

EVALUATION OF INNOVATION PERFORMANCE OF VISEGRAD COUNTRIES REGIONS PUTTING A STRESS ON HUMAN CAPITAL

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Abstract

Innovation is one of the major factors affecting the competitiveness of enterprises, regions and national economies. The effects of science, research and innovation at regional level increase the socio-economic growth of the regions and contribute to the removal of regional disparities. The European Union considers the growth of their innovation performance as a key factor in the overall development of the regions, which, with multiplier effects, is reflected in the socio-economic development of the regions. The aim of the article is to evaluate the innovation performance of regions of the Visegrad Group putting a stress on human capital. The basic method used in the processing of matter is descriptive statistics and quantitative comparative analysis. The survey will be carried out at the level of NUTS II regions. Data sources for problem processing are indicators internationally monitored through a regional innovation index, which is reported by the European Commission. Previous studies and assessments show that V4 countries are lagging behind European leaders in innovation performance; they belong to the group of "moderate innovators". In Visegrad Group countries, the highest innovation performance is reported by the capital regions.

Key words

Innovation, Innovation performance, Regional innovation index, Visegrad group countries.

JEL Classification: O15, O31, O30

Introduction

In modern new terminology the category of innovation belongs to relatively new categories and it emerged at the beginning of the 20th century in connection with the need for effective application of technological changes. Innovation is closely related to science and research and it express the practical implementation of an idea into reality, e.g. economically applied invention, while the human capital is playing an irreplaceable role in this process.

The aim of the article is to evaluate the innovation performance of regions of Visegrad Group with putting an emphasis on human capital.

Visegrad Group is the loose alliance of the Czech Republic, Hungary, Poland and Slovakia. It was formed in 1991. A favourable basis for intensive development of cooperation is ensured by the similar character of the significant changes occurring in these countries, their traditional, historically shaped system of mutual contacts, cultural and spiritual heritage and common roots of religious traditions. (Visegrad Declaration, 1991)

At NUTS II level Slovak Republic (SR) is divided to 4 NUTS II regions: Bratislavský kraj, Západné Slovensko, Stredné Slovensko a Východné Slovensko. 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.

1. Theoretical background to the assessed issue

The issue of innovation and innovation performance is widely developed in current literature. According to Freeman (1982), "innovation includes the technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of any new (or improved) process or equipment".

Lundvall (1992) states that innovations refer to the introduction of new products, services, or resources used to manufacture them to the market, launching new products and processes into the market, including the process of originating a creative idea leading up to its commercial use.

Innovation provides real benefits for us as citizens, consumers, and workers. It speeds up and improves

the way we conceive, develop, produce and access new products, industrial processes and services. It is the key not only to creating more jobs, building a greener society and improving quality of life, but also to maintaining our competitiveness on the global market (Kordoš, 2014).

Innovation in the global economy is the key for certain countries and regions. On the basis of innovative activity these may occur in all sectors of the national economy. Innovation activities can be defined as a two-step process where at first the creation and diffusion of knowledge occur and then this knowledge is transformed into innovation (Mura, Machová, Tóth, 2015).

Contemporary economic growth is based on the broadly-understood innovation. Increasing the level of innovation is one of the key challenges faced by societies of the 21st century. It determines the competitive position of countries, country alliances and the smallest regions forming the said alliances (Sipa, 2015).

The necessary presumption of innovation is human capital, its ability to develop, invent and use new, and more modern and more efficient technologies. The quality of human resources directly affects the emergence of knowledge and its application in the form of innovation. As stated Vojtovič and Karbach (2014), innovations are made by human ability to accumulate knowledge and on this basis to create new knowledge, which can be used to perfect production, its management and so on.

Decisive factor in the human capital is the scope of knowledge, or in other words the ability of an individual to transform gained knowledge into innovations – new machines, technologies, goods, services, organizational structures, systems and methods of management and so on. Innovations are the source of effectiveness and productivity and they condition the transformation of scientific knowledge into technological and managerial changes (Vojtovič, Krajňáková, 2014).

The relationship between innovation and human capital is reciprocal, innovation is not possible to be developed without human capital and, on the other hand, innovation is affecting the human capital development. As Porubčinová (2011) says, as a result of new technologies implementation, there is a fundamental shift in human capital, because innovation brings changes in the area of work skills, work organization and institutional relations between society and work.

Kianto, Sáenz and Aramburu (2017) stated that innovation in organizations is, first and foremost, a human issue. Since it is people who develop and implement ideas, innovation will depend on effective

human resource management. It will also depend on knowledge, since any innovation implies the development of new knowledge as both an input (e.g. new ideas, concepts, prototypes, etc.) and an outcome (i.e. the novelty produced).

Faggian, Partridge and Malecki (2017) argue that creativity, entrepreneurship and education are all part of a more broadly defined concept of human capital, which is the most essential production factor in knowledge societies.

Machová et al. (2015) emphasize that innovation is a key to the whole organization survival, based on knowledge, creativity and entrepreneurial feelings. Innovations are new combinations of existing knowledge. The innovation process to be successful, the expertise and skills in the industry are necessary.

We can conclude that human ability to gain knowledge and create innovations is a capital for production only under a condition if the knowledge and innovation have become the subject of buying and selling process and can be utilized in some other industries. Creativity of people as a human potential is not a sort of production capital and the base of new economy. Creativity becomes an industrial capital and lies in the core of new economy only if it is utilized in the process of innovations to be sold (Vojtovič, 2015).

Human capital is an important input in the generation and diffusion of innovative ideas. The development of innovative technological sectors can indirectly improve growth via its positive influence on human capital accumulation as much as human capital can as an important input into the generation and diffusion of innovative ideas (Alpaslan, Ali, 2017). Qualified human resources are essential in the process of knowledge creation and transfer being a prerequisite for the long-term sustainable growth.

2. The evaluation of innovation performance in the regions of Visegrad Group countries

Innovations play an important role in the socio-economic development of states and 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 (European Commission).

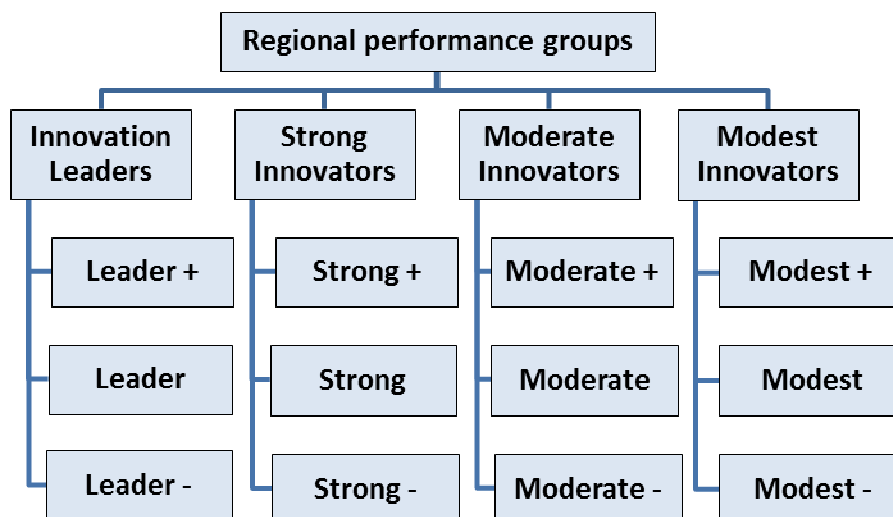
Average innovation performance is measured using composite indicators. The Regional Innovation Index summarizes the performance on 18 indicators: (1) Population having completed tertiary education, (2) Lifelong learning, (3) International scientific co-publications, (4) Most cited scientific publications, (5) R&D expenditures in the public sector, (6) R&D

expenditures in the business sector, (7) Non R&D innovation expenditures, (8) SMEs with product or process innovations, (9) SMEs with marketing or organisational innovations, (10) SMEs innovating in house, (11) Innovative SMEs collaborating with others, (12) Public private co publications, (13) EPO patent applications, (14) Trademark applications, (15) Design applications, (16) Employment in medium

high/high tech manufacturing and knowledge intensive services, (17) Exports of medium high/high technology intensive manufacturing, (18) Sales of new to market and new to firm innovations in SMEs.

Evaluated regions are grouped into four innovation performance groups (Figure 1) according to their performance on the Regional Innovation Index relative to that of the EU average.

Fig. 1. Innovation performance groups



Source: own processing

The innovation performance of regions in these groups is:

- Innovation Leaders: more than 20% above the EU average,
- Strong Innovators: between 90% and 120% of the EU average,
- Moderate Innovators: between 50% and 90% of the EU average,
- Modest Innovators: below 50% of the EU average.

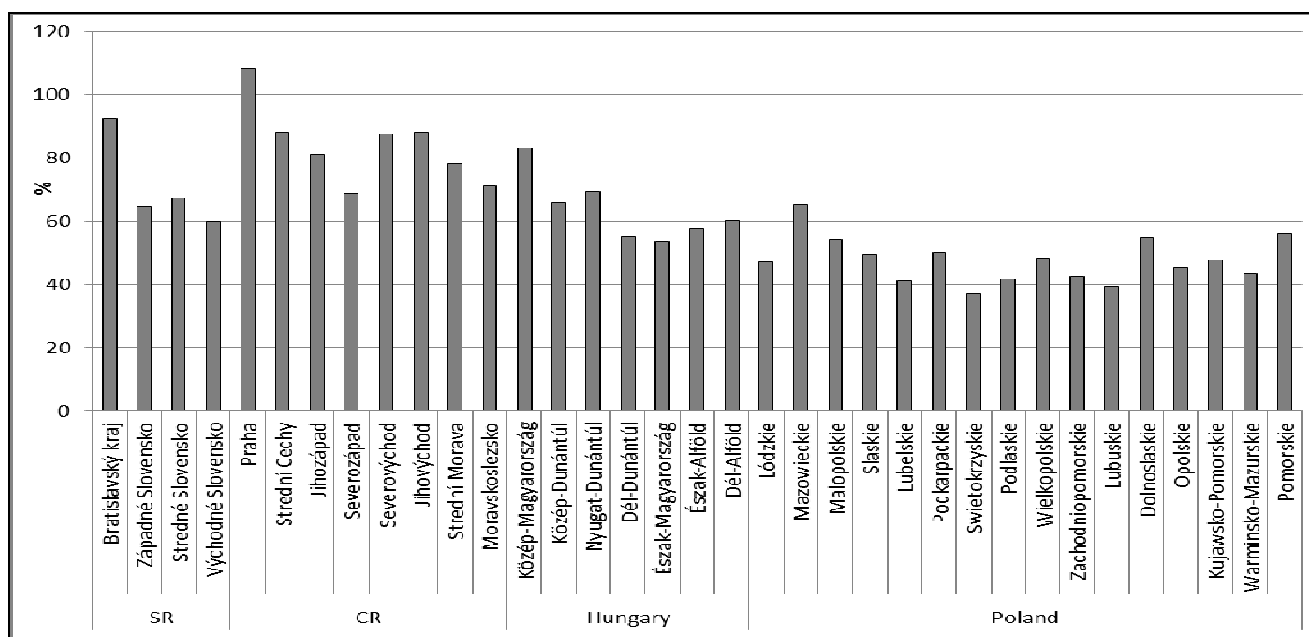
The most innovative regions will be Innovation Leaders +, and the least innovative regions will be Modest - Innovators.

2.1 Innovation performance in the regions of Visegrad Group countries in 2011

The first year of our research is 2011. This year is used by the European Commission as a starting year for the assessment of the region's innovation performance and the innovation performance of the regions in upcoming years is calculated to it. The innovation performance assessment of V4 countries' regions in 2011 through RII is shown in Graph 1.

When assessing the RII during 2011 it can be stated that among the V4 countries the highest innovation performance was achieved by the Czech region of Prague, with 108.3% of European average followed by, with a distance, Bratislava region (92.6%), as well as other Czech regions (South East, Northeast, Central Bohemia) and Hungarian region Közép-Magyarország. Poland's Swietokrzyskie and Lubuskie regions had the lowest innovation performance being below 40% of the EU average.

Graph 1. Innovation performance of V4 regions in 2011 (% to EU 2011)



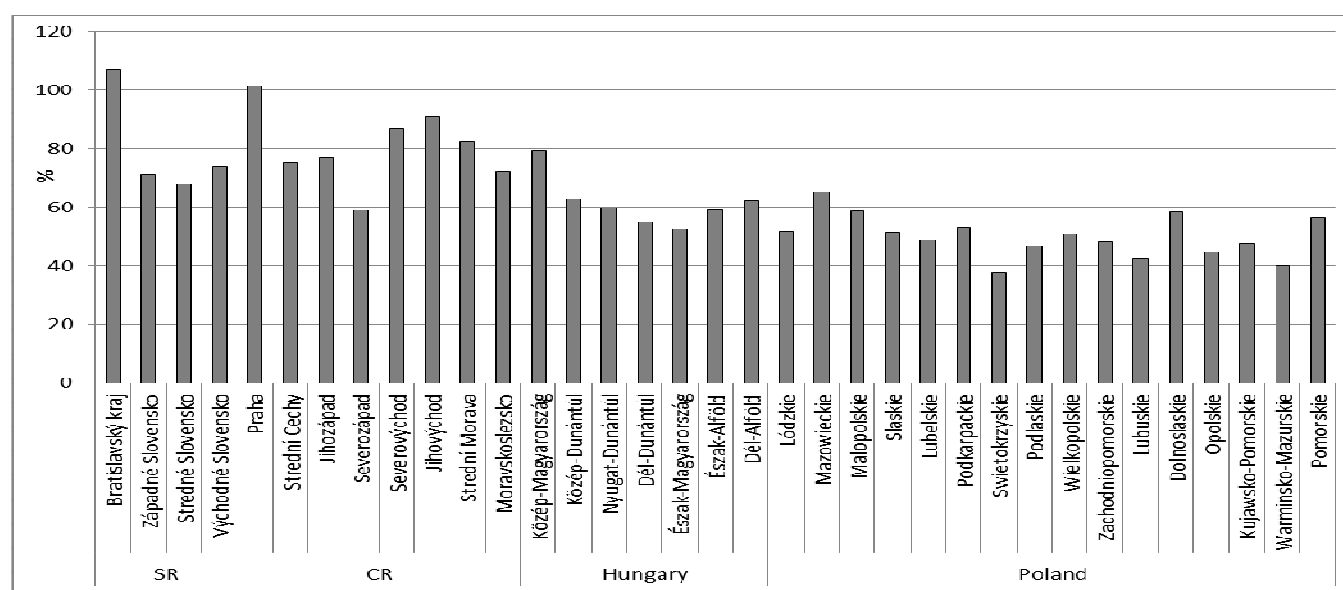
Source: own processing by European Commission. (2017b).

2.2 Innovation performance in the regions of Visegrad Group countries in 2017

The final year of our research is 2017. This year, the latest report assessing the innovation performance of regions was published. For the RIS 2017, most recent data refer to 2016 for one indicator, 2015 for six indicators, 2014 for nine indicators, and 2011 for two indicators. A reference to the most recent performance year (RII2017) in this report should thus be interpreted as referring to data about three years older than the 2017 reference year (RIS 2017).

The comparison of RII values in the regions of V4 countries is shown in Graph 2.

Graph 2. Innovation performance of V4 regions in 2017 (% to EU 2011)

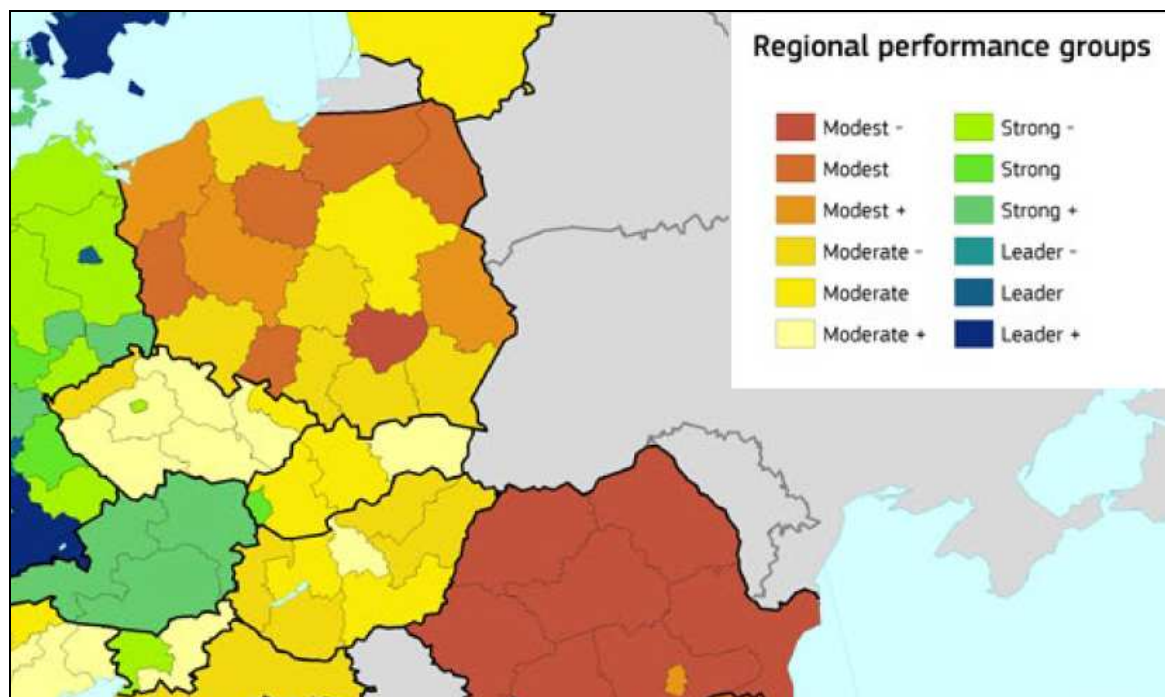


Source: own processing by European Commission. (2017b).

Graphical representation shows that Bratislava Region has the highest innovation performance in the last assessed year among the V4 countries, followed by Czech regions such as Southeast, Northeast and Central Moravia. Also from the other V4 countries, the highest innovation performance is shown by regions with capital cities: in Hungary Közép-

Magyarország and in Poland Mazowieckie. The regions of Bratislava and Prague are ranked among the Strong Innovators, other Slovak, Czech and Hungarian regions and some Polish regions are Moderate Innovators, nine regions in Poland are Modest Innovators (Figure 2).

Fig. 2. Map of innovation performance of V4 regions



Source: European Commission. (2017a).

The overall assessment of regions' innovation performance depends on the level of sub-indicators. When assessing the individual RII indicators during 2017 it can be concluded that the best evaluation of regions in V4 countries has been reached in indicators 17, 16, 15 and 1. On the other hand, the least successful are in the EPO indicator (European Patent Office) patent applications.

The differences in regional innovation performance of V4 countries within the individual indicators were evaluated by the variation coefficient. The largest differences between regions in V4 countries are in indicators 12, 3, 9 and 11 (more than 50%). The smallest differences are in indicators 17, 14, 4 and 7.

In terms of innovative performance, we focus on indicators taking into account the level of human capital - 1 and 2.

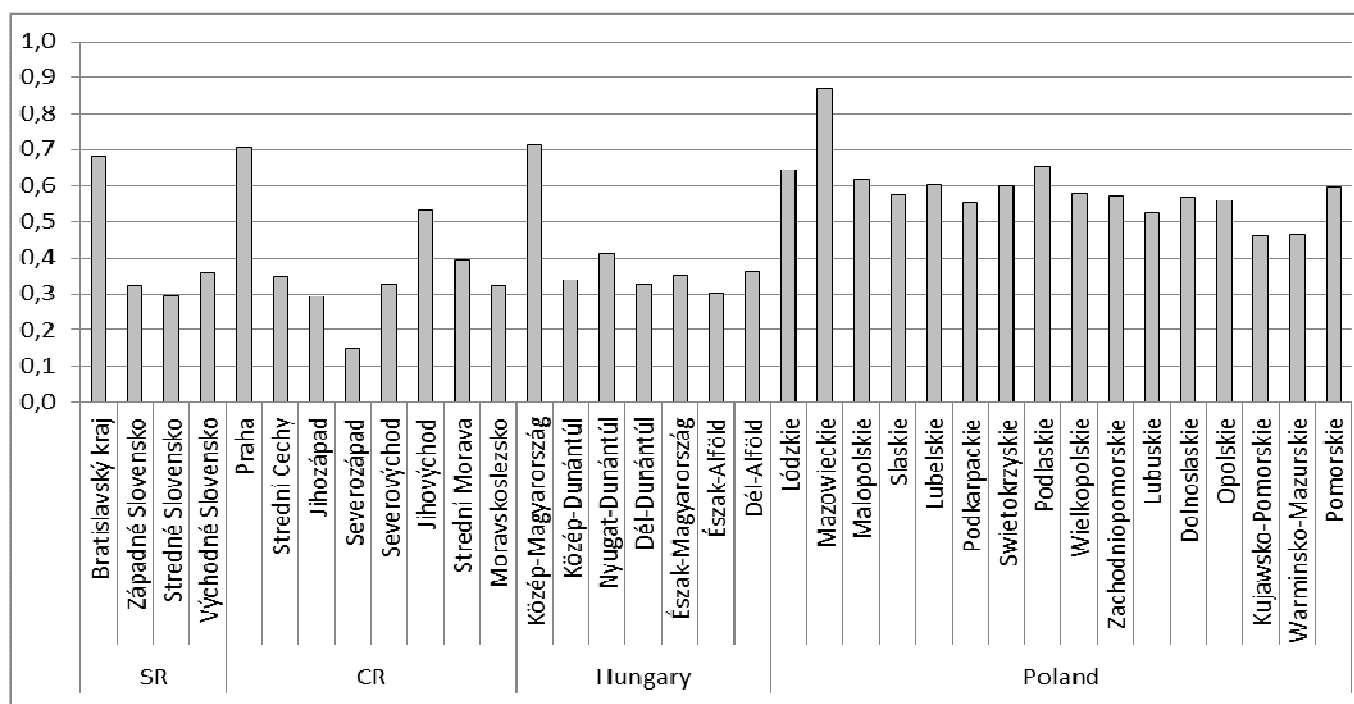
1. Population having completed tertiary education - Percentage population aged 30-34 having

completed tertiary education (number of persons in age class with some form of post-secondary education/total population between 30 and 34 years)

2. Lifelong learning - Percentage population aged 25-64 participating in lifelong learning (number of persons in private households aged between 25 and 64 years who have participated in the four weeks preceding the interview, in any education or training, whether or not relevant to the respondent's current or possible future job/Total population aged between 25 and 64 years) (RIS 2017).

The executed evaluation of V4 countries' regions in indicators 1 and 2 is shown in Graphs 3 and 4.

Graph 3. Evaluation of Indicator "Population with tertiary education" in V4 regions

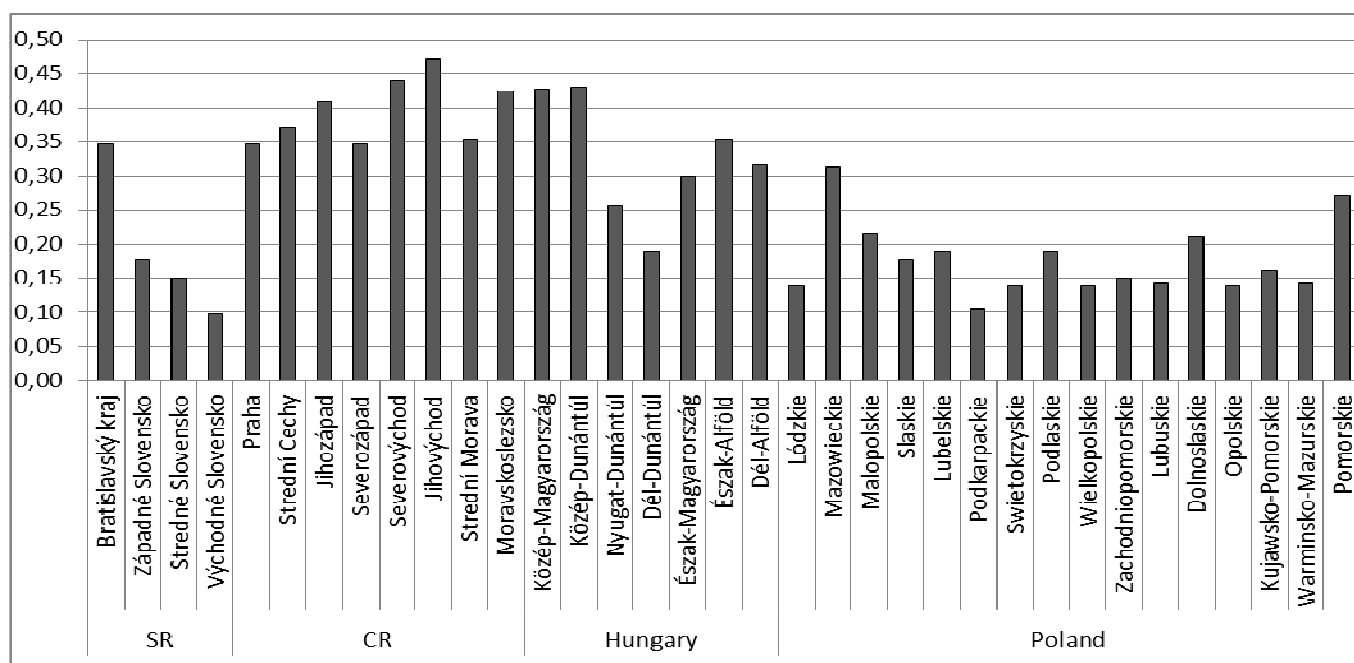


Source: own processing by European Commission. (2017b).

In indicator 1 - Population with tertiary education, the best values has been reached by Polish regions, especially the Mazowieckie region, with the highest score of 0.871 followed by three regions with similar

ratings, around 0.700: Közép-Magyarország, Prague and Bratislava Regions. The Czech North-West region has reached significantly lowest assessment in this indicator.

Graph 4. Evaluation of Indicator "Lifelong Learning" in V4 regions



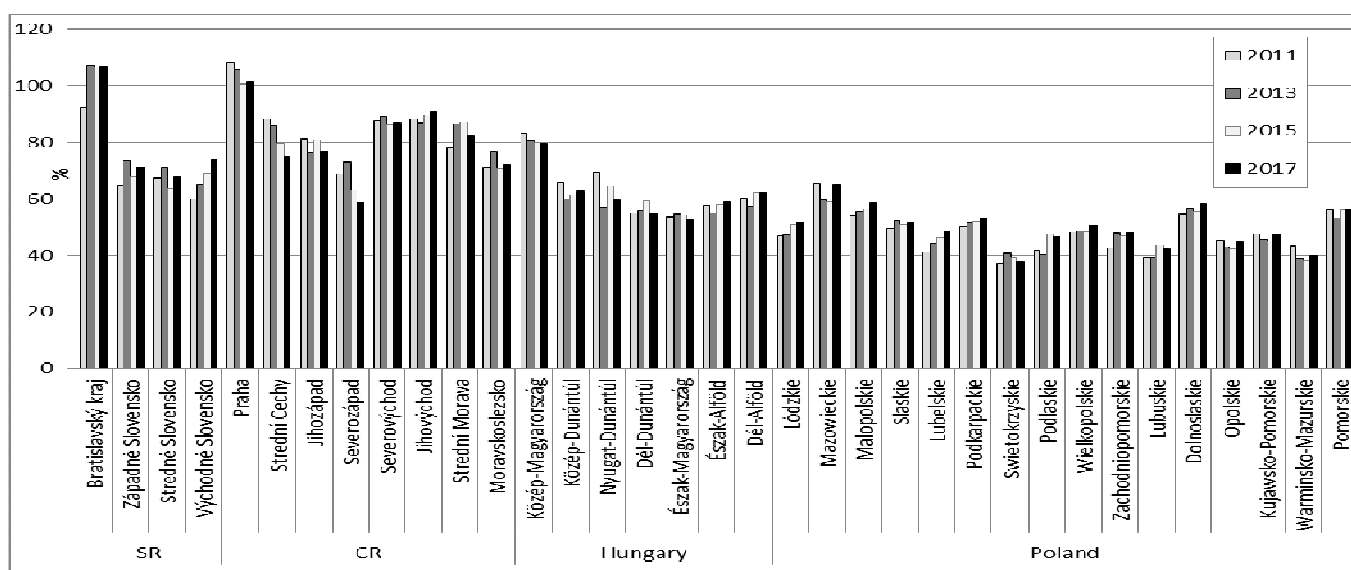
Source: own processing by European Commission. (2017b).

In Indicator 2 - Lifelong Learning, the best assessment has been achieved by Czech and Hungarian regions. The highest ranking has been achieved by South East Region (0.471), followed by Northeast, Közép-Dunántúl, Közép-Magyarország, Moravia-Silesia and the Southwest. At the bottom of the chart there are regions of Eastern Slovakia and Podkarpackie (rating around 0.10).

2.3 Comparison of innovation performance in the regions of Visegrad Group countries

The innovation performance of regions depends on reported indicators showing irregular fluctuations, which affects the overall assessment of individual regions in particular years. In Graph 5, we compare the regional innovation performance in V4 countries in 2011, 2013, 2015 and 2017, as reported by European Commission in the RIS 2017 report.

Graph 5. The comparison of innovation performance in the regions of V4 countries (%)



Source: own processing by European Commission. (2017b).

Based on Graph 5, it can be stated that the development of innovation performance in individual regions in V4 countries is uneven. The innovative performance of Bratislava region has increased significantly since 2013 compared to 2011 and similar developments are in other Slovak regions. In contrast, in Czech Republic, the innovation performance of most regions is decreasing (apart from the Southeast). In some Hungarian regions, their innovation performance is also declining, with the exception of Észak-Alföld and Dél-Alföld. In Poland, innovation performance is increasing in most regions with fluctuating tendency, but the Warmińsko-Mazurskie region is getting worse.

Generally speaking, the highest innovation performance is achieved in the regions of Czech Republic and Bratislava Region, the lowest innovation performance has been achieved in the regions of Poland.

Conclusion

The innovation performance of regions in V4 countries is a result of regional innovation policy executed by governments, as well as other determinants operating in region, such as the drawing of EU funds for scientific research projects, quality, concentration of educational institutions, the use of human capital, etc.

As we can see from the findings above, the best values in innovation performance within the V4 countries are shown in Bratislava region and Prague region, where the scientific potential of regions is concentrated and its assessment is reflected in the results. The region of Bratislava had the highest growth rate in this indicator. Also in other V4 countries the highest innovating performance can be found in regions with capital cities: in Hungary Közép-Magyarország and in Poland Mazowieckie. It should be noted that none of the regions in Poland and Hungary has exceeded the regions in SR and CR by their values.

Scientific research potential and its appreciation depend to a large extent on the quality of human resources operating in the region. Innovation and technological advancement of economy are created by human beings and their ability to accumulate knowledge and further implement it to create new knowledge to be used in improving manufacturing efficiency, (Vojtovič, Krajňáková, 2014)

The results show that in the indicator of Population with tertiary education that the best results has been achieved in Mazowieckie region in Poland, and in the rest of the countries they are again the regions with capital cities. In the Lifelong Learning indicator the best results have been achieved in Northeast region in

Czech Republic, on the other hand, the worst results are in Eastern Slovakia and Podkarpackie regions. In the results we have found in the assessed issue: innovation performance and the level of human capital usage in the regions of V4 countries, we see the persistent and widening regional discrepancies.

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