Competitiveness of Human Capital in the countries of the Visegrád Group (V4)

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The analysis of competitiveness has become an irreplaceable tool of economic studies by now. Professional literature has several approaches to the definition of competitiveness. The most accepted of these is the pyramid model of competitiveness. Each of the success factors featured in the model (including human capital) plays an important role in influencing the future competitiveness of an economy. In my essay I look at the role of human resources in shaping territorial competitiveness in the group of the Visegrád countries.

Keywords: competitiveness, human capital, territorial competitiveness, cluster analysis, factor analysis, typifying of regions, competitiveness cluster

1. Introduction

The essay focuses on the NUTS2 level spatial units of the Visegrád Countries. The name comes from the north Hungarian town of Visegrád, which was the place of a historical meeting of the Central European kings in the 14th century. In the past the primary objective of the countries of the group was the accession (integration) of the Visegrád countries into the Euro-Atlantic structure. After achieving this goal, the foreign policy of the V4 countries significantly expanded and now covers other fields as well. The Visegrád group strives for the strengthening of the identity of Central Europe within the European Union and supports the regional cooperation of the countries of Central Europe.

The aim of my research was to explore correlations between the competitiveness of this group of countries and the development level of human resources living there. These countries have been cooperating for centuries in the field of economy, culture, politics and trade. The research was meant to answer the following questions:

- Do the multi-dimensional relations within the group of the countries have common features determining their competitiveness?
- Are human resources just as dominant for all regions with different culture and mother language?

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- Are there cross-border similarities or maybe differences despite the belonging together?

2. Competition of spatial units

The concept of competitiveness defined in the 6th regional report of the EU, which is the most widespread and most accepted definition, says the following: "the ability of companies, industries, regions, nations and supranational regions to generate, while being exposed to international competition, relatively high income and employment levels" (Lengyel 2003) In other words, the goal of the respective spatial units is to acquire "abilities" by which they are able to increase the amount of incomes generated in the given territory, their employment level and thereby the living standards of the inhabitants living there.

It means that there is competition among the territories (countries, regions, micro-regions and settlements). There is competition for the tenderable resources, for investors, and for all available resources, including not last the human resources (Tóth et al. 2008).

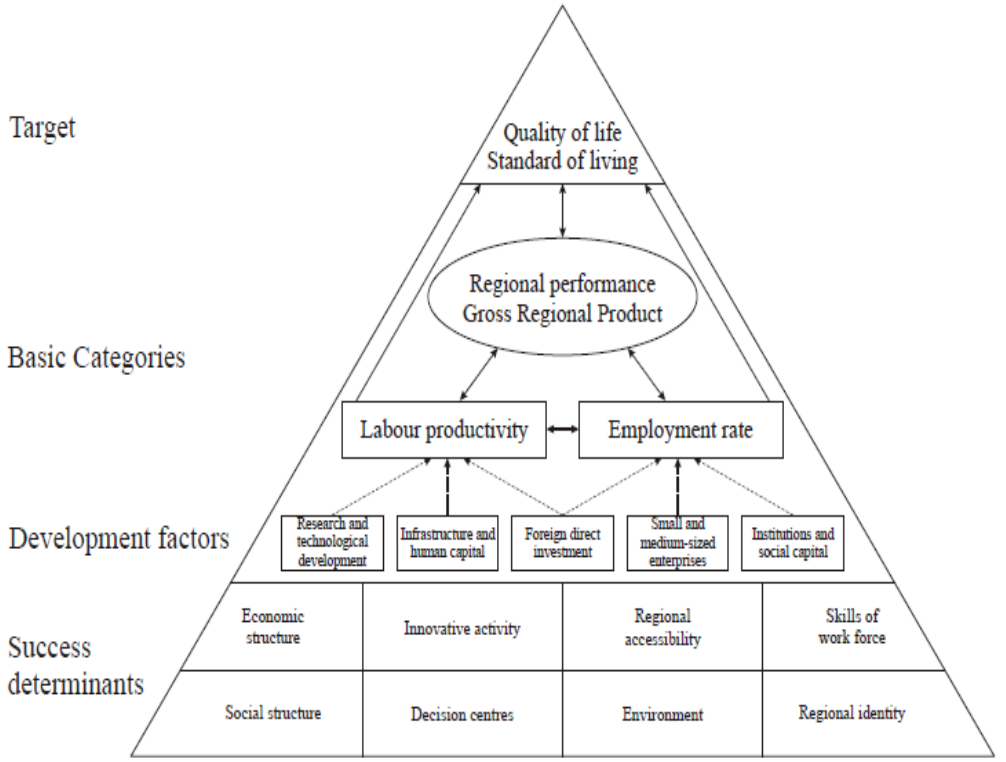
Regional competitiveness can be measured by three basic categories: work productivity, employment rate and incomes generated (GDP). The factors influencing these indices can be divided into two groups. One group is made by the basic factors that directly and usually in the short run influence incomes, employment and productivity. The development of these factors can strikingly improve the competitiveness of a region (Lengyel 2006). Basic factors are research and development, infrastructure and human capital, external direct investments, small and medium-sized enterprises, institutions and social capital. The indirectly working factors of success improve competitiveness in the long run, through indirect impacts. These factors are economic structure, innovation culture, regional accessibility, the preparedness of the labour force, social structure, decision-making centres, quality of the environment and the social cohesion of the region. The transformation of the basic factors, including then structure of human capital, is a direct tool for the improvement of competitiveness in the short-run.

3. The role of human capital in the development of the competitiveness

A basic question of regional science is the classification of regions. The typifying of regions has several methods, but each includes the development level of human capital as a basic criterion. In other words, one of the main powers of spatial organisation is knowledge. (Tóth 2009) The ability for the creation, acquisition and adaptation of knowledge determines the innovation capacities of the regions, and thereby competitiveness. Especially in the developed countries knowledge is an

outstanding power of spatial organisation. Knowledge is the main feature of the human resources. The neoclassical theory already recognised human capital as a key factor in economic development that explains the disparities among the regions. The theory differentiates between materialised and non-materialised technical development. Materialised technical development is an innovation investment itself, while non-materialised development is the provision of qualified workforce able to apply the technology. It is non-materialised technical development that is the basic source of disparities among the regions. The regions that have a high level of knowledge specialise themselves in activities such as R & D, scientific research and innovation. Regions lass abundant in human resources will specialise themselves in routine activities, the technology of which is globally available. This process further deepens the disparities among the regions. In the pyramid model of competitiveness (Lengyel 2006) human capital is among the basic factors, i.e. among the driving forces outside the economy that explain the competitiveness of a region in the short run. (Figure 1)

Figure 1. The pyramid model of regional competitiveness



Source: Lengyel (2003)

The basic hypothesis of the research is that human capital is a dominant factor in determining the competitiveness of regions. Global competition in the 21st century is not for goods or services or capital; it is for humans, for intellectual capital. It means that those regions will have a competitive advantage and develop that concentrate the advanced human resources.

4. The data

In my essay I look at the NUTS2 level territorial units of the 4 Visegrád countries, i.e. 8 regions in the Czech Republic, 7 regions in Hungary, 16 regions in Poland and 4 regions in Slovakia (Appendix 1.).

The research is built on the analysis of seven indices. The first index is the most frequently used measure of competitiveness, Gross Domestic Product per capita, the remaining indices focus on some aspects of human resources.

The indices examined were as follows:

- GDP per capity in Euro
- Number of higher education students in per cent of the total population
- Number of R & D employment in per cent of total employment
- Unemployment rate (in per cent)
- Number of employment in the field of science and technology in per cent of the total active population
- Employment rate (in per cent)
- Number of pupils and students in per cent of the total population

The data are so-called hard data that come from the databank available on the website of the Eurostat. I calculated relative indicators from the data of 2006, so that the differences coming from the size of the respective regions should not influence the research findings. The potential mistakes caused by the different units and magnitude of the data were handled by the method of standardisation.

5. The methods

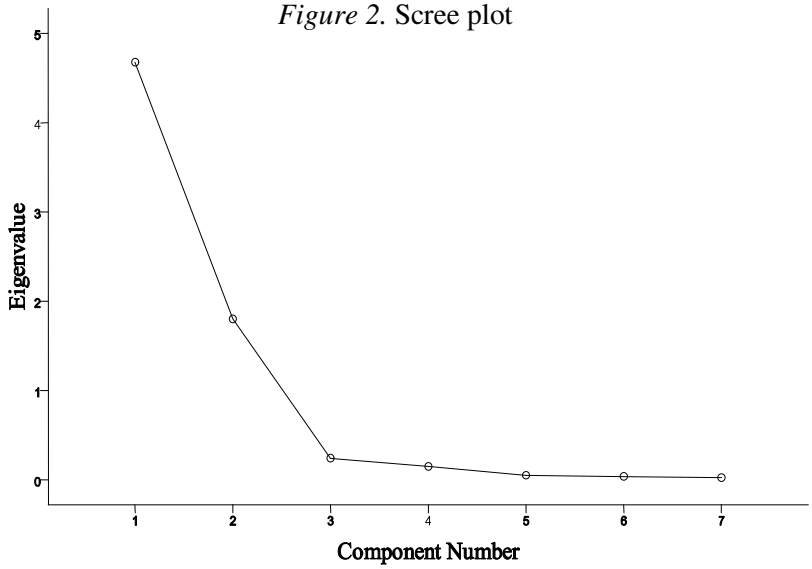
The research operated, in addition to the tools of descriptive statistics, with the methods of principal component analysis and cluster analysis. Principal component analysis is a special case of factor analysis. Factor analysis is a tool that can be successfully used for the explanation of a large number of variables with a smaller number of uncorrelated latent variables. Principal component analysis can be used for the preservation of the mass of information accumulated in the variables without a major loss, in a smaller number of uncorrelated variables, principal components (Kovács – Lukovics 2006). This method is good for making a statistical analysis in a

transformed smaller dimension space without losing important information. It can be used successfully if we have a large number of variables, strongly interrelated stochastically, that carry redundant information (Ketskeméty - Izsó 2005). Cluster analysis is a multi-variable statistical method, a segmentation of data by which blocks of data can be ordered into homogenous groups. These groups are called clusters. The main objective of cluster analysis is to classify the examined cases into relatively homogeneous groups, using of selected data, in a way that the observation units in a respective cluster should resemble each other but be different from the members of other groups.

6. The research findings

By using principal component analysis I ordered the listed indices into two well separable factors. The reasonability of ordering the indices into two principal components is justified by the values in Figure 2 and of the communality. The principal component analysis computed communality for each variable, which is actually a multiple coefficient of determination. The multiple of coefficient correlation that can be calculated from this shows the closeness of the correlation between the principal components as explanatory variables and original components as dependent variables. The communality of all seven indices is over 0.8. This means that the two principal components quite well aggregate the information content of the seven indices.

Figure 2. Scree plot

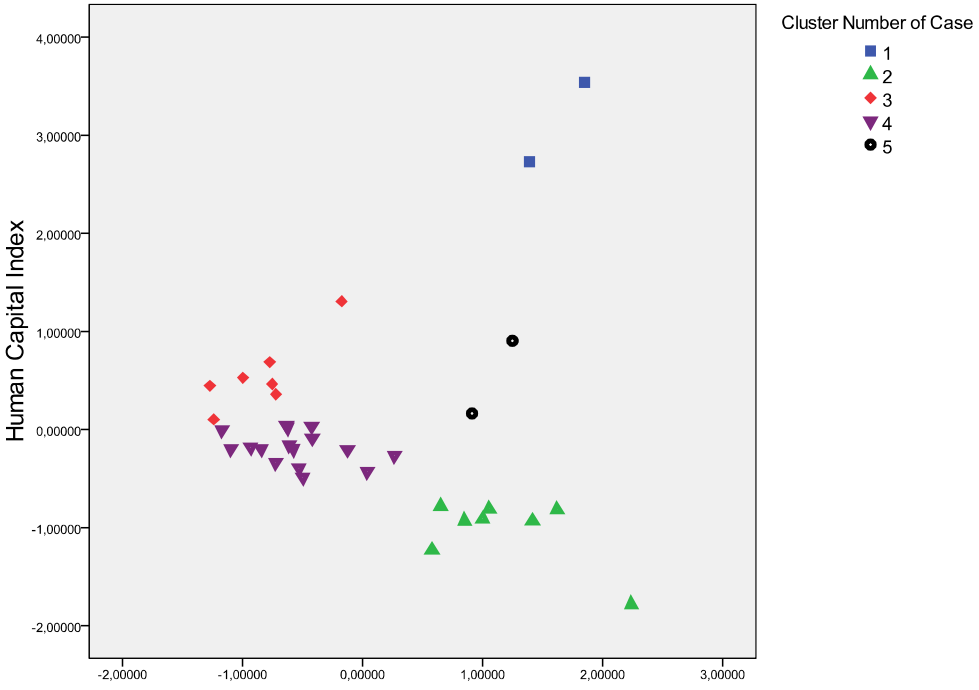


Source: Own calculation based on data from Eurostat's with statistical softver SPSS 17

The Eigenvalue of the first principal component is 4.678 and explains 66.822% of all variances of the original variables. This factor contains the proportion of higher education students, the proportion of R & D employees, the number of pupils and students in per cent of the total population, and the number of those employed in science and technology in per cent of the total active population. I called this factor Human Capital Development Index. The Eigenvalue of the second principal component is 1.803 and it explains 25.763% of the total variance of the original variables. Thus these two factors together determine 92.585 of the variance of the original variables. The indicators of the second principal component are employment and unemployment rate and the value of GDP per capita. I named this factor the Competitiveness index, because two of its components are measurable base categories of competitiveness.

In the next step I put the 35 territorial units into clusters based on the two principal components. The method I used was k-means clustering. On the basis of the analyses run, the creation of two clusters or five clusters is also a meaningful solution. First I looked at the five-cluster solution (see Figure 3.).

Figure 3. The Clusters



Source: Own calculation based on data from Eurostat's with statistical sotver SPSS 17

Cluster one includes the capital city of the Czech Republic and the region around the capital city of Slovakia. The average GDP per capita in the cluster is € 21,250. The two regions are characterised by low unemployment and a high employment rate. Twenty-nine per cent of their population takes part in some form of full time education, 3.05% of them in higher education. A high proportion of the economically active population works in the fields of science and technology, and research and development. In all indices examined, the values of Prague are better, i.e. incomes generated are higher, as is employment level, and the human resources of this area are more qualified.

Cluster two involves eight regions, which are characterised by a low development level of human resources and relatively high competitiveness. Among the members of the cluster we find two Hungarian, one Slovakian and five Czech regions. It is interesting to observe the location of the regions. The eight regions surround in a semi-circle, in an arch, Austria and the developed regions of South Moravia and Bratislava. The average GDP per capita in this cluster is € 9,050. The relatively high employment level has a standard deviation in a no more than 6.3% interval. The differences of the unemployment rates are much bigger among the regions that make this cluster. The proportion of higher education students is very low, as is the percentage of those employed in the field of R & D. Among the members of the cluster, the competitiveness of Middle Bohemia (Stredni Cechy) is outstanding, but the proportion of pupils and students is very low, so it is the region with the least developed human resources. The reason for this is that the region is situated around Prague. The capital city as a knowledge centre concentrates the educational and research functions, and the highly skilled labour force living here provides one of the most important factors of competitiveness, human capital, for the neighbour region as well.

Cluster three has low competitiveness regions with medium developed human resources. This cluster concentrates seven regions from Poland. The average GDP per capita in this cluster is € 7,371; unemployment rate on the average is 14.56%, with a standard deviation at an only 5% interval. The number of pupils is high, but only 1.07% of the population are higher education students. The proportion of those employed in R & D sector and in science and technology is almost the same as the average of the regions in cluster five.

Cluster four has regions with weak competitiveness, in which the development level of human capital is low. This cluster involves one Czech, two Slovakian, four Hungarian and nine Polish regions. The regions that belong to this cluster lag in all examined indices behind the average values of the other clusters. The cluster is generally characterised by a high unemployment level, but there are significant differences across the individual regions in this respect. The lowest unemployment rates are recorded in the South Great Plain region in Hungary, while the highest unemployment strikes East Slovakia (Vychodne Slovensko). The proportion of higher

education students is low; the smallest number of students study in East Slovakia and the Lublin Voivodship in Poland (Lubelskie).

Cluster five has two regions as well, the region of Central Hungary and South Moravia in the Czech Republic. These two regions are characterised by a medium competitiveness and medium developed human resources. In this cluster the average GDP per capita is 49.1% lower, and average unemployment rate is 64.9% higher than in the previous cluster; also, the average rate of employment lags somewhat behind that. The rate of pupils and students is almost the same as in the previous cluster, but only 1.4% of the population is students in higher education. The proportion of those employed in science and technology, and research and development is approximately half of the values of the previous cluster. (Table 1.)

At the designation of two clusters, the capital cities and the regions surrounding them were put into the same group. In this cluster there is a positive correlation between the development level of human capital and competitiveness, while this correlation is negative in all other regions. The first cluster features an average GDP per capita value of € 17,175. Of the total population, 27.10% are pupils and students, of which the proportion of higher education students from all inhabitants is 2.28% on the average; 3.06% of all employees work in research and development, 46.15% of the active population are employed in high-tech sectors, unemployment rate is 6.20% and employment rate is 65.73%. The regions in the other cluster have an average GDP per capita of € 7,087.10. Of the total population of the cluster, 22.75% are pupils and students, of which the proportion of higher education students is only 0.81%. In R & D sector 0.88% of the population, in science and technology 27.75% of the population is employed. Unemployment rate is high (11.78%), while the average value of employment rate is 56.85% (Figure 4.).

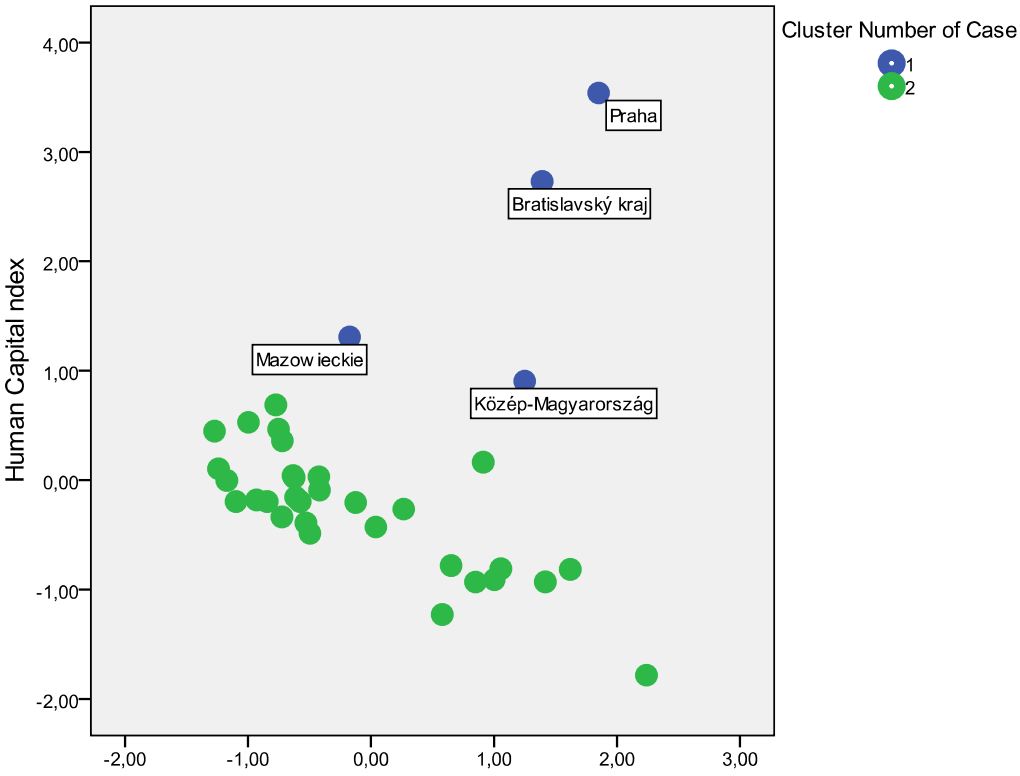
Table 1. Cluster membership of the regions

NUTS 2	Region	Cluster
CZ01	Praha	1
SK01	Bratislavský kraj	1
CZ02	Střední Cechy	2
CZ03	Jihozápad	2
CZ04	Severozápad	2
CZ05	Severovýchod	2
CZ07	Střední Morava	2
HU21	Közép-Dunántúl	2
HU22	Nyugat-Dunántúl	2
SK02	Západné Slovensko	2
PL12	Mazowieckie	3
PL21	Malopolskie	3
PL41	Wielkopolskie	3
PL42	Zachodniopomorskie	3
PL51	Dolnoslaskie	3
PL62	Warminsko-Mazurskie	3
PL63	Pomorskie	3
CZ08	Moravskoslezsko	4
HU23	Dél-Dunántúl	4
HU31	Észak-Magyarország	4
HU32	Észak-Alföld	4
HU33	Dél-Alföld	4
PL11	Lódzkie	4
PL22	Slaskie	4
PL31	Lubelskie	4
PL32	Podkarpackie	4
PL33	Swietokrzyskie	4
PL34	Podlaskie	4
PL43	Lubuskie	4
PL52	Opolskie	4

PL61	Kujawsko-Pomorskie	4
SK03	Stredné Slovensko	4
SK04	Východné Slovensko	4
CZ06	Jihovýchod	5
HU10	Közép-Magyarország	5

Source: Own calculation

Figure 4. Two clusters int eh countries of Visegrád



Source: Own calculation based on data from Eurostat's with statistical sotver SPSS 17

7. Summary

When classifying the regions of the Visegrád countries into five clusters we can see an axis along which the competitiveness and the development level of human capital of the regions improves from east to west. This classification justifies that the human resources do not determine the competitiveness of regions to the same extent, but this

fact is irrespective of the individual countries. In all four countries we find highly competitive regions and regions lagging in competitiveness, with human resources of different endowments.

If we order the regions into two clusters, we can see a basic identity. The regions around the capital cities, with their advanced economies, entertainment, cultural, career and other possibilities attract and keep intellectual capital, gaining thereby a considerable competitive advantage. The biggest difference between the two clusters can be seen in R & D sector and in the proportion of those employed in the sector of science and technology. It is clear that in regions where knowledge is concentrated, high-tech industry appears and the regional incomes increase. Between the school education indices of the two clusters there are no such significant disparities as in the case of employment in research and development, and science and technology. This justifies the assumption that in these regions one of the most significant competitiveness factors is human capital. The negative correlation between the development level of human capital and competitiveness is an interesting phenomenon that requires further researches.

Appendix 1. Regions in the countries of Visegrád

Code NUTS 2	**Name of Region**
CZ01	Praha
CZ02	Střední Cechy
CZ03	Jihozápad
CZ04	Severozápad
CZ05	Severovýchod
CZ06	Jihovýchod
CZ07	Střední Morava
CZ08	Moravskoslezsko
HU10	Közép-Magyarország
HU21	Közép-Dunántúl
HU22	Nyugat-Dunántúl
HU23	Dél-Dunántúl
HU31	Észak-Magyarország
HU32	Észak-Alföld
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PL12	Mazowieckie
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PL41	Wielkopolskie
PL42	Zachodniopomorskie
PL43	Lubuskie
PL51	Dolnoslaskie
PL52	Opolskie
PL61	Kujawsko-Pomorskie
PL62	Warminsko-Mazurskie
PL63	Pomorskie
SK01	Bratislavský kraj
SK02	Západné Slovensko
SK03	Stredné Slovensko
SK04	Východné Slovensko

Source: Own calculation

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