Double View at the Quality of Life in districts (LAU1) of the Czech Republic[1]

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The economic development, observed implicitly by the level, respectively by the development of the quality of life, is characterized more or less by heterogeneous economic, social, demographic, ecologic and other indicators. Variable approach to the definition of the quality of life and its indicators is further modified in case of an investigation at the lower than the national level. The paper focuses in detail on economic and social aspects of the quality of life at the level of districts (LAU1) of the Czech Republic. Problems stem for example from unavailability of data on a given or lower hierarchy levels. In some cases, the obtained data comes from sample surveys and they can be insufficiently representative considering a lower hierarchy level. In other cases, it is not possible to analyze data obtained at higher levels. However, the information about the quality of life and its aspects at the districts and lower levels is essential, at least from the point of view their functioning and sustainable development, whose strategy is hard to define if there is a lack of data and information.
The aim of the paper is to assess the possibility of using quality of life indicators at the various hierarchy levels, especially at the level of Czech districts (LAU1).

Keywords: quality of life, regional development, cluster analysis, GIS

1. Introduction

Districts and municipalities present the basic units of the administrative classification in the Czech Republic. According to the law, they are obligated to take care of fulfilling needs of their inhabitants. We can see the administrative units as

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environment in which its inhabitants naturally make their considerations about the quality of life. However, the relationship between wide spectrum of needs and the degree of their satisfaction on one hand, and the level of the quality of life on the other hand, is not unambiguous. The quality of life can be examined by various types of indicators (economic, demographic, social etc.) in particular administrative units. The changes of the quality of life in time and space are also important for the assessment and regional policy decision making. We tried to create a typology of the Czech districts according their level of the quality of life on the base of chosen indicators and its changes in the last decade.

2. Surveys

Canadian system "Quality of Life Reporting System" offers an inspirable look at the quality of life on the level of municipalities on the whole. It enables scenario definition of indicators according an aim, users and problematic areas (Burrett 2009). These considerations are contextualized competitiveness of large towns and urbanized units in a global world, where it is needed to make smaller towns or less urbanized complexes more attractive for living. Measuring of the quality of life is in the condition of municipalities connected with many problems which than complicate a comparison, as it can be seen on the methodology applied in Spanish 314 province of Barcelona (Royuela et al. 2003). The analysis of more than 60 municipalities in Austria concluded that the situation in agriculture is one of the critical factors for the quality of life in the countryside (Baaske et al. 2009). The research of municipalities of the Silesian province showed that the effort to balance the development needs a change of a model of their management (Skotnicka-Zasadzien – Midor 2009).

A synthetic index of 19 indices was constructed for the measuring of the quality of life in 643 Spanish villages. The indices describe consumption, social services, housing, transport, environment, labour market, health, culture and leisure, education and security. These characteristics in the frame of Value Efficiency Analysis (VEA), which is a more detailed specification of the Data Envelopment Analysis (DEA) (Gonzáles et al. 2009), provided for the construction of the order of municipalities according to their quality of life. The quality of life (as a component and a precondition of the sustainability of the development in the context of their three parts – economic, social and environmental) served also as a base of a methodology for performance evaluation (Scipioni et al. 2004). Thus, it allowed overcome the usual contrast between model usefulness and its simplicity relatively easily. Only demographic characteristics, especially a family size, served as a starting point for the research in Ghana (Arthur 2008).

Canadian municipalities (Ontario) define for the evaluation of the quality of their inhabitants priorities in four areas: economy (Business and Employment Variety, Image, Advanced Technology, Information Process, Promoting Excellence, Fi-

nancials Tools, Partnerships, Education and Research), environment (Growth and Infrastructure, Gross-Boundary Coordination, Green Space, Natural Heritage Protection, Waste Diversion, Air, Water and Soil Protection, Resources Conversation, Health), social (Volunteerism, Community Participation, Inclusiveness, Leadership, Community Identity, Vitality, Cultural Heritage, Arts and Culture) and land-use planning (Housing Choice, Access, Community Design, Development Form, Land-Use Planning Tools, Reducing Barriers, Staff Capacity, Collaboration) (Municipal 2005). It is one of examples of conceptual framework of the regional development policy, as it is perceived by OECD. Just in case, it is also advisable to consider two main "profits" of urbanization (OECD 2007), which are the decrease of commuting times and the possibility of cheaper households living. Above mentioned processes can be perceived as positive externalities which do not possess the market characteristic.

In the Czech Republic, the attention is primarily aimed, regarding the disposable database, to analyses on the level of districts. One example is the analysis of the quality of life using the socio-economic deprivation indices which were constructed only for Moravian districts (Tomášková et al. 2007). Two methods were selected for creating the SESDI based on (1) Townsend index that is calculated as a sum of Z-scores of specific factors (INDEX1); (2) MATDEP and SOCDEP that use standardized score for each of the factors for maximal value of all areas; the final index reaches values in the interval from 0 to 8 (INDEX2). The GIS was used for presentation of deprivation of enumeration districts.

Mederly et al. (2004) covered with indicators of the quality of life and sustainable development. They tried using the tools of multivariate statistical analysis to develop an alternative indicator of the quality of life and sustainable development to commonly used indicators (HDP or Human Development Index). The so called Regional Index of the Quality of Life was constructed on the regional level which is based on three parts of life: a) precondition for long and healthy life, b) preconditions for creative life with sufficient education and c) preconditions for adequate living standard. The second indicator Index quality and sustainability of life characterized the development in the Czech Republic on the national level in the period 1990-2000. This indicator was compiled for four main areas of life: a) socio-political, b) social, c) economic and d) environmental area. On the global level, there has been constructed the Index of sustainable development for 179 countries in the world. Svobodová (2008) was interested in the general determination of the term of quality of life from views of different institutions, its relation to the standard of living and to the sustainable development. She categorized and measured the quality of life on the national and regional level. The aim of Charvát´s work (2009) "Quality of life in the border regions of the Czech Republic" is to reveal differences in the level of quality of life in different parts of the borderland. The main content category consists of issues of broad groups of indicators, indicator programs, a brief socioeconomic analysis and in particular to measure the quality of life. Measurements are carried out at

the level of districts (LAU1) using alternative quality of life measure. From the results, it is obvious that the areas with the best quality of life are České Budějovice, Zlín and Liberec. Conversely, very low quality of life can be found in the districts of Chomutov, Most and Teplice. The importance of the transport accessibility, especially in the countryside and peripheral regions, is described in the work of Květoň and Marada (2006).

Another view on the quality of life presents the work of the authors Janský and Létalová (2009), they have analysed life quality in the regions of the Czech Republic from the view of natural resources. Applied indicators of quality of life by the view of natural resources evaluate natural conditions, agricultural land areas and forested areas. In the area of protection of natural resources there are evaluated investments in protection of environment in total and also per 1 inhabitant, further are evaluated noninvestment protection of environment expenses, economic gains on the activities of the protection of environment, coefficient of ecological stability, production of communal (municipal) waste in total and per 1 inhabitant.

The quality of life and its appraisal is not complete without consideration of ecologic indicators. The availability of ecologic data on the level of regions is limited in conditions of the Czech Republic because the monitoring of emissions of CO^2, NO^2 and the other for example is realized only on the level of regions (NUTS3).

3. Methods

The level of economic and social development of Czech districts was assessed in two periods: in 2001 and after five years, in the period 2007 – 2008. The second period is longer with respect to the availability of comparable data. Following indicators were chosen for a comparison both the periods:

- average salary per capita in 2001 and 2005 (CZK)[4]
- crime rate (number of crimes per 100 inhabitants) in 2001 and 2007
- dependency ratio (number people above 65 to children to 15 years) 2001 and 2008
- road transport density (km/km^2) – 2001 and 2007
- net migration 2001 and 2008
- rate of unemployment in 2001 and 2007
- hospitals bed per 10 000 inhabitants in 2001 and 2007
- completed dwellings per 1 000 inhabitants in 2001 and 2008
- average amount of pensions (CZK) in 2001 and 2008

[4] Average salary per capita was available only for the year 2005.

The transport density in 2001 was derived by spatial tools in ArcGIS from the vector layer of Czech road net, while the density for the second period was calculated from the data in Statistical yearbooks of regions in 2007. With respect to absolute dissimilarity of these sources, it is necessary to take this fact into consideration in the results interpretation.

Cluster analysis (Aldenderfer - Blashfield 2006, Everitt - Dunn 2001, Romesburg 2004) was used to obtain rough typology of Czech districts in 2001 and in the second period 2007 - 2008. We also tried to classify the Czech districts according the changes of the used variables between the two studies periods. Various algorithms and metrics were tested and their results compared to find the best solution. Hierarchical clustering served as the first step of the classification. The aim of this step was to find a proper count of clusters. The clusters were identified by the *k*-means method. The computations were realized with the programs Statistica, R, and the results visualized in ArcGIS.

Prague was excluded from the analysis because it differs too much from other districts.

4. Results

The variables used for the classification in 2001 are correlated, as it can be seen in Table 1. For that reason, we used only the non correlated variables in cluster analysis but we studied the potential influence all of the variables on the socio-economic development of regions. We also tried to realize the classification by the use of Mahalonobis´ metrics which removes the influence of oversized correlation of variables. The appropriate number of clusters is five according the results of hierarchical clustering. Wards method gave us the best results.

Table 1. Correlation matrix 2001

	Dependency ratio	Average salary	Road density	Crime rate	Net migration	Rate of unemployment	Average pension	Hospitals beds	Dwellings completed
Dependency ratio	1,00	-0,00	**0,33**	-0,16	-0,15	-0,09	**0,27**	**0,24**	-0,05
Average salary		1,00	**0,59**	**0,71**	**0,25**	-0,06	0,03	**0,28**	0,06
Road density			1,00	**0,50**	**0,29**	-0,09	0,08	**0,27**	0,11
Crime rate				1,00	0,16	0,15	-0,21	0,29	-0,13
Net migration					1,00	**-0,30**	-0,14	**-0,39**	**0,59**
Rate of unemployment						1,00	**-0,34**	0,22	**-0,41**
Average pension							1,00	0,09	-0,01
Hospitals beds								1,00	**-0,25**
Dwellings completed									1,00

Marked correlations are statistically significant at $p<0,05$.
Source: own creation

The results of our attempt to create a typology of Czech districts according the level of their economic and social development in 2001 are apparent from Table 2. Variables, statistically significant for the inclusion of districts into clusters are: average salary, transport density and crime rate.

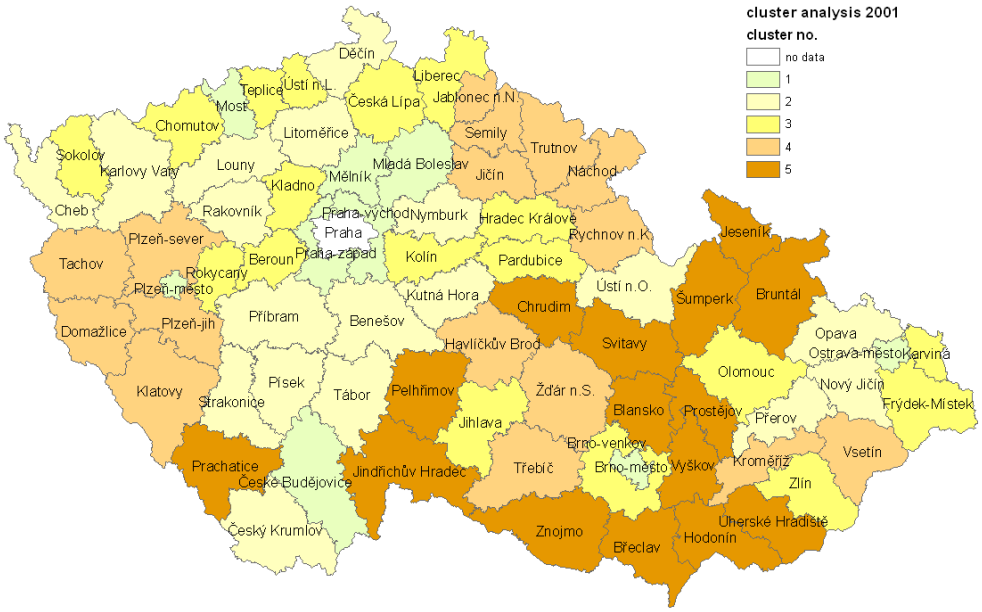
The inclusion of districts into clusters in 2001 was determined by the main forces of regional development: the average salary, transport density, the crime rate, the average pension and the level of health care. It is obvious that there exists a dependency among these variables (Table 1): transport density determines a development of activities in a region and consequently high average salaries, pensions, housing construction and also the quality of health care. An interesting finding is the positive correlation between the crime rate and the transport density. Is it possible to judge that the criminality (as partially technical-technologic phenomenon) would significantly eliminated without mobility in the 21th century? The membership of the districts into clusters is visible in Figure 1.

Table 2. Analysis of variance – 2001

variable	between group variability	df	within-group variability	df	F	p-value
Dependency ratio	563	4	13482	71	0,7408	0,567302
Average salary	84777160	4	7730815	71	194,6489	0,000000
Transport density	1	4	1	71	11,2952	0,000000
Crime rate	30	4	30	71	17,9829	0,000000
Net migration	75	4	1166	71	1,1416	0,344082
Rate of unemploy-ment	10	4	1028	71	0,1698	0,953130
Average pension	10391060	4	399471,2	71	461,7135	0,000000
Hospitals beds	11044	4	44555,1	71	4,3996	0,003104
Dwellings completed	1	4	89,0	71	0,2176	0,927804

Source: own creation

Figure 1. Districts clusters – 2001



Source: own creation

Table 3. cluster comparison (means) – 2001

Variable	cluster				
	1	2	3	4	5
Dependency ratio	96,40	93,57	96,12	96,56	96,23
Average salary	15541,67	12871,89	13829,94	12752,44	12028,33
Road density	0,91	0,60	0,70	0,61	0,56
Crime rate	4,23	2,84	3,02	2,26	1,96
Net migration	2,88	0,15	0,26	-0,06	-0,25
Rate of unemployment	8,98	9,68	10,18	6,94	9,81
Average pension	6355,33	6083,28	6475,56	6859,88	6269,87
Hospitals beds	77,05	50,05	63,96	42,10	52,62
Dwellings completed	2,52	2,10	2,14	2,17	2,63

Source: own creation

Table 3 confirms mild differences among the Czech districts in the variables which are not significant for including into cluster – variables which cannot be marked as the main driving forces for the regional development in 2001: population age structure, housing construction and rate of unemployment.

Cluster 1 consists of the metropolitan districts concentrating a wide range of activities with the largest cities in the Czech Republic. They can by characterized by the highest salaries, high transport accessibility, high level of crime, high migration gains, relatively lower rates of unemployment, average pensions, high level of health care and above-average housing construction. We can mark these districts as the development cores. The districts with under-average dependency ratio, under-average salaries, worse transport accessibility, average criminality, moderate migrations increases, slightly above-average unemployment, lower pensions and weaker health facilities constitute cluster 2. Cluster 3 consists of the districts which are distinguished by moderately above-average salaries and pensions, relatively high road density, above-average criminality, small migration gains, high level of unemployment and relatively good health care.

Relatively low salaries, average transport accessibility, lower criminality, migration decreases, under-average unemployment and also worse accessibility of health care are the features of the districts in the cluster 4. Cluster 5 is formed by the districts with low salaries and lower pensions, bad transport accessibility, low crime rates, the highest migration decreases, the highest rate of unemployment, above-average unemployment, the average level of health care.

Correlation analysis confirmed that the level or the rate of mutual influencing among studied variables demonstrated the high of average salaries in the relationship with net migration and also with crime rate. Another relatively important depend-

ency has been manifested between average salaries and the transport density. Considering the crime rate, it is not fully unique manifestation of a synergic effect which results from a sense of security of inhabitants in particular districts and the level of their public order, experience in the work of the Police of the Czech Republic and also in negative phenomena in its work, and last (but) not least in the state of prevention. The migration oneself is then, according the Strategy of Regional Development of the Czech Republic for the period 2007 – 2013 (Strategy of the Regional Development 2009) influenced by (up to present) not much developed housing market which creates a barrier to a potential development of general migration mobility. The migration flows are primarily realized as a temporary migration and commuting, changes of permanent residences are less often.

The values of the variables for the period 2007 – 2008 were much more correlated. The data in Table 4 confirm a similar pattern of mutually influencing the variables, contrary to the period of 2001, the influence of unemployment on the other variables has been increased.

Table 4. Correlation matrix 2007 – 2008

	Dependency ratio	Average salary	Road density	Crime r	Net migration	Rate of unemployment	Average pension	Hospitals beds	Dwellings completed
Dependency ratio	1,00	**-0,46**	**0,28**	**-0,25**	-0,18	-0,22	**0,36**	0,20	**-0,51**
Average salary		1,00	**0,26**	**-0,25**	**0,50**	**0,44**	**-0,45**	**-0,28**	**0,65**
Road density			1,00	**-0,27**	**0,63**	**0,40**	0,12	**0,37**	0,08
Crime rate				1,00	-0,08	0,21	0,13	**0,36**	**-0,26**
Net migration					1,00	**0,58**	-0,10	0,22	**0,38**
Rate of unemployment						1,00	-0,10	0,21	**0,24**
Average pension							1,00	**0,38**	-0,16
Hospitals beds								1,00	**-0,23**
Dwellings completed									1,00

Marked correlations are statistically significant at p<0,05.
Source: own creation

Again, using the Mahalanobis´ metrics in cluster analysis, we have found that the differentiation of economic and social development is statistically significantly determined by average salary, road density, criminality, the average pension and the

level of health care and also the more and more increasing importance of migration flows and the unemployment in the period 2007 – 2008. The allocation of the districts into clusters denotes Figure 2.

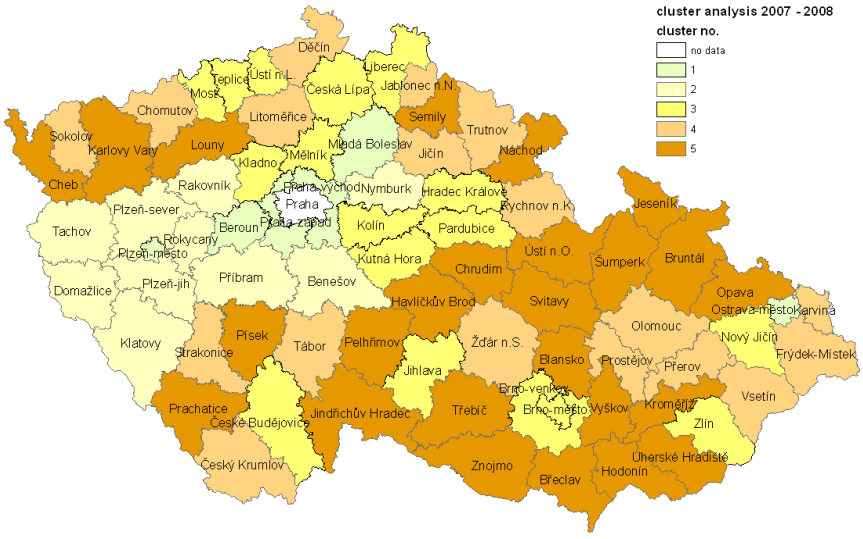
Table 5. Analysis of variance – 2007 – 2008

	between group variability	df	within-group variability	df	F	p-value
Rate of unemployment	91	4	592	71	2,7255	0,035935
Net migration	2605	4	4240	71	10,9071	0,000001
Crime rate	26	4	43	71	10,6880	0,000001
Dependency ratio	231	4	11454	71	0,3585	0,837281
Average salary	136436600	4	12483620	71	193,9941	0,000000
Road density	2	4	2	71	14,3283	0,000000
Average pension	5107522	4	4138119	71	21,9081	0,000000
Hospitals beds	9566	4	41609	71	4,0809	0,004925
Dwellings completed	60	4	171	71	6,2367	0,000233

Source: own creation

The increasing importance of the net migration and unemployment proves the increasing differentiation among Czech districts.

Figure 2. Districts clusters – 2007 – 2008



Source: own creation

Table 6. cluster comparison (means) – 2007 – 2008

Variable	cluster				
	1	2	3	4	5
Rate of unemployment	4,33	5,21	7,32	7,79	7,36
Net migration	24,12	12,30	7,78	4,52	2,76
Crime rate	3,83	2,27	3,17	2,53	1,96
Dependency ratio	97,00	101,80	102,24	99,94	103,00
Average salary	19867,17	16080,10	17829,12	16232,33	15307,80
Road density	1,28	0,70	0,81	0,73	0,66
Average pension	8857,50	8488,70	9192,06	9303,33	9172,96
Hospitals beds	53,25	27,11	65,96	50,12	52,17
Dwellings completed	5,08	1,74	2,03	1,80	1,70

Source: own creation

Keeping with the increasing importance of migration and unemployment, Table 6 confirms the increasing differentiation of the Czech districts not in the values of these variables. The typology of the districts has changed during the studied period in the following way: cluster 1 consists of the districts influenced directly by Prague or some other large cities (Plzeň, Ostrava) – the centres of various activities with the tradition of industry and tertiary sector. The typical characteristics of are: relatively convenient age structure, the highest salaries, the best transport accessibility, high criminality, the highest migration increases and low rate of unemployment. The districts distinguishing by demographic ageing, slightly under-average salaries, average road density, under-average crime rates and also large migration increases, and low rate of unemployment constitute the cluster 2. Cluster 3 consists of the districts with verifiable demographic ageing, above-average salaries, relatively good transport accessibility and higher criminality, slightly above-average migration increases and above-average rate of unemployment. The remaining clusters 4 and 5 can be characterized by under-average salaries, lower transport accessibility, lower criminality and low migration gains. While the cluster 4 has a relatively good age structure, the cluster 5 suffers from the demographic ageing. An interesting finding is that whilst these two clusters show low average salaries, they show concurrently the highest average pensions.

The final step of our analysis represents an attempt to classify the Czech districts according the changes of the followed variables in the period 2001 – 2008. In this case, the districts were classified into four groups.

Table 7. Analysis of variance – rates of change 2001 – 2008

variable	between group variability	df	within-group variability	df	F	p-value
Average salary	0,001	3	0,1644	72	0,1406	0,935331
Road density	0,026	3	1,6493	72	0,3834	0,765258
Crime rate	0,048	3	1,2432	72	0,9283	0,431612
Average pension	0,048	3	0,5652	72	2,0259	0,117864
Dependency ratio	0,060	3	0,7182	72	1,9897	0,123152
Rate of unemployment	0,154	3	1,3333	72	2,7725	0,047588
Net migration	3306,516	3	375,7849	72	211,1750	0,000000

Source: own creation

As can be seen in the Table 7, the typology of the Czech districts on the base of the changes of variables mostly determining economic and social development of the regions and so the quality of life (average salary and pensions, transport accessibility, crime rates, age structure, rate of unemployment and migration), the Czech districts can be divided into five distinct groups. Only two variables determined significantly the groups in this case: rate of unemployment and migration.

Table 8. cluster comparison (means) – rate of change 2001 – 2008

variable	cluster			
	1	2	3	4
Average salary	1,25	1,25	1,26	1,25
Road density	1,18	1,19	1,15	1,15
Crime rate	0,86	0,91	0,95	0,92
Average pension	1,41	1,40	1,42	1,46
Dependency ratio	1,01	1,07	1,05	1,10
Rate of unemployment	0,61	0,76	0,78	0,77
Net migration[5]	24,67	10,71	3,88	0,61

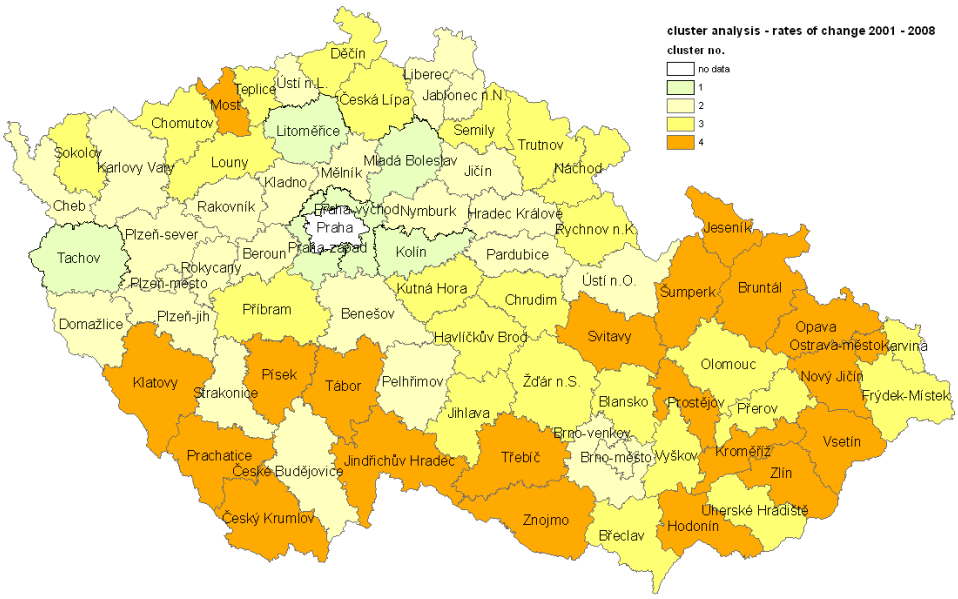
Source: own creation

Cluster 1 consists of the districts which can be characterized by the increase of transport accessibility, reduction of the criminality, low rate of unemployment and high migration gains – some adjacent districts influenced by Prague. Surprising fact is the including of district Tachov into this cluster. The districts forming the cluster 2 show similar characteristics, they differ only from the amount of migration.

[5] The change of migration was computed as the difference between the net migration in 2008 and 2001.

Most of these districts create a whorl around Prague, the other represent regions with various traditional activities. Cluster 3 consists of districts which noticed the smallest decrease of unemployment and also the migration gains are small here. The last group of districts suffers from the unemployment and also migration decreases. The peripheral or transformed former industrial regions constitute this cluster.

Figure 3. District clusters – rate of change 2001 – 2008



Source: own creation

The comparison of the values of the followed variables in the two periods (tables 2 and 4) shows the increasing differentiation of the socio-economic conditions and thus the quality of life in the Czech districts. It is also obvious that almost a half of districts changed their position in groups in the followed period. The assessment of this change is problematic. The peripheral or restructured regions experienced the biggest changes in the studied period.

5. Conclusions

In both the studied periods, the differentiation of the quality of life in the Czech districts was significantly determined by the average salary, transport accessibility and

criminality. The increasing role of migration flows follows from the analysis. Migration can be perceived as the mediating influence of economic and social factors. The Czech Republic suffers from the demographic ageing (like most of the developed European countries) which is partially eliminated by migration.

The realized comparison of the Czech regions (LAU1) points out changes of all the examined regions in time. It is obvious that the generalization of the results from the analysis is not possible because of the limited extent of the used variables. In spite of this, further to the foreign experience, the extension of the spectrum of examined variables enables us to obtain information which is needed for decision processes and which will become the starting points for the management aimed at the harmonic development of particular regions followed by a positive impact on the quality of life in municipalities.

The analysis described above should be perceived as a starting point to a deeper investigation of the situation of the regional development processes in the Czech Republic on the various levels of hierarchy relating to the quality of life. The future considerations will relate to the choice of better indicators which is influenced by the availability of data from various sources. The use of more appropriate statistical methods and solving some methodological problems seems to be the main task for the further analysis.

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