

Innovation Performance of the Slovak Republic

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Abstract: The paper aims to analyze the innovation performance of Slovakia compared to the European Union average in order to specify its strengths, weaknesses and dynamics. According to the European Innovation Scoreboard 2021 Slovakia belongs to the last third in the ranking of innovators. Moreover, it is ranked among seven countries which performance has declined between 2020 and 2021. Slovakia's strengths are in Environmental sustainability, Sales impacts and Use of information technologies. The Regional Innovation Scoreboard 2021, a regional extension of the European Innovation Scoreboard, revealed that although Europe's most innovative regions are located in the most innovative countries, Bratislavský kraj, a region in Slovakia, is a Moderate Innovator. We found out that the innovation activity of the Slovak Republic is lower compared to the European average and does not copy the trend in the performance of the European Union average, which can be described as stable with tendency to moderate growth. As we point out, the main reason is that Slovakia has significantly lagged behind the average in the share of investment in innovation for a long time. Nevertheless, the Slovak Republic has a demonstrable innovation potential, the growth of which needs to be stimulated and supported.

Key Words: Innovation, innovation performance, European Innovation Scoreboard, Regional Innovation Scoreboard, Summary Innovation Index

1. INTRODUCTION

Globalization creates an area for the development of economic activities, it intensifies global competition and fundamentally changes the parameters of competitiveness. Innovation is the main factor of achieving the competitiveness of companies and countries. In this context, especially innovations changing the usual patterns of behavior, having an impact on job creation and the development of regions and countries, are important.

Various forms of large-scale, detailed and comprehensive assessments of the competitiveness of national economies are a remarkable and important manifestation of globalization.

In our analysis, we will make use of the European Innovation Scoreboard (EIS) provided by the European Commission (EC). It compares innovation performance in EU countries, other European countries, and regional neighbours, as well as assesses the relative strengths and weaknesses of national innovation systems and helps countries identify areas they need to address.

The European Innovation Scoreboard 2021, the 20th edition since its introduction in 2001, is based on a revised framework, which includes new indicators on digitalisation and environmental sustainability, bringing the scoreboard more in line with the EU political priorities. Also, with the withdrawal of the UK from the European Union, the EU now represents the average of 27 countries. The UK has consistently performed above the EU28 average, and the absence of the UK from the EU has

resulted in a small reduction in the EU's average innovation performance already in EIS 2020.

Table 1 lists four main types of activities and twelve dimensions covered by the EIS:

Table 1: EIS 2021: Measurement framework

Activity	Dimension
Framework conditions	Human resources
	Attractive research systems
	Digitalisation
Investments	Finance and support
	Firm investments
	Use of information technologies
Innovation activities	Innovators
	Linkages
	Intellectual assets
Impacts	Employment impacts
	Sales impacts
	Environmental sustainability

Source: Own elaboration according to EC (2021)

The overall picture of innovation performance is provided by the Summary Innovation Index (SII) - a summary indicator obtained by aggregating 32

indicators used to measure innovation performance.

The Regional Innovation Scoreboard (RIS) is a regional extension of the European Innovation Scoreboard (EIS), assessing the innovation performance of European regions on a limited number of indicators (on 21 out of the 32 indicators used in the EIS 2021). The RIS 2021 provides a comparative assessment of the performance of innovation systems across 240 regions of 22 EU countries, Norway, Serbia, Switzerland, and the United Kingdom. Cyprus, Estonia, Latvia, Luxembourg and Malta are included at the country level.

In response to a need for contextual analyses to better understand performance differences between the innovation indicators used in the main measurement framework, a set of contextual indicators was introduced to the country profiles in the 2017 edition and revised in the 2018 edition. For this year's report, two additional sets of indicators are introduced, namely Innovation profiles and Climate change. The previous indicators include Performance and structure of the economy, Business and entrepreneurship, Governance and policy framework and Demography.

Surveying the position of the SR in innovation international rankings is not so widespread. Moreover, there are only few studies taking into account EIS.

Hečková, J. (2008) dealt with the analysis and evaluation of the innovation performance of the Slovak Republic (SR) with the EU average. Based on the achieved value of the Innovation index, Slovakia was included in the group of weak innovators. The author states that Slovakia will need at least 21 years to reach the average level of Europe at those times.

Similarly, Knošková, Ľ. and Dudeková, A. (2015) point out that the innovation performance of the Slovak Republic is below the EU average in most of the monitored indicators. Compared to 2008, the Slovak Republic got from the last group to the penultimate group of moderate innovators, but the dynamics of performance growth is still low.

Fíľa, M. and Kučera, J. (2015) state that the potential, as well as innovative performance between individual members of the EU are significantly different. Slovakia has been placed on the tail of innovative performance at all levels - national, regional and corporate for a long time.

This article continues in evaluation of innovation performance of Slovakia we realized in 2018. In our

survey (2018) we presented that the performance of Slovakia according to EIS 2016 together with Croatia, Cyprus, Czech Republic, Estonia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, and Spain is below that of the EU average. These countries are moderate innovators. However, RIS 2016 revealed that Europe's most innovative regions are located in the most innovative countries, although regional innovative hubs exist in moderate innovator countries: Piemonte and Friuli-Venezia Giulia in Italy, País Vasco in Spain and Bratislavský kraj in Slovakia.

By the use of analytical data, we fulfilled the aim of the article. We evaluated the innovation performance of Slovakia compared to the EU average in 2019. We also specified the strengths and weaknesses of the innovation performance of Slovakia.

2. MATERIAL AND METHODS

Dealing with the issue of evaluating the innovative performance of the economy presupposes the definition of a methodological apparatus including an information base and the selection of suitable methods of information processing and problem solving. The data base of the solved problem is represented by the official document of the European Commission concerning the current state and development trends in the field of evaluation of the level of innovation performance of economies. We performed the analysis and evaluation of the innovation performance of the Slovak Republic in comparison with the EU average according to the most recent evaluation of the innovation performance of the EU Member States - EIS 2021.

The performance of EU national innovation systems is measured by the Summary Innovation Index, which is a composite indicator obtained by taking an unweighted average of the 32 indicators. Performance of the EU innovation system is measured as the weighted average of the performance of the innovation systems of all 27 Member States. The EIS uses the most recent statistics from Eurostat and other internationally recognised sources such as the OECD and the United Nations, available at the time of analysis, with the cut-off day of 28 April 2021. International sources have been used wherever possible to improve comparability between countries.

3. RESULTS AND DISCUSSION

The coronavirus pandemic has changed the world in an unprecedented way. Research and innovation have demonstrated to be a necessary part of the coordinated EU response to the virus outbreak and

they will be vital to support Europe's sustainable and inclusive recovery.

It can be confirmed by words of Ursula von der Leyen, President of the European Commission, which are included in the foreword of EIS 2021: "As we will emerge from the pandemic, innovation will be key for the success of our digital and our green agenda." (EC, 2021)

The 2021 European Innovation Scoreboard shows that innovation performance of the EU continues to increase at a steady pace. Further overall improvement is expected in the short-term, but progress remains uneven within the EU. The process of convergence within the EU, where lower performing countries are growing faster than higher performing countries, has continued in 2021. In global terms, the EU has a performance lead over Brazil, China, India, Russia, and South Africa, and a performance gap with Australia, Canada, Japan, South Korea and the United States. South Korea is the most innovative country, performing 21 per cent above the EU in 2021. Between 2014 and 2021, the EU has improved its relative position towards 6 of its global competitors: the performance gap with Australia and Canada has become smaller and the performance lead over Brazil, India, Russia and South Africa has increased. The EU has seen a worsening of its relative position towards 4 of its global competitors: the performance gap with Japan, South Korea and the United States has increased and the performance lead over China has become smaller. More recently, between 2020 and 2021, the EU has closed part of its performance gap with Australia and Japan, but Canada, South Korea, and the United States managed to increase their performance lead.

Based on their average performance scores as calculated by a composite indicator, the Summary Innovation Index, Member States fall into four different performance groups:

- **Innovation Leaders** are all countries with a relative performance in 2021 above 125% of the EU average in 2021.
- **Strong Innovators** are all countries with a relative performance in 2021 between 100% and 125% of the EU average in 2021.
- **Moderate Innovators** are all countries with a relative performance in 2021 between 70% and 100% of the EU average in 2021.
- **Emerging Innovators** are all countries with a relative performance in 2021 below 70% of the EU average in 2021.

Belgium, Denmark, Finland and Sweden are Innovation Leaders with innovation performance well above the EU average. Austria, Estonia, France, Germany, Ireland, Luxembourg and the Netherlands are Strong Innovators with performance above the EU average. The performance of Cyprus, Czechia, Greece, Italy, Lithuania, Malta, Portugal, Slovenia, and Spain is below the EU average. These countries are Moderate Innovators. Bulgaria, Croatia, Hungary, Latvia, Poland, Romania and Slovakia are Emerging Innovators with performance well below the EU average.

The performance groups tend to be geographically concentrated, with the Innovation Leaders and most of the Strong Innovators located in Northern and Western Europe, and most of the Moderate and Emerging Innovators in Southern and Eastern Europe.

Unfortunately, Slovakia belongs to the last third in the ranking of innovators. It ranked 23rd out of a total of 27 places. The total score of the Slovak Republic is 70.98. For comparison, as for V4 countries, only Poland ranked worse. The Czech Republic, Spain and Slovenia, which have traditionally made us a company in this category, were placed in the group of moderate innovators this year and saw an improvement in innovation indicators.

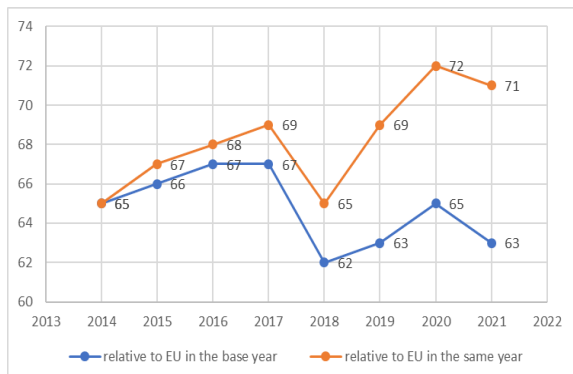
Similarly, as we noticed in our previous survey (2018), RIS 2021 reveals that the most innovative regions are typically in the most innovative countries. The overall most innovative region in Europe is Stockholm in Sweden, followed by Etelä-Suomi in Finland, and Oberbayern in Germany. Bratislavský kraj (SK01), a region in Slovakia, is a Moderate Innovator. Innovation performance of the region has decreased between 2014 and 2021 (-0.6%). Its strengths include esp. tertiary education, international scientific co – publications, employed ICT specialists, employment knowledge – intensive activities.

On average, the innovation performance of the EU has increased by 12.5 percentage points since 2014, in particular due to strong performance increases in the following indicators: Broadband penetration, Venture capital expenditures, and International scientific co-publications. Since 2014, innovation performance increased in all EU Member States. Performance has increased the most in Cyprus, Estonia, Greece, Italy and Lithuania.

Slovakia is ranked among seven countries which performance has declined between 2020 and 2021 (-0.6% points).

As Figure 1 shows, performance of Slovakia has decreased relative to that of the EU in 2014.

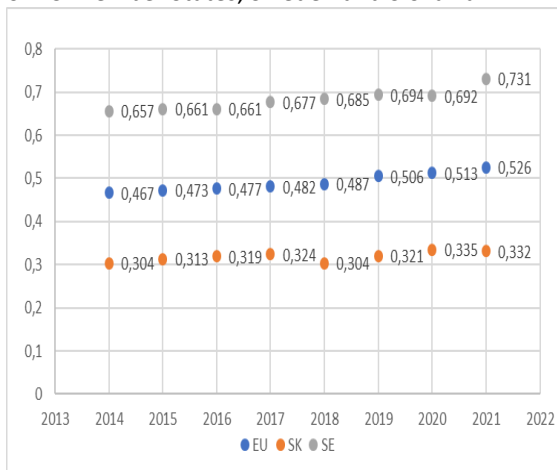
Figure 1: SII – Performance of Slovakia relative to EU



Source: Own elaboration according to EC (2021)

We can state that the innovation performance of Slovakia is significantly below the EU average with fluctuating growth trend. Regarding the evaluation of developments in Slovakia only very small year-on-year changes have been recorded from the medium term. The development of Slovakia's innovation performance has not generally copied the trend in the performance of the EU average, which together with Sweden, the innovative leader, can be described as stable with tendency to moderate growth, as evidenced in Figure 2.

Figure 2: Development of innovation performance of EU Member States, Sweden and Slovakia



Source: Own elaboration according to EC (2021)

Slovakia's strengths are in Environmental sustainability, Sales impacts and Use of information technologies. The top-3 indicators include Environment-related technologies, Medium and high-tech goods exports, and Air emissions by fine particulate matter. In recent years performance increases for Tertiary education, International scientific co-publications, Most-cited publications, Venture capital, Government support for business

R&D, ICT specialists, and Environmentrelated technologies, have been offset by reduced performance for Digital skills, Enterprises providing ICT training, Design applications, and Sales of innovative products. Slovakia has above average shares of Non-innovators and is showing below average scores on the Climate change related indicators.

Regarding contextual indicators, according to EIS 2021, Slovakia shows the highest positive difference to the EU in Value-added share foreign-controlled enterprises and Population density, and the biggest negative difference in Top R&D spending enterprises, GDP per capita and Eco – innovation index, Circular material use rate and in almost all innovation profiles.

Research & Development (R&D) is a major driver of innovation, and R&D expenditure and intensity are two of the key indicators used to monitor resources devoted to science and technology worldwide.

Table 2: Development of the share of R&D expenditure in GDP * in%:

	2013	2014	2015	2016	2017	2018	2019 ^(e)
SK	0,82	0,88	1,16	0,79	0,89	0,84	0,83
EU(28)	2,01	2,02	2,03	2,04	2,08	2,11	2,13

Notes: * according to National accounts, ESA 2010

(e) – estimated

Source: Own elaboration according to Eurostat data

Slovakia has significantly lagged behind the average in the share of investment in innovation for a long time, which has a long-term negative impact not only on the economic competitiveness of the Republic, but also on its overall innovation performance. As table 3 shows, resources spent on research and the development represented only 0.83% of GDP in 2019, which puts Slovakia among countries with the lowest and weakest support of research and development.

As a result, science including applied research and development of new goods, services, processes or procedures is significantly undersized in Slovakia in the long run. At the same time, the difference between advanced Europe, as well as the overall EU-27 average and Slovakia deepens in relative terms. Proportion of total expenditure incurred for research and development (and thus for innovation) in both the public and private sectors grows only minimally in the long term.

In this regard, we evaluate the increase in Government support for business R&D mentioned above positively.

According to Fiľa, M. and Kučera, J. (2015), if we compare the values of investments in research and

development and innovation performance expressed by SII, we find out that there is a clear positive correlation between them, and thus a higher % of R&D expenditure logically also increases a country's innovation performance especially in the medium and long term.

To this, of course, one must take into account the overall conceptual policy and systematic nature of research support, development and innovation in both industry and services, as well as in research institutions and public administration.

4. CONCLUSIONS

In the period of growing globalization and digitalisation, innovation is becoming more and more important factor determining the success of business activity and countries. As pointed out by the current pandemic, during which businesses were forced to respond quickly and flexibly to market changes, the need for innovation is needed even higher. We presented the evaluation of innovation performance of EU countries by the use of multicriterial evaluation provided by the European Commission. Innovation performance is measured using a composite indicator – the Summary Innovation Index – which summarises the performance of a range of different indicators.

We found out that the Slovak republic belongs to the group of Emerging Innovators with performance well below the EU average. However, according to Regional Innovation Scoreboard, Bratislavský kraj, a region in Slovakia, belongs to a group of Moderate Innovators.

Slovakia's strengths are in Environmental sustainability, Sales impacts and Use of information technologies. On the other hand, we observe reduced performance for Digital skills, Enterprises providing ICT training, Design applications, and Sales of innovative products.

The innovation performance shows only very small year-on-year changes from the medium term. As we argue, one of the reasons is that proportion of total expenditure incurred for research and development (and thus for innovation) in both the public and private sectors grows only minimally in the long term.

Slovakia needs conceptual policy and systematic nature of research support, development and innovation in both industry and services, as well as

in research institutions and public administration. Success in rankings devoted to innovation performance is directly proportional to the effort in this field.

ACKNOWLEDGMENT

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ENDNOTES

¹ The EIS reports have been published under the name "European Innovation Scoreboard" until 2009, as "Innovation Union Scoreboard" between 2010 and 2015, and again as "European Innovation Scoreboard" from 2016 onwards.

² In this year's edition, the thresholds for identifying the performance groups have been revised and one performance group has been renamed, making any comparisons with performance groups in previous EIS reports impossible.

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