ENTRE 2018
Conference Proceedings
12-14 September 2018
Kraków, Poland

Evaluation of selected determinants of innovation potential at NUTS 2 level in V4 countries

Ján Huňady [A], Erika Ľapinová [B], Peter Pisár [C]
[A] University of Mateja Bela in Banska Bystrica, Slovakia, jan.hunady@umb.sk
[B] University of Mateja Bela in Banska Bystrica, Slovakia, erika.lapinova@umb.sk
[C] University of Mateja Bela in Banska Bystrica, Slovakia, peter.pisar@umb.sk

Abstract

The main aim of our paper is to assess the innovation potential of NUTS 2 regions in Slovakia and compare them with other regions in V4 countries. We synthesize the existing theoretical and methodological knowledge on this issue. Pointing to some empirical research in this field and using this knowledge to apply the existing measurement methodology of regional innovation potential, while complementing it with our own method on example of V4 region. In the analytical part of contribution we apply selected indicators of regional innovation potential to measure it in V4 countries´ NUTS II regions, to compare and sort NUTS II regions in V4 countries due this potential. In the theoretical part of our contribution we systematize the findings of measuring regional innovation potential and its specificities. In the analytical part we work with data of selected European regions Then we use the factor analysis method to extract one factor of the regional innovation potential. The second approach used in the analytical part is ranking of regions on the basis of own built innovation potential index. There exist a broad range of quantitative and qualitative methods to evaluate the innovative potential of regions. We used selected quantitative indicators. In current regional theories higher importance is put to better understanding of functioning of the innovative process at the regional level. That group of innovations de-

terminants are the result of the networking and relations between actors. Synthesis and critical assessment of existing approaches to measuring the innovation potential at the regional level. Application of selected measurement methods on a practical example. Usage of own approach – creation and application of own index of innovation potential at NUTS 2 level in the V4 countries.

Keywords: Innovation potential; regions NUTS 2; Visegrad countries; ranking; determinants; factors; innovation

JEL codes: R11, O30, I23

INTRODUCTION

Innovation are becoming still more important and gaining more attention in the light of the effort to increase economic growth and competitiveness. Innovation is one of the driving forces of increasing labour productivity in the business and public sector. Innovation potential of the region could therefore be crucial for its future economic development. Regions with high innovation performance achieved higher economic growth, greater international competitiveness and ultimately a superior standard of living of the regions (Acs et al., 2013). Innovation potential into certain extent determines intensity of innovation performance as well as its impact on regional economy.

With the paper we aim to contribute to the knowledge with the measuring of the innovation potential at the regional level (NUTS II). We synthesize the existing theoretical and methodological knowledge on this issue, pointing to some empirical research in this field and using the knowledge to apply it in developing own method of measurement. We applied this approach on regional data from Visegrad countries. Moreover, our intention is to highlight the specifics of measuring innovation potential at regional level compared to the national level. In the analytical part we apply selected indicators of regional innovation potential in V4 countries´ NUTS II regions. We also compare and sort NUTS II regions in V4 countries based on the level of innovation potential.

We assess the innovation potential of NUTS 2 regions in Slovakia and compare them with other regions in V4 countries. We use the factor analysis to reduce dimensions and determine one critical factor estimating regional innovation potential. The second approach used in the analysis comprise developing own innovation potential index based on selected indicators.

In the next section of paper we describe our methodology and data in more detail. Theoretical background and results of previous studies are introduced in literature review section. Further we shown the most important results of our analysis and discuss them shortly. In the conclusion section we summarise results and make some implications.

MATERIAL AND METHODS

As stated before, the main aim of our paper is to assess the innovation potential of NUTS 2 regions in Slovakia and compare them with other regions in V4 countries (Czech Republic, Hungary and Poland). In order to fulfil this aim we decided use two different approaches. Both of them are based on the same dataset. Based on theoretical assumptions as well as data availability we choose set of eight variables that could be crucial for innovation poten-

tial of the region. All variables used in the analysis are described in more detail in Table 1. We selected internet access and accessibility to motorways as proxies for quality of infrastructure in the region. R&D expenditure and scientific publications are both capturing the research and development environment in the region. Human capital has been proxied by the share of inhabitants with tertiary education. We also take into account the quality of regional institutions and situation at the labour market. We believe that all these variables are importnant pieces of the puzzle with respect to innovation potential. Despite the fact that there are of course several other potential factors, we can say that regions with better infrastructure, more R&D activities, better educated people, better institutions and lower unemployment could be seen as those with higher innovation potential. In the first stage we used factor analysis in order to create one single variable that includes the major part of variability from each of eight mentioned variables. When using factor analysis we preselected the number of factors gained by analysis to one. This allows us to have only one variable and make easier comparison of regions based on comprehensive indicator, which capture the overall innovation potential of each NUTS 2 region.. Based on this indicator we further compared all NBUTS 2 regions in V4 countries.

Table 1. List of indicators/variables used in the analysis

Dimension of innovation potential	Indicator (proxy)	Description of the indicator	Source
Infrastructure	Internet access	Share of households in the region that have access to the Internet (%)	Eurostat Regional Information Society Statistics
	Access to motorways	Index of motorway accessibility for the population of the region (EU average = 100)	European commission based on Spiekermann & Wegener (2016)
Research and development	Total R&D expenditure	Total intramural expenditure on research and development in the region (% of GDP)	Eurostat database
	Scientific publications	Number of scientific publications registered in the Scopus database per million inhabitants of the region	ScienceMetrix (Scopus)
Human capital	Higher education	Share of population with university education (% of active population)	Eurostat (htec_kia_emp and htec_kia_emp2)
Institutions	Quality of regional public services	European Quality of Institutions Index - Indicator of public service quality. It is calculated on the basis of the regional government quality sub-index and national quality indicators of public administration.	European Commission - European Quality of Institutions Index
Labour market	Share of employees in services	Share of employees in services (% of all employed population of the region)	Eurostat database
	Total employment (except agriculture)	Employment rate of the population aged 15-65 in the NUTS 2 region (except agriculture)	Eurostat database

Source: own study.

Secondly, we also used different approach how to get one comparable indicator capturing all selected dimensions. This time we construct sub-indexes for each of eight variables. Each variable was first normalized by z-score and subsequently transformed into an index. The base value of the sub-indices is equal to 100, which is the median value of the variable calculated from all NUTS 2 regions in the EU. Subsequently, according to base value we also calculated the individual sub-indices for each region. Finally, we used non-weighted arithmetic average of sub-indexes, which represents one comprehensive index capturing the innovation potential of the region.

With respect to the main aim and theoretical assumptions we develop three main research hypotheses as follows:

H1: The innovation potential of metropolitan regions containing capital city is the highest from all regions in every Visegrad countries.

H2: Regions of Czech Republic are leading ones from Visegrad countries with respect to innovation potential.

H3: Ranking of regions based on selected two approaches are highly positively correlated together.

Due to agglomeration forces and accumulation of human capital as well as better potential in infrastructure there is a reason to believe that metropolitan regions with capital cities have higher innovation potential. Moreover, we assume that Czech regions could be in general better. This is due to better rating of innovation performance at national level. Finally, we assume that both types of methodologies used in the analysis should give similar results due to the same variables and data used in both cases.

LITERATURE REVIEW AND THEORY DEVELOPMENT

Rapid technological development brings about a change in the organization of economic activities, resulting in disintegration of production and localization of production. As a result of these changes, it is no longer possible to talk about a competitive advantage by reducing costs, but above all, the competitive advantage is manifested by the ability to innovate, bring new ideas and implement them. This ability is basis of the economic and innovative potential of cities and regions. We understand the innovation potential of the regions in accordance with the definition of Pokorný et al. (2008) as "the capacity of the region to use its own internal resources efficiently, flexibly respond to external development stimuli, create and develop activities with higher added value, and thereby obtain new, hierarchical higher quality".

The basis of the development and innovation potential is knowledge and knowledge, yet in the practice of Slovak regions still play a significant role - often exclusive - the traditional economic factors of regional development: capital investments, industrial zones, investment incentives, transport position, infrastructure, the position of municipalities in the settlement system.

Among other things, it is also necessary to talk about the multi-factor-conditional innovation and development potential of the regions. It is also possible to speak of the endogenous potential, where the resulting co-ordination of the above factors depends also on the inner environment of the region, conditioned, among other things, by the effective interaction of the region, the atmosphere, the ethics of work, self-confidence

and mutual trust. The authors of this methodological guide further distinguish the methodological specifications for different geographic ranging levels in terms of methodology and spectrum of innovation indicators.

The concept of innovation often associates innovation - enterprise innovation, innovation in the private sector. Innovation, however, is not only a domain of private or public academic institutions (university start-ups), with governments (national, regional or local) not only acting as intermediary and facilitator of innovative initiatives, providing technical, financial and other support, or an administratively favorable environment for innovation, but public governments and institutions themselves are actors (developers, disseminators or innovation implementers)

We will understand innovation in a broader sense and context. We will talk about so-called social innovation (see also Nemec et al., 2016; Bekkers et al., 2013).

There exist a broad range of quantitative and qualitative methods to evaluate the innovative potential of regions. Glebova and Kotenkova (2014) analyzed the regional innovation potential, using proposals of Alexeev (2009). Glebova and Kotenkova (2014) report following system of five regional innovation potential indexes groups with indexes mentioned in the Table 2.

Table 2. System of Regional Innovation Potential Evaluation Indexes

Index Groups	Indexes	Notation
Scientific Potential Indexes (SP)	1. Share of Personnel Number Involved in Research and Development in a Number of Those Involved in the Economy	S1
	2. Ratio of the Researchers with Academic Degrees (Doctors, Graduate Students) to a Number of Those Involved in the Economy	S2
Personnel Potential Indexes (PP)	1. Share of Higher Education Employees in a Number of Those Involved in the Economy	P1
	2. Ratio of a Number of University Students to a Number of Those Involved in the Economy	P2
Technological Potential Indexes (TP)	1. Fixed Asset Useful Life Factor	T1
	2. Fixed Asset Renewal Factor	T2
	3. Capital/Labour Ratio	T3
Financial and Economic Potential Indexes (FEP)	1. Ratio of Capital Investment Amount to GRP	E1
	2. Ratio of Domestic Research and Development Costs to GRP	E2
	3. Ratio of Innovation Goods, Works and Services Scope to the Total Scope of Goods Unloaded, Works Performed and Services Rendered	E3
Indexes of Information and Communication Component (IT)	1. Share of Organizations Which Used the Internet in a Total Number of Organizations Which Used ICT	I1
	2. Ratio of ICT to GRP Costs	I2
	3. Number of Personal Computers per 100 Employees	I3
	4. Share of Organization Which Have Its Own Web-Site in a Total Number of Organizations	I4

Source: (Glebova & Kotenkova, 2014).

Creation of regional innovation potential in current regional theories is seen like a complex / a system of actors and relationships between them. According to Nauwelaers

and Reid (1995) „main trends in methodological approaches to the evaluation of regional innovative potential in the European Union are discussed, pointing to the necessity of moving progressively towards a methodology taking into account interactions, both locally and externally, between the various components and actors of the innovation process“.

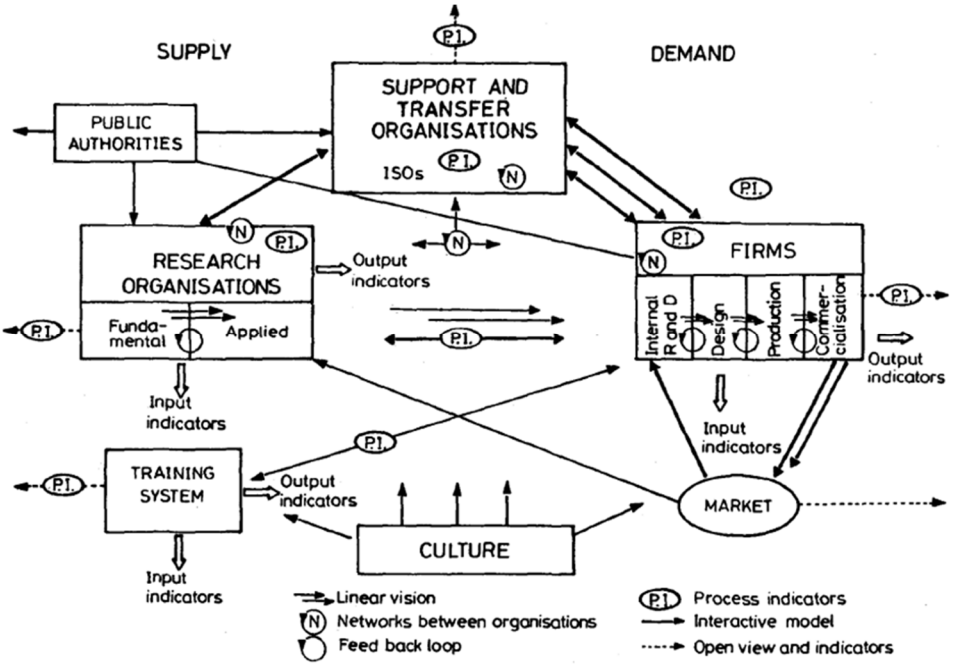

Figure 1. Regional system of innovation: linear and interactive views
Source: Nauwelaers, C. & Reid, A. 1995.

There exists a broad range of methodologies to evaluate the innovative potential of regions. It is not easy to use only quantitative analysis and quantitative indicators, higher importance is needed to better understanding of functioning of the innovative process at the regional level. European Commission within the European Innovation Monitoring System (EIMS) provides a "horizontal" dimension allowing policy research results to be turned into tools for those with responsibility for implementing practical programmes. This project involved a horizontal inventory and critical analysis of existing studies on the measurement and evaluation of regional technological innovation services and infrastructure, innovative networks and other aspects of the regional innovative potential.

Nauwelaers and Reid (1995) before reviewing the main trends in methodological approaches for evaluation of regional innovative capacities, they provide a conceptual representation of innovation dynamics at the regional level. The importance of this regional innovation process they consider as a key factor, more important, than merely listing the various determinants and indicators of regional innovation capacities and infrastructure.

The authors further mention a shifting accent from the single act philosophy of technological innovation to the social process underlying economically oriented technical novelty. This approach for example, among other things underlines the importance of

organisational capacities and networks of innovation in promoting regional economic and technological development. They are qualitative indicators or factors, which are difficult measurable, unique to some regions and to actors operating within.

In the last decade or so, a fundamental break has occurred with the previously dominant model of the linear research-to-market model. The influence of other institutions or factors such as market demand or education systems were acknowledged without particular attention being paid to the interactions between the various actors. Quality of public institution in the region appears to play important role with respect to innovation. Rodríguez-Pose, A., & Di Cataldo, M. (2014) using robust econometric techniques found that there is a strong link between the quality of government and the capacity of regions to innovate. Furthermore, Buesa et al. (2010) also argue that poublic administration and univeristies are very significant factors affecting the level of innovation in the regions (Buesa, M., Heijs, J., & Baumert, 2010). It is also found that regions dominated by large establishments tend to be less efficient than regions with a lower average establishment size. (Fritsch, M., & Slavtchev, V, 2011).

Maťáková and Stejskal (2011) speak of the following important actors in the innovation processes in the regions: 1. enterprises, 2. supportive enterprises and auxiliary enterprises, 3. environment and infrastructure. Maťákova and Stejskal (2011) also include the legal framework, strategic documents, "animators" of cluster initiatives, initiatives (public and private), hard and soft infrastructure (physical, technological, knowledge). At the same time, they stress that the system as such, without working relationships and coordination, is not a guarantee for the region's innovation or competitiveness. These are collaborative relationships, networking on a regional basis, but also clustering and specialization as key growth and competitiveness (Šipikal & Pisár, 2017).

Measuring the innovation potential is relatively demanding, resp. it is rather a complex of factors - prerequisites for supporting innovative activities in the region. These factors may exist in the region, but their interactions, the above-mentioned interactions and relationships may not be so intense. They are not measurable, so it is necessary to use qualitative analysis methods with aim to identify the nature and intensity of these interactions that are unique at a given time and place.

The above-mentioned elements of an innovation system of regions cannot be measured. It is a qualitative relationship, but there exist elements of an institutional system in the regions that can be tracked at least partially using quantitative analyzes. These institutional aspects of shaping and promoting regional innovation potential include strategies, policies, public support, public system. Among main methods supporting the regional innovation-driven development they mentioned:

1. the direct and indirect (through the government agencies) government funding of the research institutions and universities in the form of budget financing the operating costs, as well as allocating the targeted grants and placing the state orders for carrying out the research and development;
2. investing the budget funds in the capital of venture funds and other specialized financial institution involved in implementing the innovative projects;
3. financing the business incubators, industrial parks and other infrastructure objects of the innovation activity;
4. encouraging the organizations focused on the innovation activity;

5. providing such organizations with various tax benefits (tax credits, a deferment of taxes, accelerated equipment depreciation, multiplying coefficients, which allow reducing the base for calculating the profit tax);
6. the loan and guarantee support for the small and medium-sized innovation business (low or even zero interest rates, long-term maturities, minimum requirements for securing the obligations).

The intensity of this public support is quantifiable and can therefore be traced back to quantitative analysis of regional innovation potential.

RESULTS

First of all, we compare selected indicators among regions of V4 countries in order to find out the leaders and followers in selected dimensions of innovation potential. With respect to infrastructure we compare the access to internet and motorways in all NUTS 2 regions. As we can seen in Figure 2, there are rather small regional differences in internet accessibility. On the other hand, regional differences in accessibility of motorways are significant. Two Czech regions are leaders in internet accessibility together with metropolitan region of Hungary. However, the metropolitan region of Slovakia - Bratislavský kraj, is best performing region in accessibility of motorways. Especially some regions from Poland and Slovakia are significantly lagging behind in terms of motorway availability.

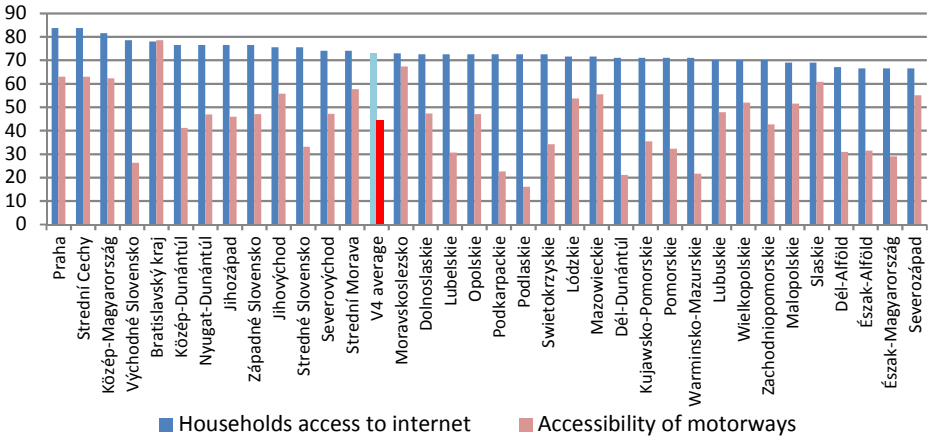

Figure 2. Internet access and access to motorways in NUTS2 regions of V4 countries
Source: own elaboration.

Next, we focus can be seen in Figure 3 and Figure 4. The order of regions is different in each case, our attention on tertiary education and R&D expenditures. The comparisons of these indicators but the best performing regions are mostly the same. All four metropolitan regions with capital cities (Bratislavský kraj, Praha, Közép-Magyarország and Mazowieckie) are performing significantly over the average in both indicators. Perhaps rather surprisingly, Czech region Jihovýchod is the leading one in total R&D expenditure.

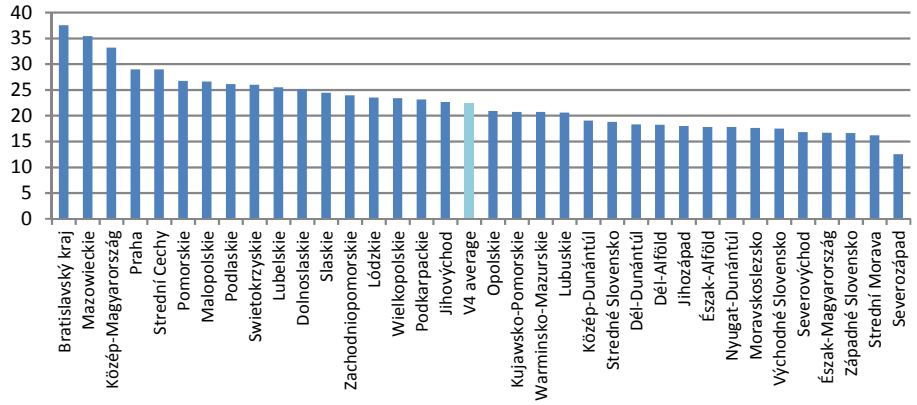

Figure 3. Share of population with tertiary education in NUTS 2 of V4 countries
Source: own elaboration.

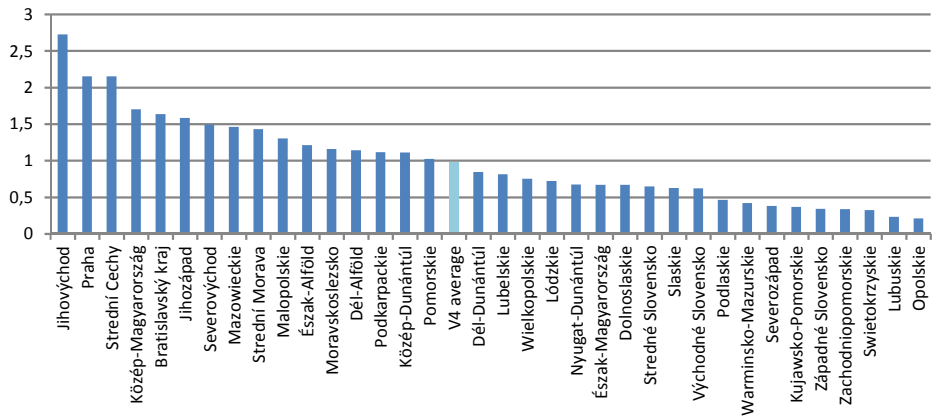

Figure 4. Total intramural R&D expenditure (%GDP) in NUTS 2 of V4 countries
Source: own elaboration.

In order to compare all regions based on one comprehensive indicator we used two different approaches. Firstly we used factor analysis. We apply the factor analysis to the eight indicators we have listed. Using factor analysis, we can reveal latent or hidden factors captured in the data. In our case we want to extract only one factor variable. We assume that in this case we can label this latent variable as a factor of the region's innovative potential. Using factor analysis, we reduce the number of dimensions from eight to one while retaining a significant share of variability captured in all eight variables. We used factor analysis based on the main component approach, which is the most common approach. In order to get as simple result as possible we decided to reduce number of factors to one only, despite the fact that two factor will allow us to capture more variability. Results of eigenvalues and percentage of captured variance are shown in Table 3.

Table 3. Components of extracted factor – innovation potential

	Initial Eigenvalues		
	Total	**% of Variance**	**Cumulative %**
1	4,234	52,931	52,931
2	1,444	18,055	70,986
3	,992	12,406	83,392
4	,605	7,568	90,960
5	,457	5,711	96,671
6	,151	1,887	98,558
7	,115	1,442	100,000

Source: own study.

As can be seen in Table 4, the latent variable (or factor), which was extracted based on factor analysis, correlates to a large extent with most of the monitored indicators. The variability of the seven variables is captured to a large extent in one created variable. The exception is the proportion of employees working in services. This variability of this indicator is not captured in the factor. These results may also indicate that this indicator is not entirely appropriately chosen for explaining the region's innovation potential.

Table 4. Components of extracted factor – innovation potential

Component	**Correlation with the component**
Internet access	0,890
Total employment (except agriculture)	0,840
Quality of regional public services	0,808
Higher education	0,742
Scientific publications	0,703
Total R&D expenditure	0,698
Access to motorways	0,671
Share of employees in services	0,091

Source: own study.

We assign to each NUTS 2 region in EU28 the factor scores, which are based on the values of the created factor. According to values of factor score, regions can be ranked. This could also represent innovation potential of the region accessed based on selected indicators. The higher the factor score, the higher the region is rated for its innovation potential. Factor score values for all V4 regions as well as their successive ranking are presented in Figure 5.

Regions Bratislavský kraj, Praha and Střední Čechy appears to be those with the highest innovation potential according to this approach. Positive scores have also been achieved in Czech region Jihovýchod, while other regions have a negative score.

The second approach we used to build a ranking of regions according to their innovation potential is creating the comprehensive index. This index of innovation potential was created on the basis of the same eight indicators. Firstly, we normalized these variables by z-score and subsequently transformed them into an index. The base value of the sub-indices was equal to 100 for each indicator. This value represents the median value of all NUTS 2 regions in the EU. Subsequently, the values of sub-indices are derived from

this value. The index of innovation potential was subsequently calculated as the unweighted arithmetic average of all eight sub-indices. Values were calculated for all NUTS 2 regions in the EU. In Figure 6, we can see the values of the index for V4 countries.

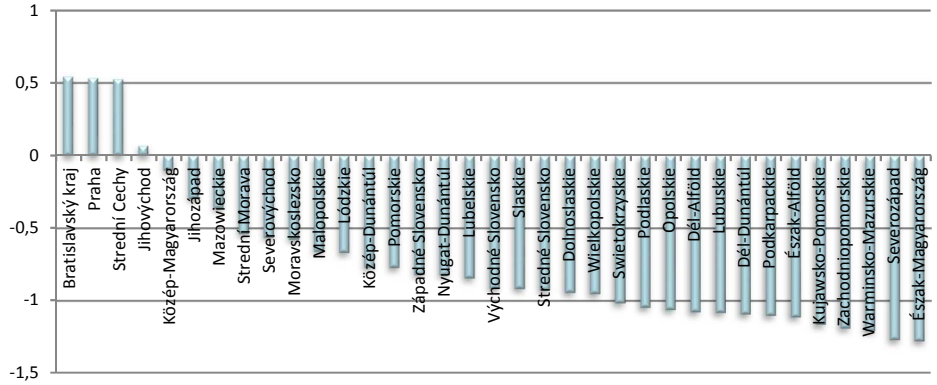

Figure 5. Ranking of regions in V4 countries according to innovation potential based on factor score
Source: own elaboration.

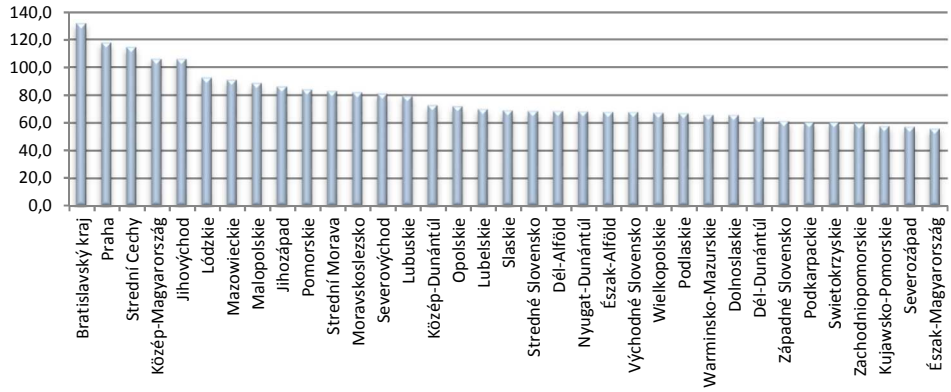

Figure 6. Ranking of regions in V4 countries according to overall innovation potential index
Source: own elaboration.

As it can been seen on both figures results are into some extent similar. Both rankings are comparable. Again we can see that the Bratislavský kraj, Praha and Strední Čechy are three regions with the highest innovation potential. The order of the first three regions as well as the last two regions remains the same as before. The Közép-Magyarország and Southeast regions changed their rankings from the fourth to fifth place and vice-versa. Nevertheless, the order of several regions is different. With respect to regions of Slovakia, in this case the results were slightly different and the second highest value of the index was achieved by region Stredné Slovensko.

As it can been seen on both figures results are into some extent similar and comparable. In order to test this similarity we also calculate Pearson correlation coefficient of values and Spearman correlation coefficient of both rankings. Results are shown in Table 5.

Table 5. Correlation between results obtained by both approaches

Correlation between values and rankings obtained by factor analysis and construction of innovation potential index		
Pearson correlation coefficient - values	0.948	Very strong positive correlation
Spearman correlation coefficient – rankings	0.879	Very strong positive correlation

Source: own study.

As we can see there appears to be a strong positive correlation between results obtained by two different approaches. This is true for values as well as for rankings.

The results both methods for regions in Slovakia, together with the overall ranking of these regions within the EU, are shown in Table 6.

Table 6. Ranking of Slovakian regions according to innovation potential within the EU28 regions

	Factor score value	Ranking within all EU 28 (NUTS2) regions	Value of created index	Ranking within all EU 28 (NUTS2) regions
Bratislavský kraj	0.542	86. /268	131.3	76./268
Západné Slovensko	-0.821	202. /268	60.9	232./268
Stredné Slovensko	-0.926	209. /268	68.2	214./268
Východné Slovensko	-0.916	212./268	67.3	219./268

Source: own study.

Metropolitan region of Bratislava dominated in V4 regions in the case of both methodologies. However, this region is still only at 86th or 76th place respectively among all regions in EU 28. Thus in general, we can say that innovation potential in the regions of V4 countries are still mostly lagging behind the best performing regions in the EU 28.

Based on our results we can make certain conclusions regarding to our research hypothesis introduced in the methodology section. Firstly our findings support the assumption that innovation potential of metropolitan regions containing capital city is the highest from all regions in every Visegrad countries. There is only one exception from these rules. Hence, region Lodzkie in Poland is outperforming metropolitan region of Warszawa by small margin when using second approach (index). Regions from Czech Republic Secondly, Regions of Czech Republic are mostly ranked in the first half of the ranking. However, there is at least one exception. Czech region Severozapad is significantly lagging behind other Czech regions and achieves one of the worst results of all regions.

However, it is important to notice that our methodology have certain limitation. First of all, innovation potential is very complex multidimensional problem and its measurement is difficult. We used only limited number of measurable and available variables, but there are many more different factors affecting this problem. Furthermore, despite the fact that we used eight variables the output factor describe only approximately 53% of their variability. Hence, in the analysis we have only limited view on innovation potential. Moreover, there seems to be rather significant differences not only between regions but

also within most of the regions. We are not able to capture and examine this heterogeneity within NUTS2 regions due to lack of data at lower levels.

As far as we know there no similar study dealing with innovation potential in regions of Visegrad countries. However, our results for Czech regions are into some extent similar to those obtained by Pokorný et al. (2008).

CONCLUSIONS

There is rather broad range of quantitative and qualitative methods to evaluate the innovative potential of regions. We measured and compared regional innovation potential using selected quantitative indicators. It is not easy to use only quantitative analysis and quantitative indicators. In current regional theories higher importance is put to better understanding of functioning of the innovative process at the regional level. Significant group of innovations determinants are the result of the networking and cooperation of various regional actors. The qualitative side of this process (the strength and nature of relationships, cooperation), the interaction of actors, the ability to apply the acquired knowledge to practice - these are qualitative factors of an innovative process that is difficult to quantify or measure. However, we decide to compare innovation potential based on selected indicators capturing the dimensions of infrastructure, human capital, research and development, labour market and institutions. We constructed comprehensive index that could into some extent capture the innovation potential of the region. Moreover, we also used factor analysis in order to extract one common factor that can reflect the innovation potential. Based on our results we can say that innovation potential is significantly higher in metropolitan regions of Bratislava, Prague, Budapest and Warsaw. All four regions containing capital cities are performing very well in general. However, there are also other two regions in Czech Republic (Střední Čechy a Jihovýchod) that reach also very high values. Despite this fact, it is important to mention that most of the regions in V4 countries still significantly lagging behind the top performing regions in EU 28. There is still lot of afford needed to improve innovation potential in less developed regions.

REFERENCES

Acs, Z. J., Groot, G.L.F. & Nijkamp, P. (2013). The Emergence of the Knowledge Economy, a Regional Perspective. Berlin: Springer-Verlag. DOI:10.1007/978-3-540-24823-1

Alexeev, S. G. (2009). Integral Evaluation of the Regional Innovation Potential. The Issues of Modern Economy, 2 (30), 306 – 308.

Bekkers, V., Tummers, L., Stuijfzand, B. G. &Voorberg, W. (2013). Social Innovation in the public sector: An integrative framework. LIPSE working paper series No. 1. Rotterdam.

Buesa, M., Heijs, J. & Baumert, T. (2010). The determinants of regional innovation in Europe: A combined factorial and regression knowledge production function approach. Research Policy, 39(6), 722-735.

Fritsch, M. & Slavtchev, V. (2011). Determinants of the efficiency of regional innovation systems. Regional studies, 45(7), 905-918.

Glebova, I. & Kotenkova, S. (2014). Evaluation of Regional Innovation Potential in Russia. Procedia Economics and Finance, 14, 230 – 235.

Maťáková, K. & Stejskal, J. (2011). Features of regional innovation systems / Znaky regionálních inovačních systémů. Scientific Papers of the University of Pardubice, Series D, 16, 22: 134-144. 181 p.

Nauwelaers, C. & Reid, A. (1995). Methodologies for the evaluation of regional innovation potential. Scientometrics, 34 (3), 497 – 511.

Nemec, J., Mikušová Meričková, B. & Svidroňová, M. (2016). Social Innovations on municipal level in Slovakia.

Pokorný, O., Kostič, M., Čadil, V., Valenta, O., Hebáková, L. & Vorlíčková, V. (2008). Analysis of the innovation potential of the regions of the Czech Republic / Analýza inovačného potenciálu krajů České republiky. Technologické centrum Akademie věd České republiky

Rodríguez-Pose, A., & Di Cataldo, M. (2014). Quality of government and innovative performance in the regions of Europe. Journal of Economic Geography, 15(4), 673-706.

Šipikal, M. & Pisár, P. (2017). The regional and sectoral dimension of promoting innovation from the European Union / Regionálna a sektorová dimenzia podpory inovácií zo zdrojov Európskej únie. 126 s.

Suggested citation:

Huňady, J., Ľapinová, E., & Pisár, P. (2018). *Evaluation of selected determinants of innovation potential at NUTS 2 level in V4 countries.* In: **K. Wach & M. Maciejewski** (Eds.), *International Entrepreneurship as the Bridge between International Economics and International Business: Conference Proceedings of the 9th ENTRE Conference – 5th AIB-CEE Chapter Annual Conference.* Kraków: Cracow University of Economics (ISBN: 978-83-65262-19-6). Published within the series "Przedsiębiorczość Międzynarodowa | International Entrepreneurship", vol. 4, no. 3 (ISSN 2543-537X).

Acknowledgements and Financial Disclosure:

This research was supported by the Ministry of education, science, research and sport of Slovak Republic within the project no.1/1009/16 entitled 'Innovation potential of the regions of Slovakia, its measurement and innovation policy at the regional level'.