

DIFFERENCES IN INNOVATION PERFORMANCE OF VISEGRAD GROUP REGIONS

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DOI: <https://doi.org/10.31410/EMAN.2019.635>

Abstract: *Innovations play a significant role in the social and economic development of countries and regions. They have an impact on economic level and contribute to reducing the regional disparities. The innovation performance of regions can be evaluated by different ways using a number of diverse indicators. In this article we evaluate the innovation performance of regions using the data from the Regional Innovation Index by Regional Innovation Scoreboard. The aim of this article is to evaluate the innovation performance and the differences in innovation performance of NUTSII regions of Visegrad Group using selected variability variables. The method of analysis, mathematical-statistical methods, comparison and synthesis are used. Our research has shown that the highest innovation performance is performed by the regions of Praha and the Bratislava region. The largest relative differences in innovation performance between Visegrad Group regions are in indicators: Public private co publications, International scientific co publications, SMEs with marketing or organizational innovations and Innovative SMEs collaborating with others (more than 54%). The smallest differences are in indicators: Exports of medium high/high-technology intensive manufacturing, Most cited scientific publications, Trademark applications, and Non R&D innovation expenditures.*

Keywords: *Innovation, innovation performance, Regional innovation index, Visegrad group countries.*

1. INTRODUCTION

Being able to cope with changes in global economic environment, increasing competition and fast technological development impulses in the form of innovation are required. Innovation is the implementation process result of creativity, new idea or new knowledge (invention). This is the application of a new, progressive idea or method, i.e. applying the ideas in action to generate financial effects. Innovation as a result of science and research is one of the main factors affecting the competitiveness of companies, regions and national economies. They have an impact on economic level and contribute to reducing the regional disparities. The innovation performance of regions can be evaluated by different ways using a number of diverse indicators. In this article we evaluate the innovation performance of regions using the data from the Regional Innovation Index by Regional Innovation Scoreboard.

The aim of this article is to evaluate the innovation performance of NUTSII regions of Visegrad Group (Czech Republic, Hungary, Poland, Slovak Republic) and to evaluate the differences in innovation performance using selected variability variables (variation range, variation coefficient). We used the method of analysis, mathematical-statistical methods, comparison and synthesis in this article.

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At NUTS II level Czech Republic (CR) has 8 NUTS II regions: Praha, Střední Čechy, Jihozápad, Severozápad, Severovýchod, Jihovýchod, Střední Morava and Moravskoslezsko. Hungary is divided into 7 NUTS II regions: Közép-Magyarország, Közép-Dunántúl, Nyugat-Dunántúl, Dél-Dunántúl, Észak-Magyarország, Észak-Alföld, Dél-Alföld. Poland is divided at NUTS II into 16 regions: Łódzkie, Mazowieckie, Małopolskie, Śląskie, Lubelskie, Podkarpackie, Świętokrzyskie, Podlaskie, Wielkopolskie, Zachodniopomorskie, Lubuskie, Dolnośląskie, Opolskie, Kujawsko-Pomorskie, Warmińsko-Mazurskie and Pomorskie. Slovak Republic (SR) is divided to 4 NUTS II regions: Bratislavský kraj, Západné Slovensko, Stredné Slovensko a Východné Slovensko.

2. THEORETICAL BACKGROUND OF REGIONAL INNOVATION PERFORMANCE

Even if the innovation category is a newer term in professional terminology, the issue of innovation and innovation performance is currently widely well-developed. Innovation is closely related to the science and research and means any practical transformation of an idea into reality. The sequence of steps from invention creation, through innovation creation and its diffusion over the market is called the innovation process. It is about the process of creating and dissemination of innovation. The innovation process results in the innovation performance of company, state and region, which can be assessed through a complex of partial indicators.

Currently an increasing attention is paid to observing and comparing the innovation performance of regions. Rylková [1] made a comparison and evaluation of Moravian-Silesian and Zlin Region in terms of innovative activities and innovation performance. Pisár, Ďurčková and Varga [2] in their paper identified state of Slovak regions based on methodology concerning state of EU regions in the connection to competitiveness of companies and tried to define strengths and weaknesses of innovation performance of the regions measured by Regional Innovation Index.

Zabala-Iturriagoitia et al. [3] applied a Data Envelopment Analysis (DEA) methodology to the evaluation of regional innovation system performance. Their results show that the higher the technological level of a region, the greater is the need for system coordination. Where this is lacking there is a loss of performance efficiency compared with other similar regions. Hajek and Henriques [4] in their study aim to develop a model based on a multi-output neural network. This model shows that the multi-output neural network outperforms traditional statistical and machine learning regression models. In general, therefore, it seems that the proposed model can effectively reflect both the multiple-output nature of innovation performance and the interdependency of the output attributes.

Bednář and Halásková [5] used the analysis of convergence or divergence related to innovation performance and R&D expenditures among Western European NUTS 2 regions. Applying differential local version of spatial autocorrelation (LISA), difference-in-difference estimation, the paper reveals the local variation of convergence and divergence and general spatial regime divergence in innovation performance and R&D expenditures within Western European NUTS 2 regions.

The issue of regional development is closely linked to the process of creating innovation and innovation performance of regions. Innovation is foundation for productivity growth, competitiveness of companies and subsequent regional growth. [2]

3. THE EVALUATION OF INNOVATION PERFORMANCE OF V4 REGIONS

The innovation performance of regions can be assessed in different ways using a number of indicators. In this paper the innovation performance in the regions of Visegrad Group countries is to be assessed by means of the Regional Innovation Index (RII) by Regional Innovation Scoreboard [6] The Regional Innovation Index summarizes the performance on 18 indicators (Table 1).

Table 1: Regional Innovation Index indicators

No.	Indicator	No.	Indicator	No.	Indicator
1	Population with tertiary education	7	Non-R&D innovation expenditures	13	EPO patent applications
2	Lifelong learning	8	Product or process innovators	14	Trademark applications
3	Scientific co-publications	9	Marketing or organizational innovators	15	Design applications
4	Most-cited publications	10	SMEs innovating in-house	16	Employment medium and high-tech manufacturing & knowledge-intensive services
5	R&D expenditure public sector	11	Innovative SMEs collaborating with others	17	Exports medium and high-tech manufacturing
6	R&D expenditure business sector	12	Public-private co-publications	18	Sales of new-to-market and new-to-firm innovations

Evaluated regions are grouped into four innovation performance groups: Innovation Leaders, Strong Innovators, Moderate Innovator, and Modest Innovators.

Within the innovation performance assessment of regions, the European Commission uses the year of 2011 as a base year and recalculates the innovation performance of regions in upcoming years. [6]. The innovation performance of regions depends on reported indicators showing irregular fluctuations, which affects the overall assessment of individual regions in particular years. The Figure 1 shows the innovation performance comparison of the V4 countries in 2011 and 2017 and their average rating.

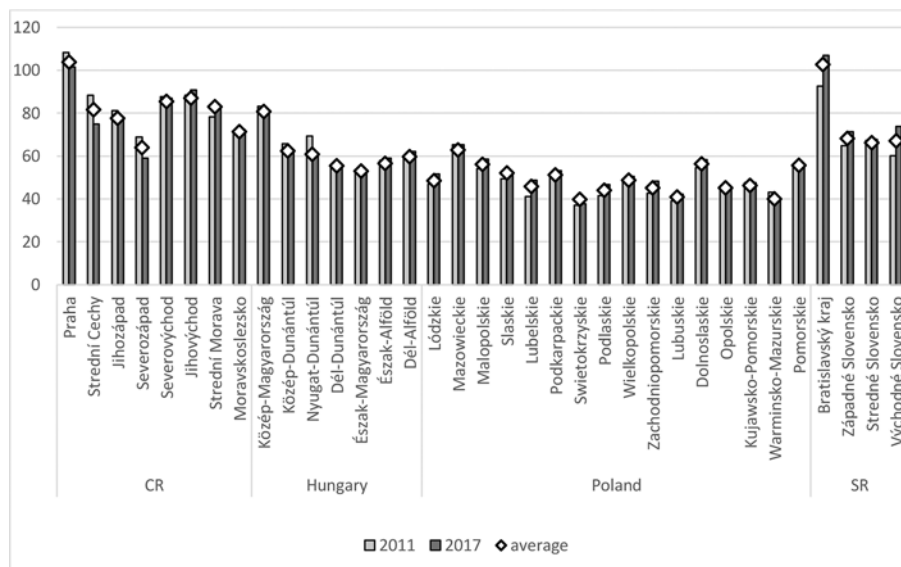


Figure 1: Innovation performance of V4 regions

The innovation performance of V4 regions (apart from Praha and Bratislava regions) is significantly below the EU average (from the year of 2011). In 2017 Bratislava Region has the highest innovation performance among the V4 countries, followed by Czech regions (Praha, Jihovýchod, Severovýchod). Also, in Hungary and Poland, the highest innovation performance is achieved by regions with capital cities (Közép-Magyarország, Mazowieckie).

The overall assessment of regions' innovation performance depends on the evaluation of sub-indicators. In Figure 2 we present the minimum, maximum and average indicator values in the regions of V4 in 2017.

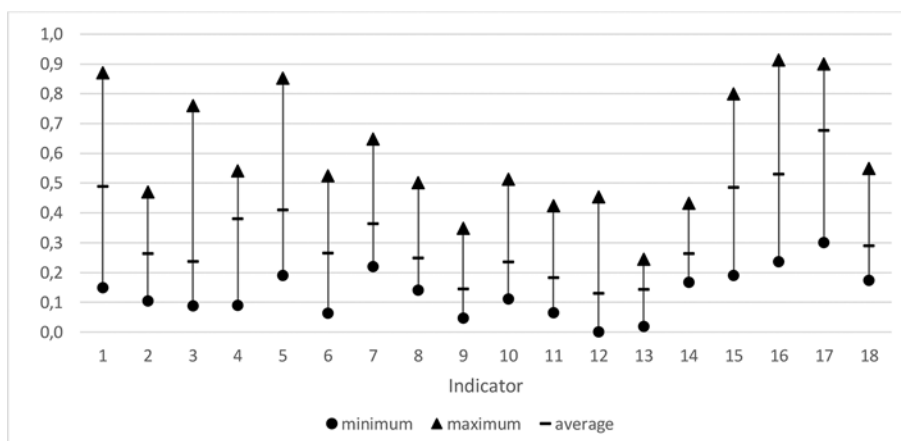


Figure 2: Comparison of minimum, maximum and average of RII indicators in V4 regions in 2017

In 2017 the best evaluation of V4 regions has been reached in indicators 16 (Employment medium and high-tech manufacturing & knowledge-intensive services), 17 (Exports medium and high-tech manufacturing), 1 (Population with tertiary education) and 5 (R&D expenditure public sector). The least successful are in indicators 13 (EPO patent applications), 9 (Marketing or organizational innovators), 14 (Trademark applications) and 2 (Lifelong learning).

The comparison of absolute differences (variation range) and relative differences (variation coefficient) within the RII indicators assessment in V4 regions is shown in Figure 3.

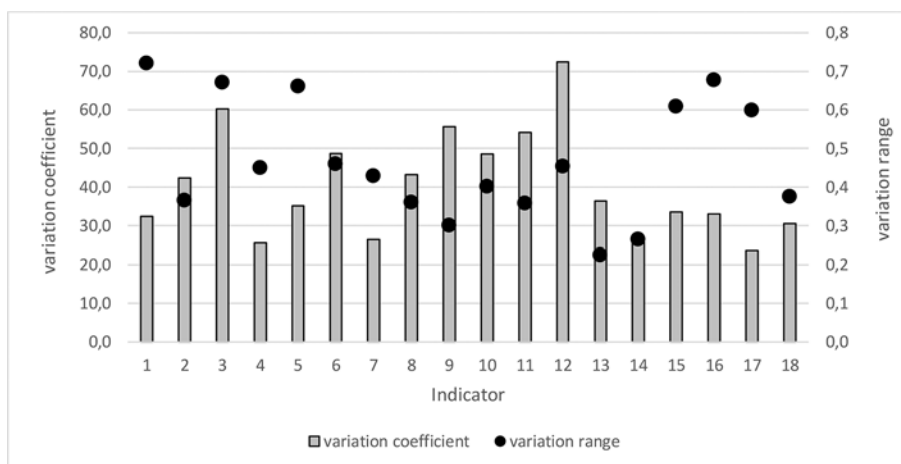


Figure 3: Differences in RII indicator assessment in V4 regions

The largest absolute differences between regions in V4 countries are in indicators 1 (Population with tertiary education), 16, 3, 5. The largest relative differences are in indicators 12 (Public-private co-publications), 3, 9 and 11 (more than 50%). The smallest absolute differences are in indicators 13 and 14, the smallest relative differences are in indicators 17 (Exports medium and high-tech manufacturing), 14 (Trademark applications), 4 (Most-cited publications) and 7 (Non-R&D innovation expenditures).

5. CONCLUSION

Innovations play a significant role in the social and economic development of countries and regions. They ensure the balanced economic growth of a state and region as well the growth of added value.

In this paper we have compared the innovation performance within the NUTS II regions in Visegrad Group countries. Our research has showed that the innovation performance in V4 countries is significantly below the average level of EU innovation performance (except for the regions of Praha and Bratislava). Regions with the capital cities have reached the highest innovation performance in Visegrad Group countries. Overall, Praha region had the highest innovation performance in 2011, in 2017 it was Bratislava region. The region of Bratislava appears to be very dominant in terms of innovation performance assessment in Slovakia. The lowest innovation performance has been achieved in the regions of Poland.

When it comes to the evaluation of individual indicators RII in 2017, the best evaluation of V4 regions has been reached in indicator Employment medium and high-tech manufacturing & knowledge-intensive services, the worst evaluation in EPO patent applications.

The largest relative differences in innovation performance between Visegrad Group regions (more than 54%) are in indicators: Public private co publications, International scientific co publications, SMEs with marketing or organizational innovations and Innovative SMEs collaborating with others. The smallest differences are in indicators: Exports of medium high/high-technology intensive manufacturing, Most cited scientific publications, Trademark applications, and Non R&D innovation expenditures.

As the innovation performance of V4 countries is at an insufficient level, an effective R&D policy and adequate innovation policy must be developed and implemented by particular governments, highlighting its regional dimension. In the same way Hajek, Henriques [4] stated that the regional innovation performance is an important indicator for decision-making regarding the implementation of policies intended to support innovation.

Similarly, Knošková and Dudeková [7], Haviernikova, et al. [8], Kordoš and Krajňáková [9] argue that high-quality research and development, functioning systemic innovation support and a functional intellectual property protection system are necessary issues for innovation to bring the economy the greatest benefits.

REFERENCES

- [1] Rylková, Ž. (2010) Innovation performance of regions, *NÁRODNÁ A REGIONÁLNA EKONOMIKA VIII*, Košice: Technical University of Košice, Faculty of Economics, pp. 847-855.
- [2] Pisár, P., Ďurčeková, I., Varga M. (2017) Competitiveness of companies and innovation performance of the regions, *Acta aerarii publici*, Vol. 14, No. 2 (2017), pp. 60-69.
- [3] Zabala-Iturriagagoitia J. M., Voigt P., Gutiérrez-Gracia A., Jiménez-Sáez F. (2007) Regional innovation systems: how to assess performance, *Regional Studies*, 41, pp. 661–672.
- [4] Hajek P, Henriques R (2017) Modelling innovation performance of European regions using multi-output neural networks, *PLoS ONE*, 12(10): e0185755, <https://doi.org/10.1371/journal.pone.0185755>.
- [5] Bednář, P., Halásková, M. (2018) Innovation performance and R&D expenditures in Western European regions: Divergence or convergence? *Journal of International Studies*, 11(1), 210-224, doi:10.14254/2071-8330.2018/11-1/16.
- [6] European Commission. (2017) Regional Innovation Scoreboard 2017, retrieved from <http://ec.europa.eu/docsroom/documents/23881>
- [7] Knošková, Ľ., Dudeková, A. (2015) Slovakia Innovation Performance in Context of European Union, *Studia commercialia Bratislavensia*, Vol. 8, No. 31 (3/2015), pp. 393-406.
- [8] Havierníková, K., Kordoš, M., Navickas, V. (2018) The motivation of Slovak small and medium entrepreneurs towards cluster cooperation, *Transformations in business & economics*, Vol.17, No.3, pp.91-101.
- [9] Kordoš, M., Krajňáková, E. (2018) Significance of innovation in Slovak regions - issues and challenges, *Ad alta-journal of interdisciplinary research*, Vol.8, No.1, pp.137-141.