HIGHER EDUCATION AS A PILLAR IN INCREASING INNOVATION CAPACITIES

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Abstract

The article tries to accent that one of the fundamental challenges and tasks of the contemporary national economies in an effort to create and maintain innovation based competitiveness is to develop and upgrade the human capital through a qualitative higher educational system. Using the data from the Global Innovation Index (GII) the paper analyses the interdependence between the quality of the educational system and the level of innovativeness of nations. The paper is focused on the South East European (SEE) countries and the quality of their educational system as one of the reasons of their innovativeness lag. Through the correlation index and regression analyses the paper confirms the differences in relationship and influence of higher education on innovativeness between SEE and the Central European Economies (CEE) todays' EU members.

The type of the article: *Empirical study.*

Keywords: *Higher education, human capital, innovation.*

JEL Classification: *H52, I25, M53, O10, O15.*

1. Introduction

The paper highlights the role of higher education system in enhancing the innovative capacities of national economies as the highest tool in creating the competitiveness of a nation. It examines the quality of higher education systems in some SEE countries (Albania, Bosnia and Herzegovina, Macedonia, Montenegro and Serbia) and its impact on innovation according to the Global Innovation Index (GII) and makes comparison with that of some CEE countries (Czech Republic, Hungary, Poland, Slovakia and Slovenia). The paper will elaborate on the reasons that might be crucial for the pillar quality lag. Second, through the correlation analyses it will prove the reliability of innovation and knowledge and technology output on the higher education quality.

Knowledge and skills of human resources are dynamic categories that are acquired through the process of continual improvement of the educational and training system that allows flexibility and adaptability of the human factor in accordance with the market needs. In this increasingly globalized and interdependent world economy, the knowledge and skills of the workforce are the key competitive weapons (Thurow, 1994). Countries with relevant knowledge and skills acquired through increased and effective investment in human resources development will be able to acquire innovation based competitiveness. The World Economic Forum (WEF) accent knowledge based society to be among the main factors, which influence the competitiveness of companies and nations. Within the knowledge-based economy, the creation of knowledge and its effective transfer in industry is a key factor towards innovation and technology led development. Investing in knowledge, skills and abilities means investment in creation of greater productivity and higher added value. Arvanitis and Stucki (2012) in their study correlate human capital directly with a higher propensity to innovation. According to Schultz (1993) the human capital "is a key factor for increasing and sustaining competitive advantage, so maintenance of competitiveness requires human capital to become a tool to increase productivity" (p. 16). Rastogi (2002) emphasizes that

"human capital is an important input, especially through the continuous improvement of knowledge, skills and capabilities" (p.198). Becker (1993) notes that "the costs of education and training are capital investment that have a return value" (p. 25). Benhabib and Spiegel (1994) notice the crucial role that human capital plays in the process of technology absorption (p. 149). David and Foray (2003) conclude that "quality of human capital and the creation of new ideas (innovation) and knowledge are the drivers of progress that create disparities in the productivity and growth of different countries". Powell and Snellman (2004) recognized innovation as driving tool for increasing competitiveness. Nelson and Phelp (1996) integrated the idea that the "adoption of new technology depends on the capacity of human capital, which is determined by level of education". McNeil and Silim (2012) identified that higher education supports the supply of skilled workers and enhance the conditions for innovation bringing substantial social benefit. Schneider et al. (2010) found a positive relation between innovation and the educational level of employees. D'Este et al. (2012) reveals that human capital is a critical factor in driving down barriers to innovation.

The quality of the higher education system is one of the key requirements in the process of creating more added values in the production of goods and services and in increasing the investment attractiveness of the SEE economies, but at the same time it is one of the major weaknesses in the creation and promotion of innovative capacity in all SEE economies.

The empirical results within the Global Innovation Index (GII) and WEF's Global Competitiveness Reports (GCR) show a high portion of differences in the level of growth of higher educational aspects in the human capital between the SEE and CEE economies. So, despite of financial aspects and investment in research activities, the qualitative level of human factor is identified as one of the main weaknesses in the innovation development process in all SEE economies.

The research analysis confirms the positive correlation between the quality of human capital and innovativeness in CEE economies, so the investment in education process together with the spending on R&D should be key weapons in the whole process of innovation creation for all SEE economies. It is useful to determine if the actual measures, policies and level of investment in education employed by the SEE countries can contribute to higher level of innovativeness. Through the research we can realize that any investment in the improvement of the quality of human capital through the more qualitative higher educational process can lead to higher innovativeness of economies. By improving the innovation capabilities of nation, the education process for the SEE economies would have a role of sustainable creator of competitiveness. The SEE economies should follow the experience of the advanced EU economies and the CEE former transition economies, actual members of the EU, which use the investment in improving the educational system as a reliable recipe in creating innovation and as a power tool towards innovation based economy.

2. Method

The first research method used for this study is a regression analysis. It helps in estimating the coefficient of correlation – R square between the higher education system and Global Innovation Index (GII) and also to investigate the influence of higher education as an input in the process of creation knowledge and technology output in the two groups of economies, the SEE economies – non EU members and CEE – EU members' economies. It is found out a weak correlation equals to 0.35 in SEE economies. Compared with CEE economies that achieved correlation index higher than 0.7 SEE economies express lag in relationship between the quality of higher education system and innovativeness. We can realise that the differences in the level of quality of higher education system lead to differences in correlation index. Individual correlation index made for the separate group of economies confirmed the differences in impact of the higher education system on innovativeness between the two groups of economies.

Using the OLS model (Hayashi, 2000):

$$y_i = a + bx + \varepsilon_i \qquad (1)$$

It is identified how the disparities in the quality of higher education system between the analysed economies can influence the innovation index. The formula 1 helps to detect what value of the quality of education system lead to higher innovativeness. So it is useful to predict how the changes in education system influence the changes of innovativeness.

Integral method within the research is comparative analysis as a useful tool to compare the data and results among analysed group of economies.

The correlation is much worse when we analyse the correlation between higher education as an input and the knowledge and technology as output in innovation process. The SEE economies express extremely low correlation of 0.05 compared to CEE economies that show medium correlation of 0.43.

Also using the OLS model we identify the disparities in influence of higher education system in the process of creation knowledge and technology output in two analysed groups of economies.

The analysis is based on the data for human capital indicators of innovation analysed and exposed in the annual Global Innovation Index.

3. Results

The annual Global Innovation Index (GII) have examined innovation as a set of complementary factors that enable or disable the process of innovation creation. Although according to the GII innovation depends on the set of factors that include institutions, infrastructure, market and business sophistication as inputs in the innovation process, the human factor as a crucial component is analysed as one of the prime determinants in the development of innovation capacity of a nation. Higher education is a key precondition for economies to move up the value chain and a determinant for transferring the economies in the highest phase of competitiveness, innovation based (Global Innovation Index, 2014).

In SEE economies the improvement of the quality of human factor has not indicated a dynamic character that is necessary in the process of creating a production with higher added value and also conditions for promotion of research activities and the development of innovative technologies.

The following table shows the correlation coefficient and, as a result of that, the differences in the influence of higher education to the innovativeness measured by GII between SEE and CEE economies. Using the OLS model we find out a weak correlation $R^2 = 0.248$ for SEE economies and $R^2 = 0.489$ for CEE economies.

Table 1. Comparison of correlation index of higher education and innovativeness between SEE and CEE economies

	Regression Statistics	
	SEE	***CEE***
Multiple R	0.498609	0.699542
R Square	0.248611	0.489359
Adjusted R Square	0.198518	0.460990
Standard error	2.444958	2.293477
Observations	5	5

Source: own calculations

The low correlation between the higher education system and innovativeness in SEE economies is connected with the weaknesses of national higher education system that have quantitative and qualitative nature.

Quantitative reasons refer to the low level of enrolment that accounts 48.3% for SEE region, compared to the percentage of enrolment in the CEE where it reaches over 68%. High percentage of coverage of the population in higher education represents one of the crucial necessities in the process of supporting innovation.

Except to the quantitative element, SEE countries lag behind in terms of qualitative aspects of education, which are directly connected to the financing of the higher education and quality of curricula and teaching methods. So according to the sub pillar of the University ranking, SEE countries present score of zero because they have non-listed universities according to the QS Quacquarelli Symonds World University Ranking (Global Innovation Index, 2014). On the other hand CEE countries indicate remarkable participation of their universities in the list of QS world ranking.

Public investment in education in the CEE accounts over 5.0% of GDP, which is consistent with the recommendations of UNESCO, despite investments in SEE countries which are below 4% of GDP (UNESCO, Institute for Statistics). These data suggest that support for education by budgetary resources is far away from established criteria to ensuring a certain level of educational quality. One of the serious weaknesses in financing of education which is common to all SEE countries is the lack of support from private sources, which in the CEE reaches more than 1% of GDP.

Using the formula for linear regression we can estimate that any increase in the quality of higher education system lead to higher index of innovativeness. So we can predict the value of the innovation index for any higher or lower value of higher education. But the OLS regression through the p-value (Table 2) finds out that this effect has different extent of intensity in each group of economies.

Table 2. OLS analysis of higher education and innovation index in SEE and CEE economies

	Coefficient	Standard error	T Stat	P-value	Lower 95%	Upper 95%
	SEE					
Intercept	25.81019917	3.843687808	6.714957	6.92618	17.617572	34.00283
Higher education	0.223021576	0.100109156	2.227784	0.041624*	0.00964396	0436399
	CEE					
Intercept	25.78118598	4.735877835	5.443803	3.58973	15.8314758	35.7309
Higher education	0.472456998	0.113754853	4.15329092	0.000597*	0.23346692	0.711447

*Significance level: *p<0.05*

Source: own calculation

By using the data from the Table 2 in the formula (1) we obtain the regression lines for the two groups of economies:

$$INNOV_{SEE} = 25.810 + 0.223HE$$

$$INNOV_{CEE} = 25.781 + 0.472HE$$

Both groups of economies indicate positive correlation between higher education and innovativeness, but it is most significantly in CEE economies compared to SEE economies. The low level of significance between development of higher education and innovation in SEE countries is due to the lack of knowledge, scientific and research spill-over between Universities and business community that is confirmed within the Global Competitiveness Reports of WEF.

Unfavourable relationship between tertiary education system and innovation in SEE economies is more obvious if we analyse the relationship between the higher education system and knowledge and technology output. The OLS analysis is made on the examples of the same groups of economies: the first group are the former transition economies from CEE today's members of EU and the second group refers to the developing countries from SEE. The following data (Table 3) show extremely low correlation equals to 0.05 between the value of the tertiary education pillar and knowledge and technology output in SEE countries. It means that only 0.05% of the variation in knowledge and technology output is explained by the variation in tertiary education system. On the other hand the value of correlation in CEE countries is equal to 0.43 or 43% of the variation in knowledge and technology output is explained by the variation in tertiary education.

Table 3. Comparison of correlation index of higher education and knowledge and technology output between SEE and CEE economies

	SEE	CEE
Multiple R	0.23832	0.657504
R Square	0.056797	0.432312
Adjusted R Square	-0.2576	0.243082
Standard error	6.503132	5.239095
Observations	5	5

Source: own calculation

The difference in the level of correlation between SEE and CEE economies is result of many reasons that are not in favour to more innovation. According to the World Economic Forum (WEF) it includes quality of scientific-research institutions, low level of funds for research and development, weak cooperation between universities and business sector, scarcity of government procurement for advanced tech products, availability of scientists and engineers.

Using the formula for linear regression and data in Table 4, we can assess the regression line for all analysed economies:

$$KTO = -0.66902 + 0.986241HE$$

Regression line indicates positive correlation between Knowledge and Technology Output (KTO) and the higher education process (HE). It enables simulation how to improve innovation index by improving higher education. The significance of relation is strengthened with *P-value* that indicate a high level of significance ($p<0.01$).

Table 4. OLS analysis of higher education and knowledge and technology output in SEE and CEE economies

	Coefficient	Standard error	T Stat	P-value	Lower 95%	Upper 95%
Intercept	-0.66902	9.286523	-0.07204	0.944337	-22.0838	2074574
Higher education	0.986241	0.153601	6.420796	0.000205	0.632037	1.340446

Source: Own calculation

The fact that education is a significant factor in the raising of national competitiveness in the contemporary knowledge-driven economy. (Johansen and Sahlberg, 2011), indicates that the education policy should be integral part of the policies for competitiveness and growth. Thus the main direction of the measures and policies that should have crucial impact in improving the competitiveness and sustainable development of the SEE economies should be focused on enhancing the education quality and constantly upgrading the quality of the workforce. The research and innovation role of higher education system should be a prime source of knowledge and innovation at national and international level, so the national economies should pursue reforms to build system of higher education, which assure quality in both research and teaching processes.

4. Discussion

Human capital is a crucial factor in the process of creation of innovation capabilities of national economies. It acts directly as input through the higher education system or as knowledge and technology output as a results of that process. As we can realised from the previous analysis, investment in human capital is one of the main tool that lead to innovation based competitiveness as the highest level of growth. Creating highly qualified human skills is a key precondition for productivity growth. According to research finding in highly developed economies there is a strong relationship between the quality of higher educational system and the level of innovativeness.

Exploring of the Global Innovation Index provides an opportunity to make a comparative analysis involving some regional groups of economies, on the same or higher level of

competitiveness, to explore the differences in the level of innovativeness and to pursue measures, activities and policies that would lead to qualitative and quantitative improvement of the higher educational process. Due to the analyses we find out that actual condition of higher education system in SEE economies does not contribute to higher level of competitiveness of economies. The low level of investment in educational system in SEE countries and weak linkages with the business community is main reasons for innovativeness disparities compared to the CEE countries. It is essential to accent that higher public and private investment must be directed in enhancing the quantity and quality of education process because the human capital is a crucial factor in switching to a higher level of development, i.e. innovation based development. Improving the performance and increasing participation in tertiary education should contribute towards SEE capacities for innovation.

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