies that are strong in research, development and innovation. To succeed, the countries have to develop not only strong industrial policies, but also policies that aim at creating solid national innovation systems. The study analyses the region's potential and uses the examples of Ireland and Singapore to describe successful innovation strategies. It is authored by a team from the Vienna Institute for International Economic Studies.

It is part of a series of FES studies on the growth model in EU-CEE and its prospects which have been published in recent years.

The full study can be found here:

<http://library.fes.de/pdf-files/bueros/budapest/21198.pdf>



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