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HUMAN CAPITAL AS A FACTOR CREATING INNOVATION IN THE VISEGRAD COUNTRIES

Human Capital is of great importance in every sector of the economy. Hence, its forms of participation in shaping the economy may differ over the years, due to e.g. increasing robotization and automatization, human capital will remain crucial as a development factor. In the knowledge-based economy, human capital plays a significant role, especially in creating innovation. While Western Europe is leading in innovation in the EU, most of the Visegrad countries are way behind the leaders. Therefore, they need to make an effort to catch-up with Western Europe. One of the most important factors of innovation is human capital. It seems, however, that the Visegrad countries do have a potential for innovation with regards to human capital. There is a growing number of university graduates across these countries, R&D personnel or doctoral students. However, it does not necessarily influence the level of innovation, meaning that some countries may have a higher potential of human capital and a lower level of innovation than others with a relatively lower level of such potential.
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1. Introduction

Human capital is an essential factor of development in the economy. In general, it is assumed that humans are creative and willing to develop and improve things and processes. Human capital is therefore considered as a driving force of the economy, however it does have some costs. People need to learn how to perform a particular job, so the time and money needed for such learning and practicing activities are considered as an investment. In hi-tech industries and innovative firms, such costs are proportionally higher because the level of investment is much higher due to specialised trainings, courses and the long-term process of creating innovations. Therefore, human capital cannot be overestimated in the knowledge-based economy.

Even OECD (2018) indicates that the methods of measuring the role of human capital in innovation processes are not well developed since there is only limited information

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available from innovation surveys. Dakhli and De Clercq (2004) underline that innovations as knowledge-intensive activities should be linked to human capital in many ways. Human capital should be perceived as a 'catalyst' for innovation. They claim that there is a positive relationship between human capital and innovation. Further, they explain that people who are more educated, in general, have more experience and expertise, that is because they spend more time investing in their skills and knowledge, what at the end impacts the well-being of the society.

Bianchi (2001) underlines that industry-specific human capital, and especially knowledge exchange within actors of that industry, is a crucial stimulus of innovation. Moreover, Coleman (1988) and Gimeno et al. (1997) point out that human capital in the form of knowledge, skills and expertise can be seen as a significant factor of competitive advantage among societies, individuals and organisations.

Other authors also suggest that extensive trainings, physical and intellectual activities performed by people, increase productivity and competitiveness in the industry, organization and society. This, in fact, creates innovation understood as a knowledge-intensive activity (Black & Lynch, 1996; Cannon, 2000).

2. Research methodology

This paper aims to provide an overview on human capital as a source of innovation in the Visegrad countries (V4). Therefore, it starts from a literature review on human capital and innovation. Then, it continues with an analysis of the European Innovation Scoreboard (EIS) which is published by the European Commission. It is necessary to look at the indicators used in this research and see which countries are leading in this statistic, and locate the Visegrad countries among other EU countries. Finally, human capital is analysed in terms of its potential in creating innovation. The following measures are applied in order to assess human capital among the EU countries: new doctorate graduates per 1000 population aged 25-34, percentage population aged 25-34 having completed tertiary education, percentage population aged 25-64 involved in lifelong learning, international scientific co-publications per million population, scientific publications among the top 10% most cited publications worldwide as a percentage of total scientific publications of the country, foreign doctorate students as a percentage of all doctorate students, employment in knowledge-intensive activities as a percentage of total employment, employment in fast-growing enterprises percentage of total employment.

3. Position of the Visegrad countries in the European Innovation Scoreboard

The EIS contains a comparative analysis of innovation in the EU countries and other regional neighbours. It provides an assessment of the strengths and weaknesses of national innovation systems. Before analysing the situation of the Visegrad countries in this measure, it is necessary to introduce all indicators that form the EIS.

Table 1

Indicators of the European Innovation Scoreboard

FRAMEWORK CONDITIONS	INNOVATION ACTIVITIES
1. Human resources	***6. Innovators***
a) New doctorate graduates	a) SMEs with product or process innovations
b) Population aged 25-34 with tertiary education	b) SMEs with marketing or organisational innovations
c) Lifelong learning	c) SMEs innovating in-house
2. Attractive research systems	***7. Linkages***
a) International scientific co-publications	a) Innovative SMEs collaborating with others
b) Top 10% most cited publications	b) Public-private co-publications
c) Foreign doctorate students	c) Private co-funding of public R&D expenditures
3. Innovation-friendly environment	***8. Intellectual assets***
a) Broadband penetration	a) patent applications
b) Opportunity-driven entrepreneurship	b) Trademark applications
INVESTMENTS	c) Design applications
4. Finance and support	**IMPACTS**
a) R&D expenditure in the public sector	***9. Employment impacts***
b) Venture capital expenditures	a) Employment in knowledge-intensive activities
5. Firm investments	b) Employment in fast-growing enterprises of innovative sectors
a) R&D expenditure in the business sector	***10. Sales impacts***
b) Non-R&D innovation expenditures	a) Medium and high-tech product exports
c) Enterprises providing training to develop or upgrade ICT skills of their personnel	b) Knowledge-intensive services exports
	c) Sales of new-to-market and new-to-firm product innovations

Source: European Commission (2018b, p. 4).

Table 1 shows indicators that were taken into consideration when constructing the EIS. It clearly presents four pillars of innovation, which are: framework conditions, investments, innovation activities and impacts. For the need of this paper, it is important to focus on human resources which is one of three components of framework conditions. At this point, it should be noted that there is a slight difference between human capital and human resources. The latter refers to a tangible asset which is the stock of productive skills and knowledge present in labour.

Human capital, however, is an intangible aspect of human resources, where any spending on employees is perceived as an investment rather than cost (Zakaria et al., 2011). Nevertheless, human resources in the EIS consist of the following measures: new doctorate graduates, population aged 25-34 with tertiary education, and lifelong learning, which, in fact, do not seem to be an extensive group of human resources factors creating innovation. It should also be debatable if it is right to devote only a tiny space in the EIS, although it is mentioned in the very first place. However, we may imagine the EIS could be constructed in a different way, where human capital is one of the pillars. In such a case, the human capital measure could include (in addition to human resources measure): international

scientific co-publications, top 10% most cited publications, foreign doctorate students, public-private co-publications, employment in knowledge-intensive activities and fast-growing enterprises of innovative sectors, and others. In this way, the importance of human capital could be underlined in the process of creating innovation.

The EIS is not an ideal measure of innovation as it is based on the measures that are accessible and possible to collect. However, it seems to be one of the most advanced measures currently available that captures many different factors of innovation. Therefore, it is necessary to comment on the results of the EIS for the Visegrad countries in comparison to other EU countries.

Table 2

2018 European Innovation Scoreboard

Country	Value of EIS	Country	Value of EIS
Sweden	0.71	Malta	0.40
Denmark	0.67	Spain	0.40
Finland	0.65	Estonia	0.40
Netherlands	0.65	Cyprus	0.39
UK	0.61	Italy	0.37
Luxembourg	0.61	Lithuania	0.36
Germany	0.60	Hungary	0.33
Belgium	0.59	Greece	0.33
Ireland	0.58	Slovakia	0.32
Austria	0.58	Latvia	0.29
France	0.55	Poland	0.27
EU average	0.50	Croatia	0.26
Slovenia	0.47	Bulgaria	0.29
Czech Rep.	0.42	Romania	0.16
Portugal	0.41		

Source: Based on data from the EIS database (European Commission, 2018a).

Table 2 shows the results of the EIS, which is a synthetic measure of all factors named in table 1. It can be clearly seen that the Visegrad countries are lagging behind the EU average in terms of innovation, according to EIS. All the Visegrad countries are placed below the EU average. The best-performing country in the EIS is Sweden followed by Finland and Denmark, and for the Visegrad countries the leader is: Czech Republic and then a way behind are the others: Hungary, Slovakia and surprisingly Poland, which is the biggest country from the V4. There is definitely room for improvement for the V4 in terms of fostering innovation in these countries or maximise the usage of their innovation potential in order to catch up with the western EU countries.

4. Human capital as a driver of innovation

Human capital is an evitable part of the innovation process. There are numerous factors of human capital activities, but not all of them are measurable. Hence, the EIS provides some set of human capital indicators in creating innovation. Due to data availability and possibilities of measurement, this paper considers just some, preferably the most significant, factors of human capital in creating innovation.

Table 3

Selected human capital factors in the EU countries

	1 a)	1 b)	1 c)	2 a)	2 b)	2 c)	9 a)	9 b)
	2016	2017	2017	2017	2015	2016	2017	2015
EU28	2.01	39.0	10.9	517.5	10.57	26.1	14.2	4.8
Belgium	1.93	45.7	8.5	1467.6	12.58	41.8	15.6	2.7
Bulgaria	1.52	33.4	2.3	226.6	4.19	6.3	10.2	6.6
Czech Republic	1.69	33.8	9.8	754.8	6.63	14.8	12.9	6.5
Denmark	3.21	46.2	26.8	2345.9	13.37	33.4	15.1	4.5
Germany	2.78	31.3	8.4	812.2	11.33	9.1	14.8	4.6
Estonia	1.08	43.1	17.2	1077.8	8.24	12.0	13.5	3.2
Ireland	2.64	53.5	8.9	1249.3	12.56	28.4	20.6	7.1
Greece	1.13	42.5	4.5	608.3	9.03	:	12.1	:
Spain	2.59	42.6	9.9	732.1	9.29	15.5	12.5	4.8
France	1.70	44.3	18.7	726.2	11.00	40.1	14.5	4.1
Croatia	1.18	32.7	2.3	492.3	4.64	3.9	11.6	3.5
Italy	1.52	26.9	7.9	631.9	10.44	14.2	13.7	3.1
Cyprus	0.65	57.0	6.9	1283.3	8.98	14.3	17.0	0.1
Latvia	0.71	41.6	7.5	315.4	6.21	11.4	12.1	5.2
Lithuania	0.86	55.6	5.9	450.5	4.30	4.6	9.7	2.1
Luxembourg	1.28	51.2	17.2	1715.0	13.06	87.0	22.0	4.6
Hungary	1.01	30.2	6.2	456.3	6.90	11.6	11.6	8.7
Malta	0.70	33.5	10.1	597.4	10.69	54.0	18.4	6.1
Netherlands	2.38	46.6	19.1	1628.1	14.59	40.1	17.1	4.8
Austria	1.90	40.3	15.8	1375.8	11.14	28.3	15.0	1.9
Poland	0.63	43.6	4.0	296.6	5.06	2.0	10.3	5.8
Portugal	1.90	34.0	9.8	918.9	9.04	25.6	10.6	5.0
Romania	0.85	25.6	1.1	181.8	4.80	3.8	7.7	2.6
Slovenia	3.55	44.5	12.0	1134.6	8.56	9.7	13.7	3.2
Slovakia	2.25	35.1	3.4	438.8	6.18	9.1	10.6	7.7
Finland	2.87	40.3	27.4	1658.8	10.83	21.1	16.2	2.8
Sweden	2.71	47.4	30.4	2018.8	12.09	34.7	18.5	5.5
United Kingdom	3.08	47.3	14.3	1222.3	14.98	42.9	18.5	6.4

Where: 1 a) 1 b) 1 c) 2 a) 2 b) 2 c) 9 a) 9 b) are the factors named in table 1.
Source: Based on data from the EIS database (European Commission, 2018a).

Table 3 presents selected factors from the EIS that characterise human capital and its activities. The first three of them come from the human resources category, which is considered as innovation input. It means that doctorate graduates, people with tertiary

education, and people involved in lifelong learning need to be viewed as a ground for innovation. It may also be defined as innovation potential, i.e. the more people that are well-educated, the more chances of having innovative products or services in the economy. However, there might also be an issue of unused or not fully used innovation potential. There could be a high percentage of people with tertiary education that does not necessarily have an impact on innovation. Therefore, it is important to have a closer look into specific human capital indicators, not just at the EIS in general.

From the human resources, the first indicator 1 a) shows the number of new doctorate graduates per 1000 population aged 25-34. The EU28 average is 2.01 whereas the Czech Republic, Hungary and Poland are lagging behind that average scoring 1.69, 1.01, and 0.63 respectively; except for Slovakia that managed to score 2.25. It is interesting to notice that the EU leaders in this measure that score more than 3 are: Slovenia, Denmark, and the United Kingdom. Surprisingly, Slovenia is just below the EU average in the EIS. Then, 1 b) describes the percentage population aged 25-34 having completed tertiary education. Here, the situation is different since Poland is leading within the V4 since it scored 43.6% whereas the EU average is 39%. Other V4 countries are placed below the EU average, but the percentage is higher than 30, while the leading EU countries are: Cyprus, Lithuania, and Ireland. The first two countries are placed below the EU average in the EIS. However, it is interesting why Germany scored only 31.3% considering the fact that it is quite an innovative country according to the EIS. Next indicator 1 c) presents the percentage population aged 25-64 involved in lifelong learning. When looking at the results in a comprehensive way, one may notice that there are significant disparities among the EU countries in this measure, starting from Romania with a level of 1.1%, and ending at the best-performing country – Sweden with a share of 30.4%. The EU average is 10.9% whereas all V4 scored below that number.

In attractive research systems, there are three indicators which may be classified as input of innovation as well. Foreign doctorate students are an input, international scientific co-publications and 10% most cited publications are inputs of innovations as well unless they already describe the innovative process, product or service. The first in the list which is 2 a) presents the international scientific co-publications per million population. The EU leaders Denmark and Sweden have more than 2000 such publications per million people, whereas Romania has less than 200, Bulgaria and Poland have more than 200 and less than 300. Slovakia and Hungary are also behind the EU average (517.5) while the Czech Republic is placed above that average with a score of 754.8. Then, 2 b) shows scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country. In this measure, the V4 are placed below the EU average which is 10.57. Poland scored 5.06% that is the least from the V4 and Hungary was the V4 leader in this measure scoring 6.9%. The best performers are western EU countries: the United Kingdom, the Netherlands, and Denmark. Next indicator is 2 c) that presents foreign doctorate students as a percentage of all doctorate students. This indicator, however, seems to be biased by the small countries and at the same time open economies that attract foreign students. Luxembourg is such a case, where 87% of doctorate students are foreign ones, followed by Malta with a share of 54%, and then the United Kingdom with 42.9% foreign doctorate students. The EU average is 26.1% while the worst performing country in this indicator is Poland 2% whereas Slovakia, Hungary and the Czech Republic with a share of

9.1%, 11.6% 14.8% respectively, are not even close the EU average. It is quite surprising that Finland that score 21.1% is below the EU average, and at the same time is one of the leader in the EIS. The score of Germany which is 9.1%, also seems to be scanty in comparison to the EU average.

The last considered group of indicators are employment impacts that could be perceived as innovation outcome. The first of them is 4 a) which is employment in knowledge-intensive activities as a percentage of total employment. In this measure, the results range from 7.7% (Romania) up to 22% (Luxembourg) with the EU average of 14.2%. All the V4 are below that average, scoring more than 10%. The last considered indicator is 4 b) employment in fast-growing enterprises as a percentage of total employment. That is the only indicator from that selection where all the V4 are above the EU average which is 4.8%. The EU leader in this measure is Hungary with a score of 8.7%, followed by Slovakia with 7.7% share and then Ireland that scored 7.1%. It is worth noting that such countries like Denmark, Finland, Luxembourg Germany, Belgium are below the EU average although they are above the EU average in the EIS.

There is a need for improvement in the V4 regarding human capital and innovation. Therefore, as the V4 are the countries which form an alliance that focuses on cultural, economic, military and energy cooperation, they might consider creating innovation as the next pillar of that alliance.

5. Conclusion

The Visegrad countries are placed below the EU average in the European Innovation Scoreboard. When considering human capital indicators in the process of creating innovation, the V4 need to improve in almost all the measure, but some of them require special attention, including: lifelong learning, top 10% most cited publications, foreign doctorate students, and employment in knowledge-intensive activities. However, the V4 are leading in employment in fast-growing enterprises of innovative sectors. The V4 have innovation potential, however the problem is how they can fully use it in order to catch up with the western EU countries. Further research on this topic might include a regional perspective of human capital, preferably as a single synthetic measure, in creating innovation in the Visegrad countries based on the Regional Innovation Scoreboard.

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