The Development Potential of the Regions of the EU

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Abstract:

The aim of the paper is to express the potential of the NUTS 2 regions in the EU in order to enable the policy-makers to better target the financial support. The sustainable development of the regions is stressed in many strategic documents of the EU, recently in Europe 2020 - The EU strategy for smart, sustainable and inclusive growth. For meaningful distribution of subsidies which should contribute to the enhancement of the regions' development, the policy-makers should know what are the strength and weaknesses of each region, i.e. what is its development potential.

In our study we have chosen indicators commonly used by scholar to assess the development potential of regions and compartmentalized them in four groups: economic and social area, equipment and agricultural characteristics. The data obtained from Eurostat for NUTS 2 regions in the EU were analysed by principal component analysis. This enabled to choose only indicators which significantly contribute to principal components and to avoid multicolinearity among variables. Using hierarchical cluster analysis (Ward's method and Squared Euclidean distances), the regions were clustered into groups with same characteristics. These imply that that all regions in a cluster have similar development potential. The clusters were described and the regions compared in the values of particular indicator to the average of the values of all regions. This enabled to distinguish the areas with higher or lower potential for development. The policy-makers should concentrate the finances to the regions with lower development potential, which are mainly in Bulgaria and Romania and to Cyprus.

Key words:

development potential, NUTS 2 region, principal component analysis, cluster analysis

Introduction

European Union provides funds for regional development since 1980s. The need for financial support to mitigate the differences has risen with entrance of less developed Greece in 1981 and later Spain and Portugal in 1986. EU regional policy is an investment policy which supports job creation, competitiveness, economic growth, improved quality of life and sustainable development. These investments support the delivery of the Europe 2020 strategy. (DG Regio, 2013)

"Structural and Cohesion Funds are instruments to promote economic and social cohesion." (Mairate, 2006) It is necessary, that policy-makers are aware about the impact of the programmes and measures. A precondition for achieving desired results is to target the support according to the needs of the particular region. "The aim of the regional policy is that the region should have the same chances and possibilities and that their demographic, economic and natural potential would be fully utilized." (Binek et al., 2009) For meaningful distribution of subsidies which would contribute to the enhancement of the regions' development, the policy-makers should know what are the strength and weaknesses of each region, i.e. what is its development potential.

The development potential can be expressed by various indicators. Since 1934, when it was elaborated by Simon Kuznets, GDP is a traditional indicator of the economic growth. For

the purposes of the comparison of standards of living, GDP or GNP per capita is used. This measure is also utilized for subsidies targeting in the EU. Objective 1 of the Structural and Cohesion Funds aimed at regional convergence "includes countries, or regions of countries, whose general level of economic development is regarded as lagging behind the average for the Union as a whole. The conventional threshold of Objective 1 status is a level of Gross Domestic Product (GDP) per head less than 75 % of the average." (Bradley, 2006) Objective 2 – Regional Competitiveness and Employment is aimed at the regions above the 75% GDP per capita threshold.

However, GDP measure has been for a long time a subject of wide criticism. As Palumbo (2013) stated "even those who defend GDP would admit that GDP alone cannot measure all aspects of human development, does not account for social costs, and should be complemented by alternative indicators." For the measurement of regional development have been designed alternative indicators that allow assessing the development according to the territorial specifics. Despite that numbers of alternative indicators has been suggested, it is difficult to choose the optimal ones as there is no common understanding of development. Therefore, we argue that it is better to substitute the real indicators by artificial variables using principal components analysis. These variables will capture the most of the variance in the original variables and enable to reduce their number. The artificial variables (appropriately interpreted) can be utilized in consequent analysis.

The aim of our paper is to identify the appropriate indicators of the development potential of the NUTS 2 regions in the EU and cluster the regions according to their similarities in order to enable the policy-makers to better target the financial support for regional development. The structure of the paper is as follows: In the literature review, we introduce the indicators commonly used for development measurement in various researches. Next section includes the description of used methods (principal component and cluster analysis) and of the data sample. Then we present the results of the analysis and consequently suggest measures to be taken by policy-makers. The last section contains the conclusions.

Regional development measures

Bernard (2011) defines development as a process of change that leads to the improved quality of life. "Achieved development level is the result of external factors which influence the situation in the village, but is also determined by internal development potential of the village." (Bernard, 2011). The very same is true for the development of the regions. The potential is a precondition for the development.

It is not easy to define the development potential, because, as Boháčková and Hrabánková (2009) state, "thanks to the variability of the regions the development potential is not always fully identical and is not composed of the similar conditions, factors and characteristics." This implies that what can be a potential for development in one region does not have to be necessary the potential in another. They suggested tangible capital and human potential indicators. The tangible capital was further divided on quantitative and qualitative. From quantitative were suggested (1) number of enterprises by: the sphere of business, by size and by legal status; (2) efficiency of enterprises, (3) number of entrepreneurs on 1 000 people, (4) investment rate; (5) tax yield of the municipalities, (6) GDP / capita, and (7) GDP / employed person. Qualitative indicators included those from the environmental area. Human potential was measured by (1) demographic development, (2) employment, (3) incomes, (4) population health, and (5) education structure.

Agarwal et al. (2009) studied economic results of the UK´s rural areas. They were searching for key factors which enhance the competitiveness of the territories and came to the conclusion, that the essential development drivers are economic and human capital. Cultural and environmental capital, productivity, employment and participation on the job market were not that important. Economic potential can be measured by indicators such as income, material living conditions, and unemployment and employment rates.

Stewart (2005) included in his analysis of the well-being in the EU regions: average household income, poverty rate in relation to national and in relation to the regional standard, the quality of housing, the proportion of people out of work, long-term unemployment, two indicators of education, the standard mortality rate of women and men, poor health among men and women, child mortality, membership in clubs and visiting friends / neighbours at least once a week. Palumbo (2013) suggests the indicators which should measure the development and progress based on the EU´s surveys. He presents the result of the GlobeScan research (2011), where was suggested to include health, social and environmental statistics to measure national progress. Special Eurobarometer 295/March 2008 showed that more than two thirds of EU citizens feel that progress should be measured using environmental, social and economic indicators equally.

Dufek and Minařík (2010) in order to measure the human resources in the regions of the CR as the potential for their development utilized indicators from: (1) demographic area, (2) economic and employment field, (3) standards of living and social level, and (4) education, health and criminality. The demographic development was assessed by the population density, share of rural inhab., age structure, age index, life expectancy at birth of males and females, number of live born and number of death on 1000 inhab., and migration increment on 1000 inhab. The economic level and employment is expressed by registered subjects on 1000 inhab., employed on 1000 inhab., rate of economic activity, number of job seekers on 1000 inhab., available jobs on 1 job seeker and registered unemployment rate. Standards of living and social level was determined by GDP and Net Revenue per capita, average wage, number of pension receivers on 1000 inhab., average pension, number of places in social care on 1000 inhab. Education and health of the population was expressed by number of students at high schools and universities on 1000 inhab., number of inhab. per 1 doctor, and average work inability. The criminality was represented by number of crimes on 1000 ihab.

Set of methodologies for assessing economic and development potential of the area was elaborated by the advisory company of the Ministry for Regional Development in 2009 (Poledníková, 2013a). They utilized the indicators from the area of the human resources, scope, intensity and structure of the economic activities, economic and innovative ability, institutions and the support of the business, geographical position, transport accessibility and settlement structure.

Transformation of the available resources to the development potential must be selective. The actors must choose only few development directions. The policy makers should support these directions by subsidies. Therefore, it is essential for them to have the necessary information.

Materials and Methods

The data about NUTS II regions in the EU were obtained from the Eurostat database and are actual as of August 2013. We selected particularly indicators from economic, social (human resources), equipment, and agricultural characteristics. The indicators, units and year for which the data were available are displayed in Tab. 1.

There are 270 regions at NUTS 2 in the EU. We have chosen 66 regions from 14 countries: Czech Republic, Denmark, Bulgaria, Ireland, Spain, Cyprus, Latvia, Lithuania, Luxembourg, Hungary, Austria, Romania, Slovakia, and Sweden according to the data availability.

Each region has the same weight. It is possible due to the fact that NUTS II were created in order to make possible the comparison between states and to create as homogenous groups as possible. The NUTS regulation defines minimum and maximum population thresholds for the size of the NUTS II regions from 800 000 to 3 000 000 inhabitants.

Tab. 1: Indicators from economic, social, equipment and agricultural area

Nr.	***Economic indicators***	***Units***	***Year***
1.	Employed persons	1000 hours worked	2010
2.	Employees	1000 hours worked	2010
3.	Unemployment	1 000 pers.	2012
4.	Unemployment	1 000 pers. 20–64 years	2012
5.	Unemployment	1 000 pers. 25+ years	2012
6.	Long-term unemployment (over 12 months)	nr. persons	2012
7.	Long-term unemployment rate	%	2012
8.	Long-term unempl. as a % of the total unempl.	%	2012
9.	GDP at current market prices	euro per inhabitant	2010
10.	GDP at current market prices	euro per inhabitant in % of the EU average	2010
11.	GDP	millions of PPS	2010
	Social indicators		
12.	People at risk of poverty or social exclusion	%	2011
13.	Infant mortality rates	‰	2011
14.	Pupils and students in all levels of education	% of total population at regional level	2011
15.	Purchasing Power Standard per inhabitant		2010
16.	Purchasing Power Standard per inhabitant	% of the EU average	2010
17.	Income of households	euro per inhabitant	2009
18.	Disposable income, net	euro per inhabitant	2009
	Equipment indicators		
19.	Households with access to the Internet at home	nr. persons	2012
20.	Percentage of households with Internet access at home	%	
21.	Households with broadband access	%	2012
22.	Frequency of Internet access: once a week	%	2012
	Agricultural indicators		
23.	Farmland (UAA)	hectares	2007
24.	Sole holders working on the farm	nr. persons	2010
25.	Labour force - members of sole holders' family	nr. persons	2010
26.	Family labour force	nr. persons	2010
27.	Regular non family labour force	nr. persons	2010
28.	Regular labour force	nr. persons	2010
29.	Annual Working Unit (AWU): Sole holders	nr. persons	2010
30.	AWU: Labour force: members of sole holders' family	nr. persons	2010
31.	AWU: Family labour force	nr. persons	2010
32.	AWU: Regular non family labour force	nr. persons	2010
33.	AWU: Regular Labour force	nr. persons	2010
34.	AWU: Non-family labour force working on non-regular basis	nr. persons	2010
35.	AWU: Total: Labour force not directly employed by the holding	nr. persons	2010
36.	AWU: Female: Labour force not directly employed by the holding	nr. persons	2010

Source: Eurostat (2013)

Firstly, the sample is characterized using descriptive statistics – arithmetic mean, standard deviation and variation coefficient. Because the indicators were measured in different units, the data were standardized by *Z*-transformation as expressed in equation 1. This enabled to exclude the influence of different level and variability of the indicators.

$$Z_{ij} = \frac{x_{ij} - \bar{x}_i}{s_i} \tag{1}$$

where x_{ij} is the value of $i^{(th)}$ indicator of $j^{(th)}$ region, $\bar{x}_i$ is a mean of the $i^{(th)}$ indicator, s_i represents standard deviation of the values of the $i^{(th)}$ indicator.

For the quantification of the development potential of the regions principal component analysis is utilized. This method enables "to reduce the dimensionality of a data set consisting of a large number of interrelated variables, while retaining as much as possible of the variation present in the data set. This is achieved by transforming to a new set of variables, the principal components (PCs), which are uncorrelated, and which are ordered so that the first few retain most of the variation present in all of the original variables. (Jolliffe, 2006). These principal components are consequently used to replace them with artificial variables – so called principal components.

The regions were grouped according to the new artificial variables using hierarchical cluster analysis which minimize variability within clusters and maximize variability between clusters," (Poledníková, 2013b). It "is a method for displaying the similarities and dissimilarities between pairs of objects in a set," (Romesbourg, 2004). The distances between objects were computed by Euclidean method based on Pythagoras' theorem because the "most of the existing clustering methods are typically built on the Euclidean distance and geared toward analysing continuous response," (Baolin, 2012).

The agglomerative clustering procedure used Ward's method based on the analysis of variance to evaluate the distances between clusters. "This approach does not combine the two most similar objects successively. Instead, those objects whose merger increases the overall within-cluster variance to the smallest possible degree are combined," (Mooi, Sarstedt, 2011). The cluster analysis included the regions with the same development potential to one group. Agglomeration schedule was used to determine the number of clusters. The clusterization was stopped when the increase in the coefficients between two adjacent steps was large. This was observed from a plot of linkage distances across step.

Groups of regions were consequently described and compared and the policy suggestions were formulated.

Basic statistics, Principal Component Analysis and Cluster Analysis were calculated in Statgraphics Centirion XVI, version 16.1.11, Statistica 64, version 10 and IBM SPSS Statistics 20, release 20.0.0.

Results and discussion

Descriptive statistics of the indicators in a sample are presented in Tab. 2. The regions are quite diverse as in the majority of cases the standard deviation is much higher than arithmetic mean. Coefficient of variation is the highest in case of *employed persons* and *employee's* indicators. On the other hand, the regions are the most similar in *percentage of households with Internet access at home*. Huge differences between minimal and maximal values among regions were found also in case of agricultural characteristics. There are regions with no agriculture at all, as there is neither utilised agricultural area (UAA), neither labour force.

Tab. 2: Statistical characteristics of the variables

	Mean	Minimum	Maximum	Std. Dev.
Employed persons	12366.8	47.000	721366	88621
Employees	9530.1	42.200	554667	68140
Unemployment	138.8	12.800	1390	218
Unemployment from 20 to 64 years	131.8	12.200	1337	210
Unemployment over 25 years	112.4	9.200	1163	183
Long-term unemployment (12 months and more)	62.5	2.400	602	99
Long-term unemployment rate	5.8	0.540	19	4
Long-term unemployment as a percentage of the total unemployment	41.2	15.410	71	14
Gross domestic product (GDP) at current market prices	21348.5	2900.000	78600	14502
Gross domestic product (GDP) at current market prices (%)	87.2	12.000	321	59
GDP (Millions of PPS)	40715.5	1630.000	208261	39669
People at risk of poverty or social exclusion (%)	26.7	9.100	60	12
Infant mortality rates (‰)	4.6	1.700	11	3
Pupils and Students in all levels of education - as % of total population at regional level	21.6	13.600	29	4
Purchasing Power Standard per inhabitant	22333.3	6500.000	65200	10627
Purchasing Power Standard per inhabitant in percentage of the EU average	91.3	26.000	266	43
Income of households (euro per inhabitant) - 2009	12733.4	1668.400	29079	7726
Disposable income, net (euro per inhabitant) - 2009	11266.7	2078.000	27689	6340
Households with access to the Internet at home (%) - 2012	70.2	38.000	95	14
Households with broadband access (%) - 2012	66.9	38.000	89	13
Percentage of households with Internet access at home - 2012	95.7	73.000	100	5
Frequency of Internet access: once a week (including every day) (%) - 2012	67.2	38.000	95	15
Utilised agricultural area (ha) - 2007	953133.5	0.000	5471310	1120588
Sole holders working on the farm - 2010	87621.4	0.000	795300	173607
Labour force - members of sole holders' family - 2010	79623.2	0.000	666190	149304
Family labour force - 2010	167244.4	0.000	1452490	321707
Regular non family labour force - 2010	10603.0	0.000	72800	11005
Regular Labour force - 2010	177846.2	0.000	1468960	325815
AWU: Sole holders - 2010	25305.6	0.000	182820	36943
AWU: Labour force: members of sole holders' family - 2010	18302.0	0.000	137680	29531
AWU: Family labour force - 2010	43607.6	0.000	320510	66215
AWU: Regular non family labour force - 2010	7530.3	0.000	36710	6734
AWU: Regular Labour force - 2010	51137.7	0.000	331340	68957
AWU: Non-family labour force working on non-regular basis - 2010	4772.9	0.000	98650	12973
AWU: Total: Labour force directly employed by the holding - 2010	55909.8	0.000	354720	76535
AWU: Female: Labour force not directly employed by the holding - 2010	1112.4	0.000	15280	2473

Source: own calculation based on data from Eurostat (2013)

After the standardization of the variables, PCA was performed. All together the first 3 PC accounted for the 78 % of the total variation in the original indicators. The first PC is fed positively by frequency of internet access once a week and negatively by AWU indicators. The second PS is mostly influenced by economic indicators related to unemployment and long-term unemployment. For the third PC, indicators such as long term unemployment rate, % of households with internet access at home and sole holders working on the farm and family labour force at a farm.

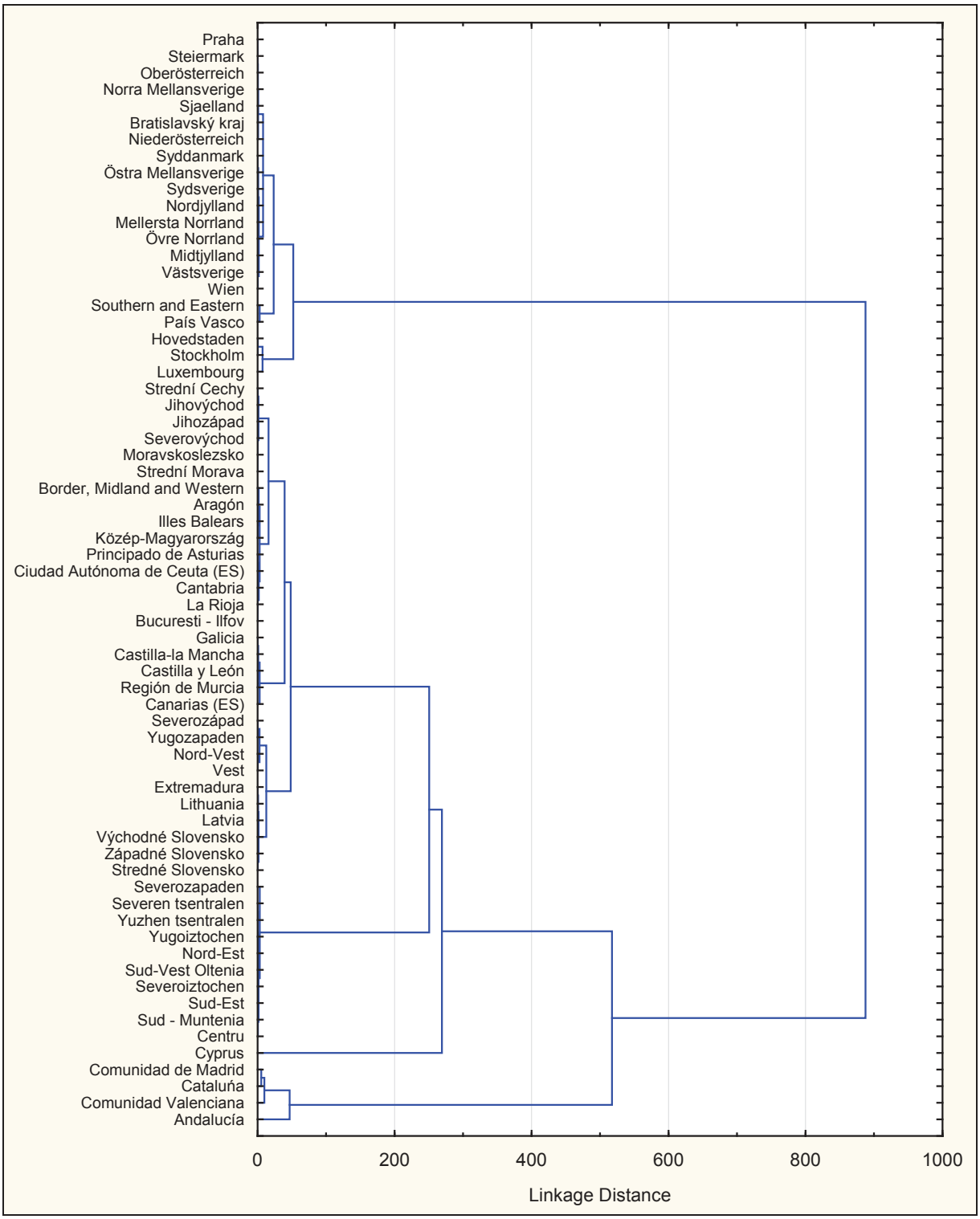

Fig. 1: Dendrogram for 66 regions

Source: own calculation based on data from Eurostat (2013)

We took those 3 PC and clustered the regions in the EU according to them. Amalgamation schedule suggested that the cut should be done at distance of 53 created. This created 4 groups of regions. The dendrogram for all analysed regions is displayed at Fig. 1. First group consisted of 21 regions, mostly from Denmark, Austria and Sweden. Also Prague (CR) and Bratislavský kraj (Slovakia), all Luxembourg, Southern and Eastern region in Ireland and País Vasco (Spain) were included. This cluster can be considered to have the best development potential as the employment (in 1000 hours worked) is relatively high and

the average unemployment in total or in all categories is the lowest from all regions. Long-term unemployment rate is only 2.17 % in average, which accounts for 27.55 % of the total unemployment. What is more, the average GDP in this group is the highest. Similarly social characteristics are favourable in these regions. There are only 17.10 % people at risk of poverty or social exclusion while in other regions the percentage is much higher. Infant mortality rate is lower than 3 ‰. 24.83 % of total population in a region are pupils and students in all levels of education. The economic situation of households is also good, as the PPP per inhabitant is over EU average (134.95 %), income per households is almost 21 000 euros per inhabitant. This cluster is also the best in terms of equipment. Majority (83.43 %) of households have access to the internet at home, 80.67 % to the broadband internet and almost 84 % of them are using internet regularly at least once a week. On the other hand, UAA is the lowest as same as the number of sole holders working on the farm. There is the less labour force in all categories (total, family labour force, non-family labour, AWU).

Other groups are not that clearly determined, but as the second most develop cluster can be considered number 4 with four Spanish regions: Comunidad de Madrid, Cataluña, Comunidad Valenciana and Andalucía. The economic situation is bad due to low number of employed inhabitants and high unemployment – long-term unemployment rate reached 11.75 % (which is 45.42 % of total unemployment). On the other hand, GDP is quite high (167 188.50 mil. of PPS). Social situation is not that bad as in group 3 and 4, but there are 26.30 % of people at risk of poverty and infant mortality rate is over 3 ‰. Relatively high percentage of pupils and students of the total population (22.50 %) is at all levels of education. PPS are above EU average (102 %). Only 69 % of households have the internet access at home, but they access it frequently (66.25 % of people use internet at least once a week). Average UAA is the highest from all regions here as same as regular non family labour force.

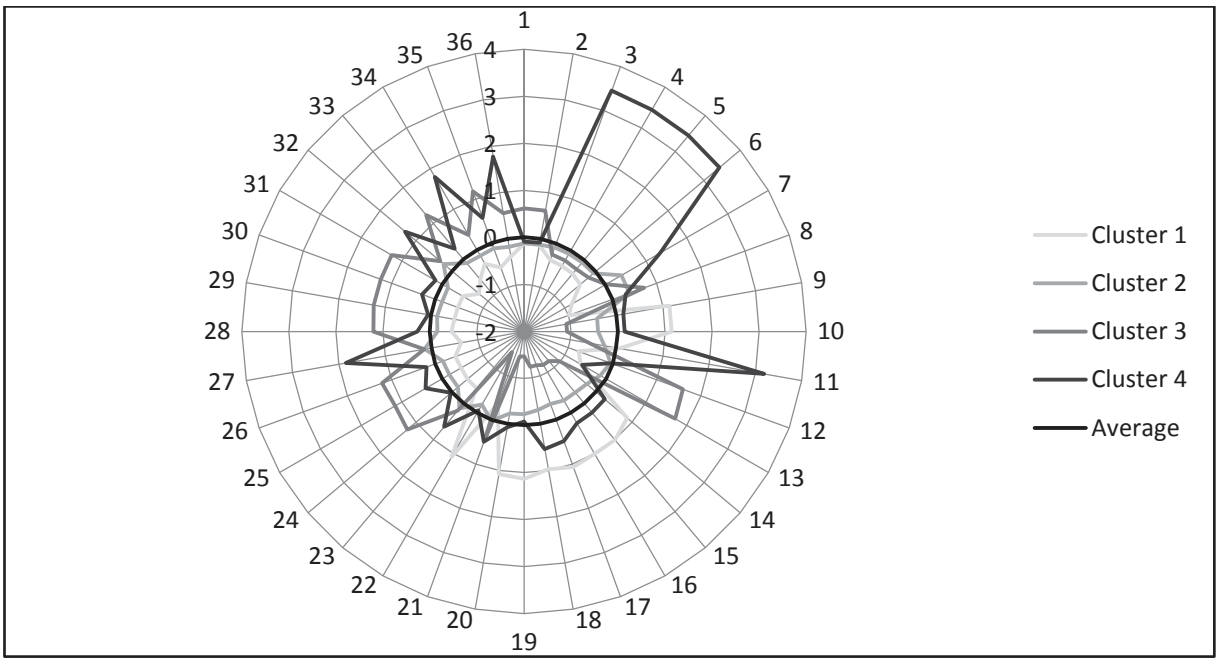

Fig. 2: Comparison of clusters to the region´s average

Source: own calculation based on data from Eurostat, (2013)

Cluster number 2 contains 30 regions mainly from Czech Republic, Slovakia, Spain and Romania. There is also one region from Bulgaria, Hungary and Ireland and Lithuania and Latvia. The development potential of these regions is lower as the long-term unemployment is quite high (7.54 %) and 46.58 % of unemployed persons are long-term unemployed. GDP is 20 416.60 mil. of PPS which is much lower than in regions in cluster 1 and 4, but still

higher than in cluster 4. There are 26.16 % at risk of poverty or social exclusion and high infant mortality rate, which implies worse social conditions.

On the other hand the share of pupils and students at all level of education on all population is not that low (almost 21 %). PPS reaches only 78 % of the EU average. Equipment with internet is even lower (66.77 %) as same as the frequency of its usage. UAA is quite high, but average number of labour force is lower than in cluster 3 or 4.

Regions in cluster 3 (6 from Bulgaria, 5 from Romania and Cyprus) have the highest amount of people employed and the long-term unemployment rate (5.84 %) is not that bad, but it reaches 51.27 % of the total unemployment. GDP in mil. of PPS is the lowest from all clusters (only 17 443.27). Social conditions are also unfavourable as there are 46.53 % of people at the risk of poverty and infant mortality rate is high (9.25 ‰). Also there is only 17.78% share of students at all level of education. PPS are only at 40.09% level of the EU average and disposable income is 5 times lower than in the first cluster. The regions in cluster 3 have also low access to the internet (only 49.09 % of households). This cluster might have the good development potential only in agriculture, but the high amount of labour used can suggest lower labour productivity.

The comparison of selected indicators to the common arithmetic mean is displayed at Fig. 2. As all indicators are expressed in different units, standardised values were used. The numbers correspond to the number of indicator (see Tab. 1).

Conclusion

The aim of this paper was to assess the development potential of the regions in the EU in order to help the decision makers to better focus the financial support. Principal analysis selected three principal components which capture the most of the variability in original variables (chosen from economic, social, equipment and agricultural area). Consequently the regions were clustered into 4 groups according to their development potential.

We can summarize that the development potential is the highest in Sweden, Denmark and regions which contain the capital city. Cluster 4 (4 Spain regions including big cities) is intermediate. Cluster 2 is less developed, but the worst situation is in cluster 3, where Bulgaria and Romania regions and Cyprus have the less development potential. Hence, the highest financial support should be aimed at these regions.

We are aware that our sample contains only 24.4 % regions in the EU. Therefore, the challenge for future research is to search for newly available data and complete the sample to include all regions in the EU.

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