

EVALUATION OF INNOVATION ECONOMIES OF THE CENTRAL AND EASTERN EUROPE COMPARED TO OTHER EU COUNTRIES

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Abstract: The purpose of this article is the evaluation of innovation economies of Central and Eastern Europe (CEE) compared to other countries of the European Union, based on the aggregate indexes (Global Innovation Index, Innovation Union Scoreboard) and their components. It was found that the CEE countries are still a sizable distance from the “old members” of the European Union. The exceptions are Estonia, Slovenia and the Czech Republic, that owe their position to the effectiveness of the deployment of innovative and relative high expenditure on the development of innovation finance. The weakest proved to be Romania, Bulgaria, Latvia and Poland.

Keywords: Innovation, Central and East Europe, Global Innovation Index, Innovation Union Scoreboard

INTRODUCTION

Innovation sets the development of each country and its processes of transformation, hence the many years of innovation are seen as the main source of competition, economic growth and job creation. Innovation economy is the ability and willingness of operators to continuously seek out and use in business practice the results of research, and of research and development, new concepts, ideas and inventions, improvement and development of the used material and non-material production technology (services), the introduction of new methods and techniques in the

organisation and management, improve and develop the infrastructure and knowledge resources. In economic science attempts to explain this, observed the functioning of the innovation economy. There's even a new section called innovative economies. The impulse for the creation of the mainstream in economic thought was the entry into NAFTA in 1994, which was a free-trade zone. Parties to the agreement were Canada, Mexico and the United States. The agreement went beyond the traditional zone of free trade formula. Liberalisation also refer to the movement of professional services, which did not bring the expected results. So, innovation economics considers that the factors of production in the economy are documenting innovative social capital, creative capital, intellectual capital and entrepreneurs [Drabińska 2012].

One of the most important EU actions aimed at increasing competitiveness and innovation was announced in 2000, the *Lisbon Strategy*, which set a goal that by 2010, the EU economy has become the most competitive and dynamically developing knowledge-based economy in the world, capable of maintaining sustainable economic growth, create more and better jobs and social cohesion. Unfortunately, this goal could not be achieved, so a new document was developed. - *Europe 2020. A European strategy for smart, sustainable and inclusive growth*. Smart growth means strengthening knowledge and innovation as drivers of future growth, which in practice translates into actions aimed at improving the quality of our education, strengthening research performance, promoting innovation and knowledge transfer throughout the Union.

The objective of this paper was to attempt to answer the questions: What distance is the Central and Eastean Europe countries from other countries of the European Union in terms of the level of innovation? Which components of innovation are strong, and which are the weakest? In an attempt to answer the questions, the authors resort to rankings, which assess the innovation of the individual countries.

MATERIAL AND METHODS

Central and Eastern European Countries is an OECD term for the group of countries comprising of Albania, Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, the Slovak Republic, Slovenia, and the three Baltic States: Estonia, Latvia and Lithuania. The main subject of research work includes only 11 countries belonging to the EU (CEE), and not including Albania.

Innovation and innovation potential is not only difficult, but also supports the measure. This is due to the multi-step and the complexity of the process of the creation and implementation of innovative solutions. Therefore, most commonly for the purpose of diagnosis and international comparisons of innovation, the economies of a number of indicators are to be used in the aggregate indexes. So, in the comparative analysis we used two aggregate indicators of innovation and their sub-indexes: the Global Innovation Index and the Innovation Union Scoreboard. The

source material were the thematic reports of the European Commission, data from Eurostat and the Report of the Global Innovation Index, which is co-published by Cornell University, INSEAD, and the World Intellectual Property Organisation (WIPO, an agency of the United Nations). The research applied comparative analysis of methods and descriptive statistics.

AN OVERVIEW OF RESEARCH RESULTS

The Global Innovation Index (GII) project was launched by INSEAD in 2007 with the simple goal of determining how to find metrics and approaches that better capture the richness of innovation in society and go beyond such traditional measures of innovation, as the number of research articles and the level of research and development (R&D) expenditures.

The GII relies on seven pillars. Each pillar is divided into three sub-pillars, and each sub-pillar is composed of two to five individual indicators. Each sub-pillar score is calculated as the weighted average of its individual indicators. Each pillar score is calculated as the weighted average of its sub-pillar scores. The framework of the GII calculation shows Figure 1.

Figure 1. Measurement framework of the Global Innovation Index

Global Innovation Index						
Innovation Efficiency Ratio						
Innovation Potential Input Sub-Index					Innovation Output Sub-Index	
Institutions	Human capital & research	Infrastructure	Market sophistication	Business sophistication	Knowledge & Technology	Creative output
Political environment	Education	ICTs	Credit	Knowledge workers	Knowledge creation	Intangible assets
Regulatory environment	Tertiary education	General infrastructure	Investment	Innovation linkages	Knowledge impact	Creative goods & services
Business environment	Research & development	Ecological sustainability	Trade & competition	Knowledge absorption	Knowledge diffusion	Online creativity

Source: [The Global Innovation... , 2015]

The Global Innovation Index includes three indices and one ratio:

- The Innovation Input Sub-Index is the average of the first five pillar scores.
- The Innovation Output Sub-Index is the average of the last two pillar scores.
- The Global Innovation Index is the average of the Input and the Output sub-index scores.
- The Innovation Efficiency Ratio is the ratio of the Output sub-index score over the input sub-index score.

Table 1. Rankings of Global Innovation Index and their sub-indexes for members of EU

Countries	Global Innovation Index	Innovation Inputs Sub-index	Innovation Outputs Sub-index	Innovation Efficiency
United Kingdom	2	6	5	18
Sweden	3	7	4	16
Netherlands	4	11	3	8
Finland	6	3	10	41
Ireland	8	14	7	12
Luxembourg	9	20	2	3
Denmark	10	8	12	49
Germany	12	18	8	13
Austria	18	19	18	37
France	21	17	23	51
Estonia	23	26	14	17
Czech Republic	24	27	17	11
Belgium	25	21	28	59
Malta	26	33	13	7
Spain	27	24	29	67
Slovenia	28	30	27	22
Portugal	30	28	33	62
Italy	31	29	32	57
Latvia	33	34	30	26
Cyprus	34	32	43	90
Hungary	35	42	37	35
Slovakia	36	37	38	48
Lithuania	38	35	42	74
Bulgaria	39	49	35	21
Croatia	40	43	41	50
Montenegro	41	50	40	29
Greece	45	38	57	98
Poland	46	39	56	93
Romania	54	57	52	58

Source: own preparation based on [The Global Innovation Index 2015]

Country/economy rankings are provided for indicator, sub-pillar, pillar, and index scores. In 2015 the GII ranking included 141 countries (Table 2).

The head of the rankings are classified, according to Switzerland, and it ranked the three countries belonging to the EU- UK, Sweden and the Netherlands. With a group of CEE countries the best turned out to be Estonia and the Czech Republic (occupying 23rd and 24th place respectively), and the lowest ranked was Poland (46th) and Romania (54th).

The Innovation Efficiency Ratio serves to highlight those economies that have achieved more with less, as well as those that lag behind in terms of fulfilling their innovation potential. In theory, assuming that innovation results go hand in hand with innovation enablers, efficiency ratios should evolve around the number one. This measure thus allows us to complement the GII by providing an insight that should be neutral to the development stages of economies.

Least innovative potential was in Poland and in Lithuania (below 50%), while Estonia and the Czech Republic once again proved to be the best. In turn, Bulgaria is an example of a country, that despite the relatively small potential, intensely deploys innovative solutions. Estonia and the Czech Republic are examples of a country in which have achieved *more with less*. In this comparison the worst economy was Poland which has a large potential for innovative and lowest efficiency of its use. For more information about the components of potential and innovation products for individual EU Member States provide the European Innovation Scoreboard.

The European Innovation Scoreboard (EIS) is used to evaluate and compare the results of innovation of the individual countries, according to the respective indicators. Preparation of this cyclic type of report, is the result of the adopted Lisbon strategy, which is one of the main assumptions about economic growth, which is strongly correlated with the level of innovation. Innovation performance is measured using a composite indicator – **the Summary Innovation Index (SII)** – which summarises the performance of a range of different indicators. The Innovation Union Scoreboard distinguishes between three main types of indicator – *Enablers*, *Firm activities* and *Outputs* – There are 8 innovation dimensions, capturing in total 25 indicators. The Innovation Union Scoreboard 2015, the 14th edition, since the introduction of the European Innovation Scoreboard in 2001, follows the methodology of previous editions. Table 2 summarises the SII obtained by EU countries in 2007 and 2014, this is drawn up on the basis of the rankings. In addition, it has been presented as the SII 2014 in relative to the EU28 (average of the EU countries).

Table 2. Comparison of the Innovation Summary Index by EU countries for 2007 and 2014

Country	Summary Innovation Index (scores)		Ranking of SII		SII 2014 in relative to EU28
	2007	2014	2007	2014	
EU28	0.519	0.555	—	—	100%
Sweden	0.723	0.740	1	1	133%
Finland	0.672	0.676	2	3	122%
Germany	0.650	0.676	3	4	122%
Denmark	0.647	0.736	4	2	133%
Luxembourg	0.640	0.642	5	6	116%
Netherlands	0.573	0.647	6	5	117%
Belgium	0.573	0.619	7	9	112%
Ireland	0.570	0.628	8	8	113%
United Kingdom	0.565	0.636	9	7	115%
Austria	0.557	0.385	10	18	69%
France	0.544	0.391	11	17	70%
Cyprus	0.449	0.445	12	13	80%
Slovenia	0.446	0.534	13	10	96%
Estonia	0.420	0.489	14	11	88%
Spain	0.396	0.385	15	19	69%
Italy	0.393	0.439	16	14	79%
Czech Republic	0.373	0.447	17	12	81%
Portugal	0.365	0.403	18	15	73%
Greece	0.362	0.365	19	21	66%
Hungary	0.336	0.369	20	20	66%
Malta	0.325	0.397	21	16	72%
Slovakia	0.316	0.360	22	22	65%
Croatia	0.296	0.313	23	23	56%
Poland	0.292	0.313	24	24	56%
Lithuania	0.244	0.283	25	25	51%
Romania	0.240	0.204	26	28	37%
Latvia	0.215	0.272	27	26	49%
Bulgaria	0.184	0.229	28	27	41%

Source: own calculation based on Innovation Union Scoreboard 2015

Analysis of the change in ranking positions, showed that the highest increase in the ranking (5 places) recorded were Malta and the Czech Republic, and the largest decline was Austria (8 places) and France (a decrease of 6 places). In the CEE

group of five countries has not changed its position and the same amount of rises in the rankings, only Romania has fallen in the ranking by 2 places. In the latest ranking, by states belonging to this group, top ranked Slovenia (10) and Estonia (11) and the list closes with Romania.

As a result, based on Summary Innovation Index, the member states fall into the following performance groups:

1. The group of innovation leaders include Member States in which the innovation performance is well above that of the EU, i.e. more than 20% above the EU average. These are Denmark, Finland, Germany and Sweden, which confirms the top position of these countries as compared with last year's edition of the Innovation Union Scoreboard.
2. The group of innovation followers includes Member States with a performance close to that of the EU average i.e. less than 20% above or more than 90% of the EU average. Austria, Belgium, France, Ireland, Luxembourg, Netherlands, Slovenia and the UK.
3. The group of moderate innovators includes Member States where the innovation performance is below that of the EU average at relative performance rates between 50% and 90% of the EU average. Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Slovakia and Spain.
4. The group of modest innovators includes Member States that show an innovation performance level well below that of the EU average, i.e. less than 50% of the EU average. This group includes Bulgaria, Latvia, and Romania [Innovation..., 2015].

To find the cause of these poor performances from some of the countries of the CEE, a test of comparative analysis of the sub-indicators of the SII (in this model, called the indicator dimensions of innovation). The Innovation outputs are described by the following dimension: *Human Resources, Research Systems, Finance and Support, Firm Investments, Linkages & Entrepreneurship* and *Intellectual Assets*. The last two indicators (the Output dimensions) relate to various aspects of the use of innovative solutions (*Innovators, Economic Effects*). The results of the comparative analysis are presented in Figure 2, where numbers mean relative value of indices to the average of the EU and the symbols reflect the result of a comparative analysis of the value between the analysed countries.

Figure 2. The SII dimension in relative to the EU average for the CEE countries

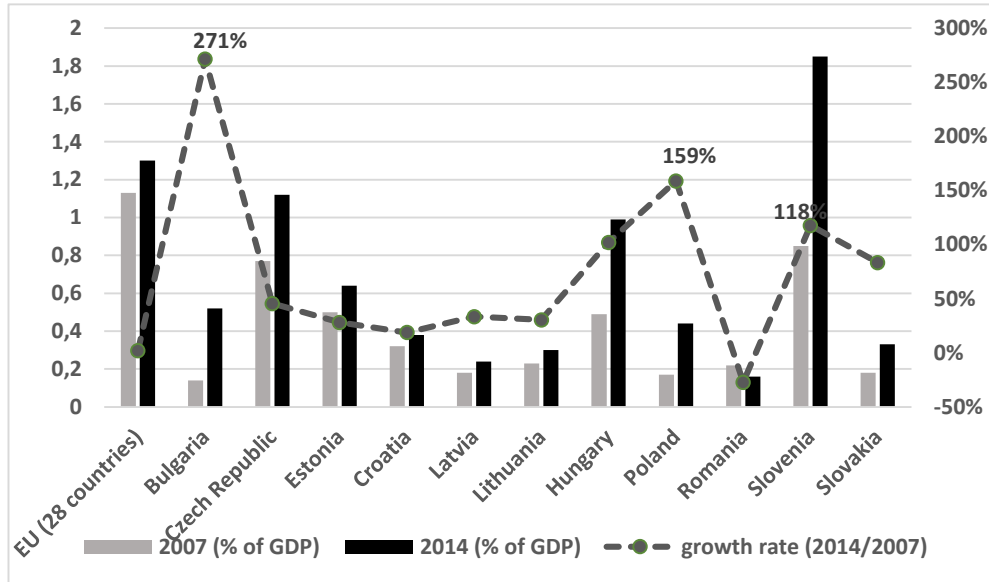
Country	1. Human Resources	2. Research Systems	3. Finance & Support	4. Firm Investments	5. Linkages & Entrepren.	6. Intellectual Assets	7. Innovators	8. Economic Effects
Bulgaria	↓ 83,1	↓ 23,2	↓ 16	↓ 43,6	↓ 12,1	↗ 64,9	↓ 33,7	↓ 32,4
Croatia	↑ 115,4	↓ 30,1	↗ 54,7	↗ 74,9	↗ 63,2	↓ 34,9	↗ 56,8	↓ 44,8
Czech Republic	↗ 99,5	↗ 47,6	↗ 75,5	↗ 90,3	↗ 89,9	↗ 65,5	↑ 97,0	↑ 85,7
Estonia	↗ 99,8	↑ 68,3	↑ 150,5	↑ 135,2	↑ 98,3	↑ 95,5	↗ 74,3	↗ 62,2
Hungary	↓ 82,1	↗ 37,8	↗ 62,8	↗ 85,9	↗ 38,5	↗ 55,1	↗ 64,0	↑ 92,3
Latvia	↗ 98,00	↓ 18,8	↗ 58,6	↗ 91,4	↓ 18,6	↗ 59,0	↓ 18,0	↓ 43,4
Lithuania	↑ 120,7	↗ 32,3	↗ 113,3	↗ 76,4	↗ 36,8	↓ 41,3	↓ 21,8	↓ 29,5
Poland	↗ 96,7	↓ 23,6	↗ 65,6	↗ 79,1	↓ 14,6	↗ 67,3	↗ 49,3	↗ 53,9
Romania	↓ 78,80	↓ 20,8	↓ 26,4	↓ 17,6	↓ 9,1	↓ 27,4	↓ 31,5	↗ 53,6
Slovakia	↑ 112,9	↓ 30,8	↗ 60,6	↗ 63,2	↗ 42,3	↓ 42,9	↗ 73,7	↑ 80,5
Slovenia	↑ 122,2	↑ 72,5	↗ 93,9	↑ 119,8	↑ 119,2	↑ 107,9	↑ 84,8	↗ 72,0

↑	up 75%
↗	between 50% and 75%
↘	between 25% and 50%
↓	less 25%

Source: own calculations

The analysed group of countries shows that Slovenia is the best, because effectively uses their innovative potential. The same is true in the case of Estonia. In turn, the Czech Republic and Hungary with less potential for innovation, have reached a relatively high level of the output of innovation (application and economic effects). The poorest in this summary was Romania and Bulgaria, which in all dimensions of innovation clearly deviates from the other Member States. Innovation in the case of the other countries analysed can be described as unbalanced, since it affects the considerable variations among potential factors, innovation and relatively low levels of components of the output products innovation. (for example the Polish economy has the potential for innovation based on human resources, with a very low tendency for innovation and research and development cooperation). Table data show that the large variations between countries analysed occurs in the area of financial support for the development of innovation. How were the expenditure on R&D in individual countries shown graphically on the chart? (Figure 3).

Figure 3. Comparison of the research and development expenditure (business enterprise sector) and the dynamics of changes for CEE countries in 2007 and 2014



Source: own preparation based on EUROSTAT

During the period from 2007 until 2014, countries (except Romania) have had an increase in funding from the R&D sector. The largest increase reported, was for Bulgaria (near three-times) and Poland (c.a. 160%). In 2014 the greatest relative expenditure for the development of innovation finance was in Slovenia and the Czech Republic — they have been highly classified in ranking in the Innovation Summary Index (10th and 12th place). However, in the case of Estonia, with the 11th place in the ranking, the level of expenditure on the R&D is just a bit more than 0.5% of GDP. Of course, the amount of the funding depends on the size of the GDP, so it may not be the basis for the quantitative assessment of inputs, but gives the picture of the trend in development in different countries.

SUMMARY

Over the last programming period (2007-2013), 11 countries of Central and Eastern Europe gained access to almost 176 billion euros of funding from the EU. In this period the amount of allocated EU funds varies by country – the highest budget was allocated to Poland (67,19 EUR billion), which bears the biggest population among the CEE countries. However, EU funds per capita ratio is the highest in the Czech Republic (2,5 EUR), Estonia (2,59 EUR) and Hungary (2,51 EUR). These funds have contributed to the overall development of each economy in many aspects – most visible was in transport infrastructure and environmental protection, both of

which had been neglected during the communist era. Over the 2007-2013 research and development were not enjoyed by the majority of the population, and both the number and value of projects in various countries of Central and Eastern Europe were small. Most of the projects financed by the European Union aimed at improving the quality and alignment of the standard of living among the EU Member States. Not all projects have contributed to building long-term strategic benefits to the economies [EU Funds..., 2015]. So it's no surprise that the level of innovation in the CEE countries significantly differs from the other countries of the European Community.

Among the CEE countries the most innovative were found to be Estonia, Slovenia and the Czech Republic, they owe their position, thanks to the effectiveness of the deployment of innovative and relative high expenditure on the development of innovation finance. Out of the remaining countries belonging to this group, where much work in the area of innovation is required is Romania, Bulgaria, Latvia and Poland. Improving their efficiency requires innovative capital, increasing pressure on the development of research systems and Linkages & Entrepreneurship. These partnerships include, brokerage mechanisms, business linkage initiatives, hybrid commercial and social business models, innovative financing instruments, enhanced enterprise support services, and new types of alliances between companies, trade associations, governments, donors, academic institutions and non-governmental organisations.

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