CLUSTER POTENTIAL IN SLOVAK REGIONS IN THE CONTEXT OF BUSINESS ENVIRONMENT'S QUALITY

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Abstract
The purpose of the paper is the statistical generation of clusters from 79 Slovak regions from the aspect of cluster potential which is identified based on the quality of its business environment. The main findingsof the papere are:

- Theoretical: (a) the creation of economic competitiveness subject's concept based on the knowledge of domestic and foreign relevant authorities in the area (b) development of the mutual relationship of competitiveness and prosperity (enterprises, regions, state) based on the innovation and business environment quality; c) presentation of clusters as a possible tool to ensure competitiveness of regions.
- Practical: (a) creation of five clusters from 79 examined regions (districts) of Slovakia at the level of NUTS IV based on their business environment quality (4 sub-indices): 1.economic activity, 2. public administration and legislation, 3. technology and infrastructure, 4. education and human resources; (b) identification of the business environment's strengths and weaknesses of the of created 5 clusters; (c) basic outline of the development strategy for the 5 created clusters; (d) methodology processing to identify clusters potential.

Keywords: quality business environment; competitiveness; prosperity; regions; cluster potential.

1. INTRODUCTION

Marshall (1920) identified the potential (economies of scale and spill-overs effects), which results from the local concentration of industries. On this observation later established authors (Porter, 1998, 1998a, 1988b, 2000, Dunning, 2000, Motoyama, 2008) further enhanced the knowledge around the concept of clusters and competitiveness. After Marshall, the studies of local concentrations were outside the interest of the mainstream of economic theory and from 1950s the studies have been developed in the framework of regional science and sprung into the spotlight in the 1980s. Since the beginning of the 1990s research focused on the relationship between different industries and their complementarity and

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analyses cooperation of companies with the government and other institutions through the network connections (clusters).

Kačírková (2011) research of clustering leads to a better understanding of the reasons why clusters are created and what is their contribution to the productivity, prosperity and innovation with a view to incorporate them into the design and development of national and regional economic programs and in this context are science, research, innovation, agglomeration tendencies, clusters and local environment significant theme of the policy makers and the academic community.

The objective of this paper is to show statistical generation of clusters from 79 Slovak regions at the level of NUTS IV from the aspect of cluster potential which is identified based on the quality of its business environment. This paper offers a possible solution for cluster-based policy composed into national and regional programs based on advantages and disadvantages (strengths and weaknesses) of the business environment.

2. METHODOLOGY

Competitiveness, prosperity, business environment and clusters

Kačírková (2008) notes that sustainable competitive advantage is founded on the combination of internal and external resources available at the national or local business environment (BE) in which are strategic decisions taken and business activity is formed. Gabrielová (2008) in this context points out that one of the characteristic features of the current trends of globalization and regionalization is leading to fragmentation of production processes as the various stages of the manufacturing process can be carried out practically anywhere where there are available competitive labour force and other inputs. Result is the creation of global and regional value chains and global and regional production networks. According to Porter (2000) globalization paradoxically reinforces the role of clusters and supports their development, because the removal of barriers to trade and investment leads to stiffer competition between sites. Based on Ketels and Sőlvell (2005) this leads to greater specialization in specific clusters and the possibility of access into these local clusters often becomes a source of competitive advantage for some companies that use inimitable benefits of participation in a given cluster, because only in this way they can differ from their competitors.

The concept of competitiveness is explored by many researchers who consistently state that the creation of wealth in the economy is influenced by factors (incentives) which affect the businesses from the different levels of their ambient (Table 1).

TABLE 1 – ANALYSIS OF THE CONCEPT OF COMPETITIVENESS AT DIFFERENT LEVELS OF THE ECONOMY

	Business competitiveness	Regional competitiveness	National competitiveness
Researchers	Ward, Duray, Leong, Sum, 1995; Nonaka, 2000; Monthana, 2002; Outrata, 2002; Čihovský, 2002; Porter, 2003; Beneš, 2006; Kassay, 2006; Slaný, 2007; Veber, 2000, 2007, Lalinský, 2008, Kislingerová a kol.2008; Košturiaková, 2009;	Porter,1990; Amstrong-Taylor, 2000; Choa, Moon 2000; Martin, 2003; Kitson,Martin, Tyler, 2004; Boschma, 2004; Skokan, 2004; Bristow, 2005; Kadeřábková, 2005; Viturka, 2005; Slaný, 2006; Beneš, 2006; Kahoun, 2007; Ivanička, 2007; Buček, 1992, 2001, 2008; Buček, Rehák, Tvrdoň, 2010;	Markus 1981; Porter, 1990; Dluhosch, Freytag, Kruger, 1996; Scot, Londge, 1985; Clegg,1987; Starr, Ullman, 1988; Fagerberg, 1988; Inotai, 1988; Hilke, Nelson, 1988; Karunaratne, 1988; Dunning, 1993; Krugman, 1994;. Manzur et. al 1999; Turok, 2004; Kadeřábková, 2005; Šikula, 2006; 2011;
General basis of the competitiveness	*competitive business advantage* over other market participants	*competitive advantages of the region* (the speci-fic characteristics and conditions of theregion) which help better to meet the objectives of each business	*competitive advantages of the national economy* /comparative aspects of competitiveness
Symptoms of competitiveness	*success of businesses in the competition in the domestic or foreign market* with other companies and their market adaptability	*success of regional economies in the competition in the national and global market* as a result of its performance, productivity and adaptability	*success of the national economy in competition* with other countries in the production of goods and services and their implementation *beyond the economy*
Determi-nants/ factors of competitiveness	*specific internal and external situation of enterprises*, the overall situation at the micro and macro level	*specific internal and external situation of the region*, the overall situation at the micro and macro level	*specific internal and external situation of the national economy,* the overall situation at the micro and macro level
Result of competitiveness	*prosperity,* efficiency and success of the company	*region prosperity*, rising living standard of the population of the region; productivity of the region; employment;	*state prosperity*, rising living standard of the population of state, productivity of state; employment;

Source: Own processing from stated sources

General base of competitiveness is competitive advantage (Porter, 2003). Scientific investigation of competitiveness instead of results of competitiveness mainly focuses on the factors/determinants (Figure 1) leading to the improvement of competitiveness (Kadeřábková et al., 2003, Kuzmišin, 2009), thus the specific internal and external situation of enterprises (overall situation in the micro, macro and regional level), in other words, the quality of business environment (BE), which is behind of the content of definition of competitiveness of the economy and its subjects (Kadeřábková et al., 2005).

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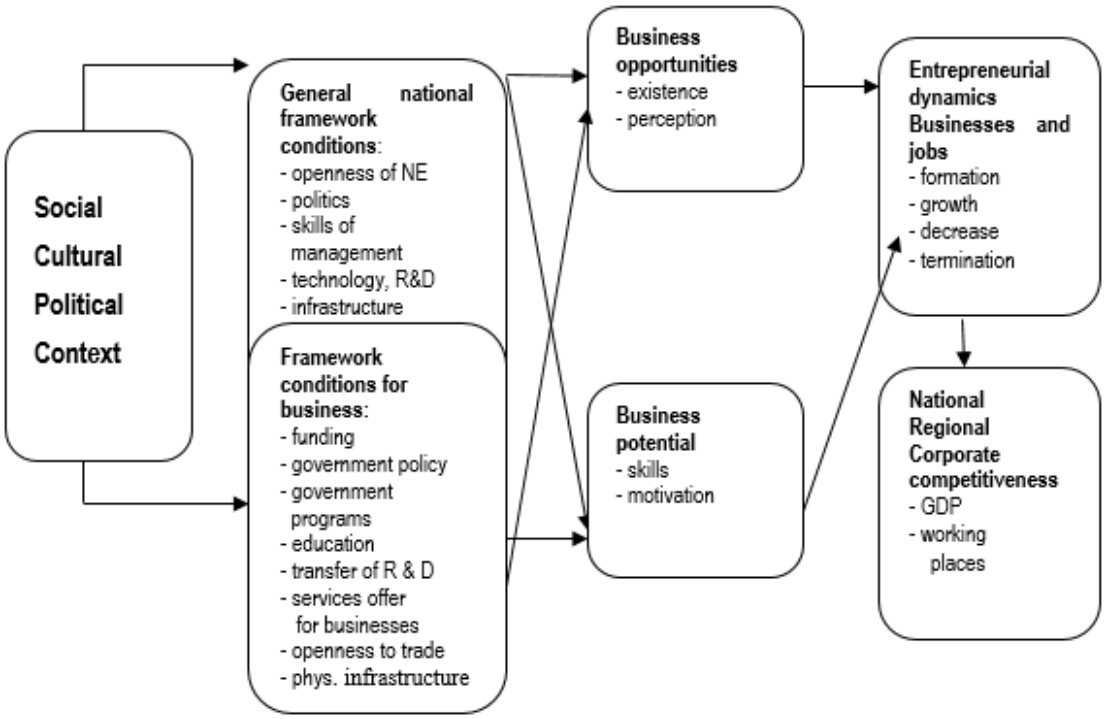

FIGURE1 – BUSINESS ENVIRONMENT AS A DETERMINANT OF COMPETITIVENESS
Source: Own processing based on Reynold et al., 2005. Cited in Lukeš and Jakl, 2006.

Šikula (2008, p. 15) "Competitive advantages in the global economy are often heavily localized and formed from the merger of highly specialized skills and knowledge, institutions, related businesses and customers. This already stated is in the level of regional competitiveness, which is a joint effort on the most productive use of internal resources in an interaction with the efficient involvement of external resources".

The understanding of the mutual conditionality of regional competitiveness, business environment and clustering should be based on Porter's microeconomic theory of competitiveness, in which the basis for competitiveness is considered the efficiency and quality of enterprises and the quality of the business environment in conjunction with macroeconomic, political, legal and social framework for economic development. Porter identifies the quality of the regional business environment (1980) with four groups of factors: a) factor of inputs (supply of production factors), b) demand factors (in particular the importance of domestic demand), c) factors generated by the presence of related and supporting industries (links to division of labour and integration of the economy) and d) factors that are generated by strategies and competitive nature of the business (links on the investment climate and local policies). In this sense Viturka (2005, p. 12) "regions compete with each other in order to create the best conditions for the development of business activities".

Generally, it is stated that the business environment is composed of innumerable number of factors that are not under the control of the company's management in the short term and thus pose a threat to some companies. There were crystallized four dimensions, which together form the business environment, namely: dynamism, complexity, diversity and responsiveness (Dess and Beard, 1984, Harris, 2004, Mintzberg, 1979, Ward et al., 1995). Lawless and Finch (1989) these dimensions are considered the most critical dimensions of the business environment in respect to strategic decisions.

Kačírková (2008) examination of interactions between the various factors of business environment and competitiveness at the regional level has resulted in a wide range of theoretical approaches and models of regional development. Current theories of regional development present as a new paradigm of regional policy the innovation systems and innovative dynamism that give an emphasis to the networking of actors as a system (Huggins et al., 2007). Porter (1998b), Motoyama (2008) presented cluster as a new way of looking at the national, state, regional and local economy within the study of agglomerations and showed a new role of companies, governments and other institutions in improving of the competitiveness. Porter (2003) modified the approach to the concept of clusters from positive (study of processes within the agglomeration) to normative (how to induce and stimulate these processes). One of his conclusions is that clusters have the potential to affect competition in three ways: a) by increasing the productivity of companies within the cluster, b) by promoting of innovations and c) by attracting new companies.

Theory and practice have confirmed that successful innovation requires vital interaction between the different participants of the innovation process (Kuzmišinová, 2009). Etzkowitz and Leydesdorff (1997) from a structural point of view it is a system that consists of sub-systems: educational and scientific, economic, political and administrative and networks, respectively links between them (see, for example, , thus it is a clustering of all the entrants of regional development. By Kačírková (2008) clusters can be seen as a potential key aspect of regional value created by unique blend of knowledge, skills and abilities essential to competition of the location.

Data, measurement issues and stylized facts

The underlying source of analysis of the quality of business environment as the basis for clustering are the results of the project Competitive regions 21, conducted by the Business Agency of Slovakia (PAS) in late 2010 and early 2011. Quality of the business environment of 79 regions in Slovakia at the NUTS IV level was evaluated by 106 business environment indicators that are used to assess the competitiveness of countries by renowned international institutions via range of 1-6, which was used for stratification (division) of 79 districts into a number of clusters (groups), in 4 sub-indices with weights:

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- sub index I.: economic activity (31 per cent);
- sub index II: public administration and legislation (15 per cent);
- sub index III: technologies and infrastructure (23 per cent);
- sub index IV: education and human resources (31 per cent).

The main method for the evaluation of the competitiveness of the business environment of 79 Slovak Regions is cluster analysis at NUTS IV level. The resulting values before processing of sub-indexes are standardized so that the average value of the individual sub-indices is equal to 0 and standard deviations are equal to the 1. Cluster analysis breaks down a set of objects into several homogeneous subsets-clusters so that the objects belonging to different clusters can be the most remote and the least similar and objects belonging to the same cluster to be close and the most similar. Mathematical formulation of cluster analysis as a grouping of objects is by Stankovičová & Vojtková (2007):

Xi (i = 1,2,...,n) into clusters C1, C2,..,Cq (2<q<n) (1)

To estimate potential clusters is done via chosen method K-means. Using this method allows for the formation of k ∈ {1, 2, ... } clusters, which are formed so that the individual elements (districts), which belong to the cluster are as close to the centre of the cluster (the group). To measure distances in p-space, Euclidean standard is used. The middle is usually defined as the point in p-dimensional space whose coordinates are the average values of the elements of the cluster (sometimes medians are used instead of the average medians). A disadvantage of this procedure is that, prior to the analysis it is necessary to choose the number of clusters. One of the general rules is to choose the number of clusters k, for which it applies: $k = \sqrt{n/2}$, in this case $k = \sqrt{79/2} = 6{,}2849$. However, these methods do not offer a clear answer to the number of clusters. Therefore the Hartigan and Wong (1979) algorithm is used, where the initial centres of clusters were selected randomly and it seems that the optimal number of clusters is five.

The objective of cluster analysis is to:

- identify quality (strengths and weaknesses) of business environment via stated sub-indexes in individual clusters,
- find out in what is the business environment of generated clusters as similar as possible, what clusters have in common;
- which Slovak districts belong to created clusters;

- determine whether clusters are formed based on the geographical principal;
- create clusters from 79 Slovak regions, which are in terms of monitored variables = 4 sub-indexes of quality of the business environment as similar as possible. Statistical generation of clusters based on the strengths and weaknesses of the business environment of 79 Slovak regions offers the possibility to propose adequate cluster policy while creating regional and national development programs.

The empirical model

The resulting values of assessed 4 sub-indexes of business environment quality of 79 Slovak regions at NUTS IV level for the assessment scale 1- 6 (Graph 2).

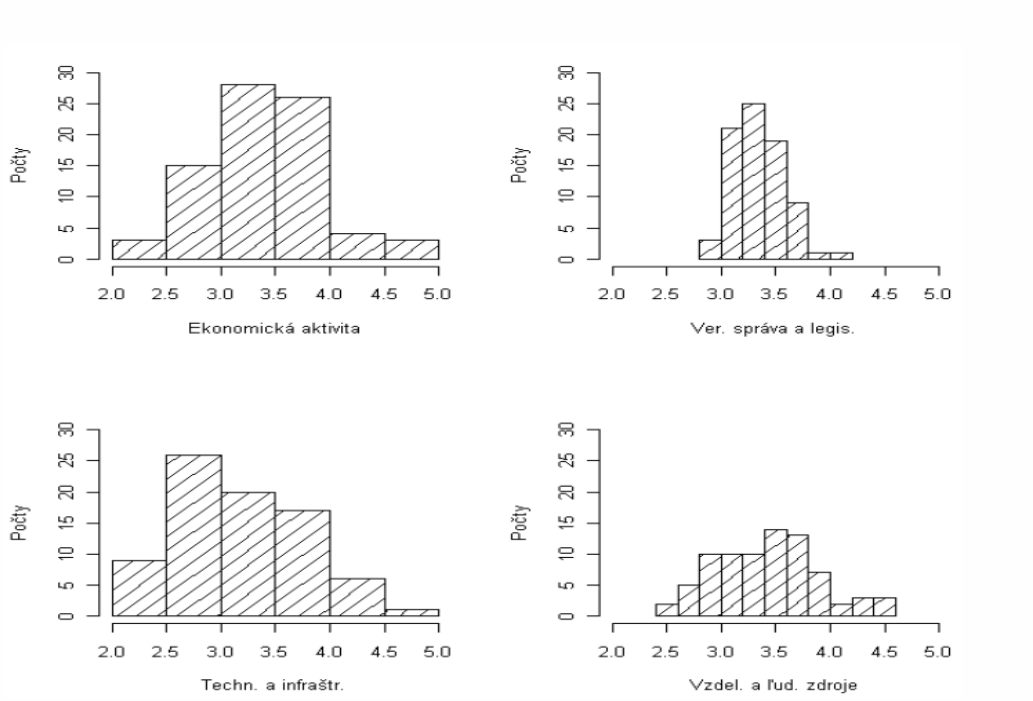

FIGURE 2 - HISTOGRAMS OF 4 BUSINESS ENVIRONMENT SUB-INDEXES OF 79 SLOVAK REGIONS
Source: Own processing based on PAS Regions 21

Histograms of the 4 sub-indexes values of 79 Slovak regions, economic activity and technology and infrastructure (moving from 2 to 5) present a biggest difference between studied business environment conditions among the counties. Most districts reaches in economic activity from 3 to 3.5 and the technology and infrastructure 2.5 – 3. The most similar conditions of business environment are in the sub index government and legislation (2, 7 – 4, 2). K-means method has divided 79 Slovak regions into 5 clusters (clusters were created by statistical program R) based on analysed business environment

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quality sub-indexes, their averages and standard deviations are shown in Table 2, in which is stated the order of the generated clusters and the number of regions in Slovakia which are creating them.

TABLE 2 – BASIC STATISTICAL CHARACTERISTICS OF THE 4 BUSINESS ENVIRONMENT QUALITY SUB-INDEXES FOR K = 5 CLUSTERS

Average						Standard deviation			
Economic activity	Government and legislative	Technologies and infra-structure	Education and human resources	**Rank of clusters**	Descr. of cluster and number of districts	Economic activity	Government and legislative	Technologies and infrastructure	Education and human resources
3,5633	3,3211	3,2511	3,5889	**III.**	**Cluster 1** (18)	0,2073	0,1310	0,2861	0,2022
3,1824	3,4595	2,92381	3,2319	**IV.**	**Cluster 2** (21)	0,1396	0,1400	0,1846	0,1387
4,5167	3,0983	4,3367	4,3767	**I.**	**Cluster 3** (6)	0,3832	0,0898	0,2247	0,1684
2,7259	3,5647	2,5547	2,8224	**V.**	**Cluster 4** (17)	0,2149	0,2156	0,1879	0,1598
3,7776	3,1047	3,7846	3,7641	**II.**	**Cluster 5** (17)	0,1356	0,1432	0,2220	0,2097

Source: Own processing based on data from PAS Regions 21, available on alianciapas.sk

The biggest differences of average business environment value are in sub index economic activity (2.7259 – 4.5167) and in the sub index technologies and infrastructure (2.92381 – 4.3367) as it involves activities affected by specific regional business environment and competitors. The smallest differences are in the sub index government and legislation (3.0983 to 3.5647), which refers to activities that are needed everywhere and have centrally defined framework.

First place was awarded to cluster 3, which reaches in three business environment sub-indexes the highest values (4.33 – 4.51). Regions/districts belonging to cluster 3 are among the most developed regions of Slovakia (5 districts of Bratislava and Trnava region). Followed by a cluster 5 (17 districts) with values of 3 business environment sub-indexes around 3.7, which includes the regions in western Slovakia, near Žilina, along the northern highway D1 and 4 districts of Košice. On the third place in the maturity of the business environment is cluster 1 (18 districts) around cities: Bratislava, Žilina, Banská Bystrica, Zvolen, Liptovský Mikuláš and Poprad, where the 3 sub-indexes range from 3.25 to 3.58. Fourth place achieved cluster 2, whose regions are spread over the whole country, it is the most numerous (21 districts) with values of business environment sub-indexes from 2.92 to 3.23. The least developed are 17 districts of cluster 4, where are the districts/regions of the south and east of Slovakia and their business environment sub-indexes values are in the range of 2.55 to 2.82. This shows also significant regional disparities in quality of business environment among these 5 clusters.

It can be concluded that clusters located at the top (cluster 3 and cluster 5) are formed by regions/districts in Slovakia which have developed production characteristics (economic activities). It is residence of companies such as Volkswagen, PSA Peugeot - Citroen, Kia, U.S. Steel and others, as

well as infrastructure (motorway D1) and thus employment. Regions, whose economic activities use or rely on local natural resources, are registered in clusters on lower and middle levels (cluster 1, 2, 4). Public administration affects the assessment of the business environment especially via employment creation, which is concentrated in the centres of political self-governing regions and districts. Graph 3 shows the clusters created based on the statistical characteristics of the business environment quality sub-indexes.

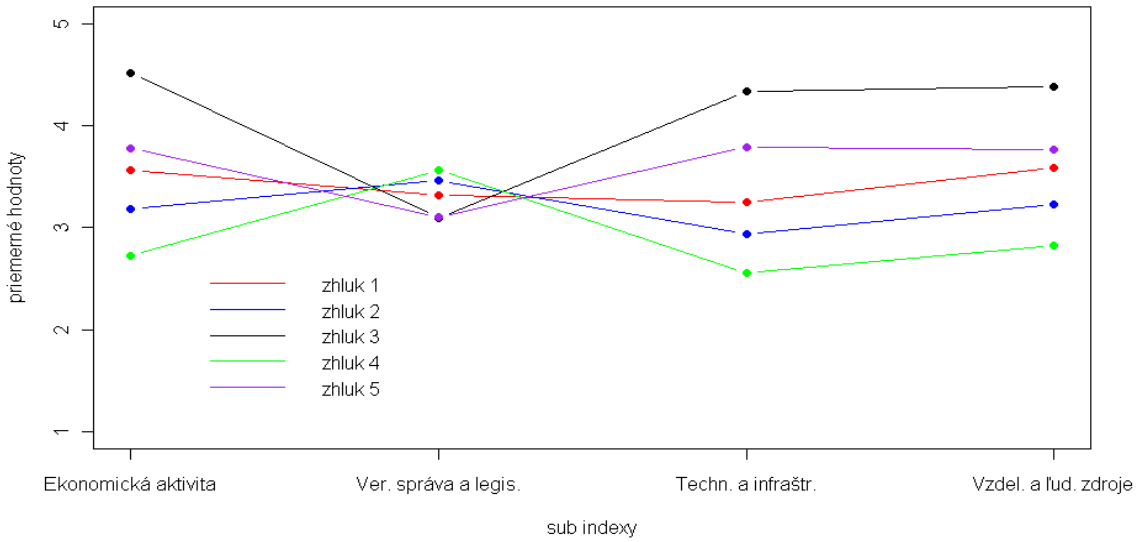

FIGURE 3 - AVERAGE VALUES OF 4 SUB-INDEXES FOR K = 5 CLUSTERS
Source: Own processing based on data from PAS Regions 21, available on: www.regiony21.sk

According to Graph 3, the 5 generated clusters differ from each other by the level of the average value only in three sub-indexes (excluding public administration and legislation). There are therefore created such groups of regions which differ from each other in 'monotonic' way in three sub-indexes. This means that if one cluster of regions reaches higher values in economic activity over the second cluster of regions, than it reaches (almost always) higher values in the other two sub-indices: technology and infrastructure, education and human resources. This is an interesting effect, which says that regions can be quite clearly divided by the total level of business environment quality sub-indexes, because the differences between the 5 created clusters in economic activity, technology and infrastructure, and education and human resources are basically the same. From Graph 3 it is also seen relatively small range of values of sub index government and legislation that affects its central regulation that creates in all districts 'similar' conditions, while also points to an interesting negative correlation of sub index government and legislation in relation to other 3 sub-indexes (Table 3). Therefore, this sub-index will not be taken into account when interpreting 5 created clusters.

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TABLE 3 – PEARSON'S CORRELATION COEFFICIENT OF 4 BUSINESS ENVIRONMENT SUB-INDEXES

Pearson's coefficient	Economic activity	Government and legislative	Technologies and infrastructure	Education and human resources
Economic activity	1	- 0,607	0,881	0,932
Government and legislative	- 0,607	1	- 0,653	- 0,582
Technologies and infrastructure	0,881	-0,653	1	0,852
Education and human resources	0,932	- 0,582	0,852	1

Source: Own processing based on data from PAS Regions 21

In the map (Figure 2) are color-coded 5 clusters created from 79 Slovak regions, where is identified similar cluster potential based on the quality of the business environment .

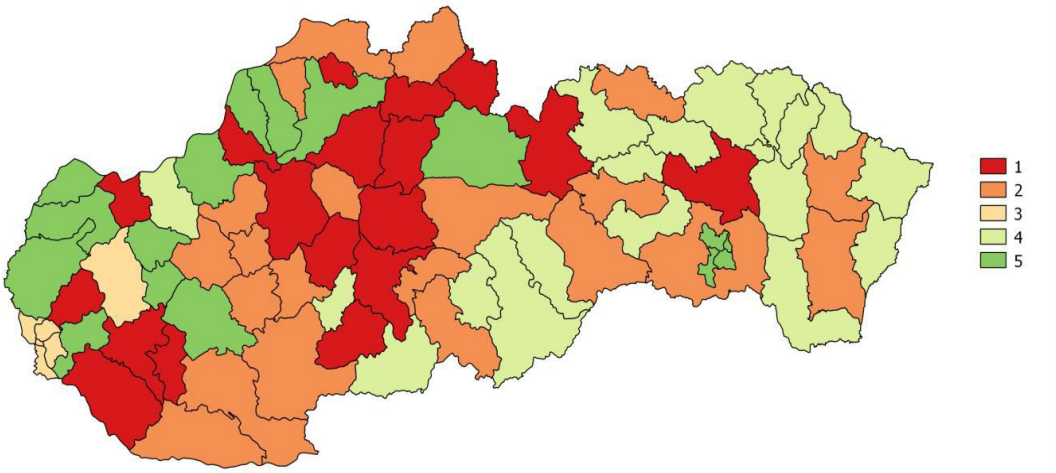

FIGURE 2 – GEOGRAPHICAL LOCATION OF SLOVAK REGIONS BELONGING TO K - 5 CLUSTERS
Source: own processing

Figure 2 also shows that clusters based on the quality of the business environment are not clearly based on the geographical principle. Generally, it can be said that maturity of the clusters according to the quality of the business environment directs from west to east Slovakia.

3. CONCLUSIONS

Globalization and technological changes have highlighted the importance of knowledge-based components of companies, regions, states, and world and thus enhance the effects of clustering and optimization of creation and flow of knowledge, as well as the interactions between them within a particular economic area and conditions that they were able to effectively create and use. The common perception of opportunities and threats of all participants of clusters is the basis from which emerge common visions, strategy.

Based on multivariate statistical classification, the potential of 79 districts / regions of Slovakia were identified. These were grouped into five clusters based on 4 analysed sub-indices of quality of the business environment. It can be noted that the regions that are highly manufacturing developed have generally higher cluster potential and vice versa.

Among the 5 clusters generated are evident disparities in levels of their business environment quality, one of the possible factors of backwardness of some clusters can be identified as fragmentation and underdevelopment of some regional clusters. Evaluation results of cluster potential of 79 Slovak regions confirm the presence of a relatively low regional cluster specialization and suggest that regional policy in Slovakia should focus on its activities mainly at the microeconomic level. In terms of maturity of the business environment, overall tendency towards is convergence to a common level (the identified growth is identified in all tested sub-indexes of business environment quality).

Clusters located at the top could become an instrument and basis of national technological and innovation policy. Clusters in lower positions would require applying policy of business development of small and medium-sized enterprises and regional competitiveness based on natural resources available within the geographical location. They should develop activities (mainly services) that are needed elsewhere and are not directly affected by inter-regional competition and focus on the development of agriculture and forestry and tourism.

Presented cluster potential of Slovak regions based on quality of their business environment is a possible starting point for clustering policy, consists in stimulating level of local prosperity and well-being using the strengths of business environment and eliminating its weaknesses. The role of the official Bodies is to implement a policy of harmonizing the quality of regional business environment and supporting cluster initiatives through programs of socio-economic support to less developed regions, programs of regional competitiveness in relation to the European Cluster Policy, the first step to use cluster potential is to identify companies with the cooperation and development potential and then create feasible clusters, for example in the form of cluster concept, Triple Helix, science and technology parks.

Theoretical benefit of this paper:

a) the creation of economic competitiveness subject's concept based on the knowledge of domestic and foreign relevant authorities in the area (Table 1);

b) development of the mutual relationship of competitiveness and prosperity (enterprises, regions, state) based on the innovation and busines environment quality);

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c) presentation of clusters as a possible tool to ensure competitiveness of regions.

Practical benefit of this paper:

a) creation of five clusters from 79 examined regions (districts) of Slovakia at the level of NUTS IV with the help of multidimensional statistical analysis methods (cluster analysis) based on their business environment quality (4 sub-indices): 1.economic activity, 2. public administration and legislation, 3. technology and infrastructure, 4. education and human resources.

b) identification of the business environment's strengths and weaknesses of

c) the of created 5 clusters;

d) basic outline of the development strategy for the 5 created clusters;

e) methodology processing to identify clusters potential in projects of

f) further regional development and economic development implication at the

g) national level.

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