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Assessment of regional development in light of rural and agricultural indicators within the Královéhradecký region (NUTS4, the Czech Republic)

Abstract: *Regions in the Czech Republic, the same as in most European countries, show in their rural areas a considerable difference rate from points of view demographic, social and economic as well as from point of view of infrastructure. The paper deals with an assessment of NUTS 4 in Královéhradecký region in light of rural development and agriculture indicators. The methodological approach is based on multivariate statistical analysis using composite indicators. Identification and a subsequent analysis of these differences and a determination of a certain sequence of regions and their categorization can be beneficial for definition of trouble shooting regions and better support aiming. In the paper is also evaluated current regional policy applied in observed NUTS 4 in relation with disparity analysis results and categorization.*

Keywords: *Composite indicator, rural region, disparity, ranking, categorization*

Introduction

Disparities among regions are a very frequent term in the Czech Republic in last 20 years. Major and still deepening disparities among rural areas started to appear at the beginning of 90's in connection with an economic reform. Kahoun (2007) presents that this economic transformation led in past to increase of economic differences among of individuals and also among particular areas. The same as market economy leads to a concentration of wealth in more successful society groups. It also leads to concentration of economic activity and wealth in advanced regions where presumptions for more successful economic development are created. Economy restructuring, including agrarian sector, led generally to a decrease in development of agriculture as an employer for rural population, however im-

pacts of this change were not same in all regions. This logically implied a rise of disparities among a town and the country and rural municipalities mutually. Currently, regions fight with various problems in their rural areas. There is observed a decrease and aging of the population, a lowers growth of incomes and jobs and decrease in bio-diversity and abandonment the land.

These problems have to be solved. A balanced development of rural areas is an aim of both the cohesion policy as well as the rural development policy which presently represents the II pillar of the Common Agricultural Policy.

As it was mentioned above, the countryside is not homogeneous. The evaluation of these disparities should be than as background for an application of policies which aim to development of rural areas. Here, an importance of the methodical scheme construction, enabling a comparison of regions and possibly a determination of sequence of these regions, grows. Composite indicators are valued for their ability to integrate large amounts of input indicators into easily understood formats for a general audience and therefore are used for benchmarking the mutual and relative progress of countries or regions. Munda, G. and Nardo, M. (2005) mentioned the options of usage: “Composite indicators are very common in fields such as economic and business statistics and are used in a variety of policy domains such as, sustainable development, quality of life assessment, industrial competitiveness, globalization, innovation or academic performance.”

Typology of composite indicators, methods of construction, requirements for input data and other issues are reviewed by Manly (2005), Saisana and Tarantola (2002), Mundo and Nardo (2005) and OECD (2008). OECD very often uses the composite indicators for the benchmarking or the monitoring performance of countries. As it was remarked above, composite indicators are used for comparison of regions from a view-point of the situation in rural areas and agriculture in this paper. The definition of input indicators has cardinal importance. Bryden, J. (2002) features some key rural development indicators; OECD (1996) provides set of basic indicators relevant to rural areas as well. These indicators with respect to Czech conditions could be used for the purpose of this analysis.

Aims and methodology

The valuation with the help of particular instruments of descriptive statistics is the starting point, but it is not fully sufficient. One-dimensional methods which expertise every single indicator separately provide information about the state and the development of every single indicator separately. That is very valuable information in terms of the development of regions, but fractional and not sufficient.

It is important to use such indicators for the regional development. It would be possible to accomplish complex characteristics. Composite indicators provide that. These indicators are able to describe complex conceptions such as prosperity, efficiency and sustainability. They can be easier interpreted than the whole com-

plex of fragmentary indicators and enables the fast comparison of regions from given point of view. Their construction is more complicated and that is why it is very important to pay attention to following analysis to prevent wrong interpretation.

The main aim of this article is to assess rural development in selected regions in light of rural and agriculture indicators. Assessment is based on composite indicator analysis which enable the comparison of the level of the development of regions and on its basis the categorization of regions. For its achievement there has been set a few partial aims:

A) The selection of suitable method of construction of composite indicator, these requirements are thought by author:

- the method of calculation is easy and understandable even for non-statistician,
- the value of composite indicator is easy to interpret,
- the composite indicator shows largely the regional differences,
- Composite indicator is applicable to all thematic topics (to be able to create one complex summary indicator for all topics together).

B) The valuation of region's position for the year 2008 and for the change in the years 2004 – 2008 with the regard for results of composite indicator of chosen method. The work is focused on the modeling of multidimensional statistic methods whose analytical apparatus enables complex analyses mutual incidence relevant indicators. The example is illustrated on selected indicators on the level of the districts (five NUTS 4 regions in frame of region Královéhradecký kraj (NUTS 3) of the Czech Republic).

Data entering the analysis were obtained from regional year-books of the Czech Statistical Office in 2004 – 2008, Ministry of Agriculture and Land Parcel Identification System. The choice of input data was realized on base of literature (see Bryden J. 2002, OECD 1996) and foregoing researches as well as with respect to accessibility of data.

Table 1: Table of input indicators

Demographic indicators	Social situation indicators
Average age of inhabitants	Rate of reg. unemployment
Age index	Average monthly wage
Share of people with university degree	Average registered number of employees
Natural growth	Share of employment in agriculture, forestry and fishery
Migration balance	Average monthly wage in agriculture
Average age of employees in agriculture	Number of applicants for 1 job
Growth by immigration	Share of employment in industry and building industries
Population density	
Economic-production indicators	Infrastructural indicators
Share of agr. land in region acreage AWU/ha	Number of beds in mass accommodation facilities per 1000 inhabitants
Share of farms in size category 100 ha and more in total number of businesses	Number of inhabitants per 1 doctors
Ratio of arable land	Number of municipalities per primary school in district without district town
Intensity of farm animal breeding	Opened flats per 1000 inhabitants
Average size of farm	Number of inhabitants per 1 kindergarten
Ratio of less favoured areas	Number of health-service facilities in district without district town per municipality
Number of farms	Finished flats per 1000 inhabitants
	Number of inhabitants per primary school

Source: Czech Statistical Office 2004 – 2008, Land Parcel Identification System, Ministry of Agriculture

The Královéhradecký region (NUTS 3) is situated in northeastern part of the Czech Republic and covers the territory of the following five districts (NUTS 4): Hradec Králové, Jičín, Náchod, Rychnov nad Kněžnou and Trutnov. With an area 4 758 square kilometers and a population of 548 368 inhabitants it belongs among the smaller NUTS 3 regions of the Czech Republic. The part of its northern and eastern border is as well the state frontier with Poland.

There are many approaches to determination of the countryside. Some definitions contain limit values (e.g. border for a rural municipality up to 2000 inhabitants), others are all-descriptive. The European Commission uses the OECD methodology. This definition of rural areas is the most widespread and it is dealt with the only definition internationally recognized and it serves for international comparisons.

The OECD methodology is based on a population density and on a share of inhabitants living in rural communities in a given region. A statistic limit, commonly used in the Czech Republic for limitation of rural municipalities is 2000 inhabitants. In ex ante evaluation of the Program of Rural Development of the Czech Republic it is reminded that from a view-point of methodology it is useful for determination of rural area to present an influence into two categories – a number of inhabitants and a population density per km². Each of the above mentioned ways of the country determination has its advantages and disadvantages and it is not possible to determine unambiguously which typology is the best and reflect best the reality.

Královéhradecký region includes 448 municipalities, from that 58 are towns (more than 2000 inhabitants). About 69% of Královéhradecký region acreage occupies rural territory; this area includes 29% inhabitants of this region (according to OECD). Least urbanized is district Jičín, where more than 20% population live in municipalities with up to 500 inhabitants. In the Královéhradecký region is this share about 12%. Average acreage of the municipality in this region is 10,6 square km and average number of inhabitants in one municipality is 1238.

The table 3 shows the above mentioned variant of the rural municipality definition. The first variant stems from the OECD methodology where as a rural municipality is considered a village with population density up to 150 inhabitants per km². According to the OECD typology, the region Jičín belongs in the category „a rural region“ – so a region where more than 50% of population live in rural municipalities. Other regions belong among so called transitional regions, i.e. regions with a share of inhabitants in rural municipalities in an interval 15 – 50%. A town region (less than 15% of population live in rural municipalities) is not in the Královéhradecký region (NUTS 3).

Table 2: Extent of rural area in the districts (NUTS 4) of the Královéhradecký region (NUTS 3)

	Hradec Králové	Jičín	Náchod	Rychnov nad Kněžnou	Trutnov
Number of inhabitants	160 412	78 098	112 302	78 753	120 078
Number of municipalities including towns	104	111	78	80	75
Average number of inhabitants per municipality	1 542	704	1 440	984	1 601
Share of people living in municipalities with density up to 150 inhab. per square km in total number of inhabitants	24.23	53.64	28.89	45.34	31.24
Share of people living in municipalities up to 2000 inhabitants per total number of inhabitants	25.11	42.23	27.39	42.00	29.90
Share of people living in municipalities up to 2000 inhabitants and with density 150 inhabitants per square km in total number of inhabitants	21.38	40.06	26.42	34.40	27.54

Source: Czech Statistic Office 2008, own calculations

As Majerová (2009) presents, owing to specific conditions and historical development, are the most represented in the Czech Republic mixed regions. They constitute a wide range of transition between an expressively rural and expressively town regions. For the reason the middle category is further divided into three other types:

- Preliminarily rural (37.5 - 50 % rural population) – Rychnov n. Kněžnou;
- Mixed regions (25 - 37.5 % rural population) – Náchod and Trutnov;
- Preliminarily town regions (15 - 25 % rural population) – Hradec Králové.

Selected methods of composite indicators

The models of the aggregate indicators have been applied on chosen indicators of the theme of situation in rural area and agricultural development.

The literature of composite indicators (see Hrach, K. 2005, Saisana, M., Tarantola, S. 2002, Svatošová L. 2005) offers several examples of aggregation techniques. In the paper were used methods as follows (table 3).

The order or five observed regions for each indicator was created in case of ranking method. The first rank has been allocated to the best value of an indicator; the fifth rank has been allocated to the worst value. The identical values have been assessed by the average order. The region, whose sum of orders of indicators was the lowest, was found in the best position. The region whose total sum of order was the lowest had the best position. In case, where lower value of the indicator indicates better state, is y_{ij} in ratio method expressed as reverse value of observed proportion. Standardized scores y_{ij} are in standardized method computed according to (3), if higher value of variable presents positive state. If higher value presents negative state (for example unemployment rate), are modified y_{ij} values included to composite indicator with negative sign.

Table 3: Synopsis of compared composite indicators methods

Name	Method of calculation	Formula number
Ranking	$CI_i = \sum_{j=1}^m q_{ij}$	(1)
Ratio	$CI_i = \frac{\sum_{j=1}^m y_{ij}}{m}$, where $y_{ij} = \frac{x_{ij}}{\bar{x}_{\cdot j}}$	(2)
Standardization	$CI_i = \frac{\sum_{j=1}^m y_{ij}}{m}$, where $y_{ij} = \frac{x_{ij} - \bar{x}_{\cdot j}}{s_j}$	(3)
Range	$CI_i = \frac{\sum_{j=1}^m y_{ij}}{m}$, where $y_{ij} = \frac{x_{ij} - \text{extr}(x_{\cdot j})}{R(x_{\cdot j})}$	(4)

Note: q is the sequence of regions, index i represents region; $i = 1, \dots, 5$ and index j variable; $j = 1, \dots, m$; where m is number of variables; x_{ij} is original variable; $\bar{x}_{\cdot j}$ is arithmetical average; $\text{extr}(x_{\cdot j})$ refer to minimal value of selected variable (in case that high value of the variable indicates positive state) or maxima value (if high value indicates negative state); $R(x_{\cdot j})$ is range.

Results and discussion

A) The selection of the calculation of the aggregate indicator for the evaluation of districts in the Czech Republic

The goal in this section is to choose such method which is in the intentions of signalized requirements under partial aim A. There were given points to each method depended on the fulfillment of given requirements. The scale had three levels: the method which does not comply with the result in terms of requirements obtained 0 points. The method which complies but there are some reservations were got 1 point. Two points were given to the method which obtains given requirement without reserve. The classification of points has been accomplished by the author of the work.

Simplicity

The criterion of simplicity reflects the evaluation of severity of the composite indicator's calculation. To meet the requirements without reserve, the user without knowledge of statistics should be able to calculate the result. That means only with the knowledge of calculation of mean. The ranking and the ratio method fulfill that. The range method can be accepted with the reservation. This method works with variation range, which is not a well known concept for a common user. Standardization method contains the variance in its result. It is possible to calculate the variance in MS excel, but its interpretation and understanding can cause difficulties for the common user. That is why the standardization method is not in this evaluation considered as easy and understandable.

Interpretation

Sufficient interpretation of resulted value of composite indicator is an important aspect.

This aspect is different in particular method. The ratio method is considered to be the most appropriate. We can easily comment which results are higher than average (which is higher than 1) and which results are below the average. We can even say by how many percent or how many times is the result of a certain region higher or lower than the average. Standardization and range methods are acceptable with the reservations. Utilization of standardization method is limited when the mean value is zero. When using range method, we do not calculate with the mean. Further, it is not possible to deduce which regions are higher than average and which are below the average. It is hard to relate results of other regions to the zero mean when using standardization method, especially when calculating the proportion. The interpretation of ranking method is not complicated; however there is information about primary values lost.

Differences reflection

When calculation the regional differences it is important to intercept and qualify these differences as well as it is possible. The results of ranking method depict the differences in results out of the focus. That is why we consider this method not suitable. All other methods are suitable with reservations. Each of them in a certain way lowers the degree of disparity and the influence of the distant values. The result of the ratio method depends on the distant indicator's values. They distort the height of the mean and also the value of the composite indicator. The standardization method is a bit more resistant against extreme values than the ratio method. The range method is even less sensitive to those values than the standardization method.

Applicability

All compared approaches were found to be applicable to the data in the regional development. All methods enable to summarize the data in different units and to create the final aggregate indicator. When calculating the ratio method there can not be zero in the denominator which may be limitative.

According to adjusted requirements for the aggregate indicator was chosen **the ratio method**, which has obtained the highest number of points in the selection phase (table 4).

Table 4: Composite indicator method selection according to proposed conditions

Criterion\Method of composite indicator	Ranking	Ratio	Standardization	Range
Simplicity	2	2	0	1
Interpretation	1	2	1	1
Differences reflection	0	1	1	1
Applicability	2	1	2	2
Total	5	6	4	5

Note: point scale is as follows: 2 = comply with requirement without reserve, 1 = comply under reservations, 0 = not acceptable.

Source: own calculations

B) The evaluation of region's position using chosen methods of composite indicator and subsequent categorization of regions from the point of view of ranked indicators into the composite indicator

Position evaluation

The ratio method has been chosen as a method of composite indicator. The ratio method has still got the reserve in one of the criteria of selection – in the reflection of the differentiation. For this particular reason the author suggests the modification of ratio method. It consists of the substitution of the mean by the value of median. Median is a robust characteristic of central location. Its usage in the calculation enables more expressive differentiation of the resulting value of composite indicator. Median of each indicator is not influenced in the calculation by distant observations as much as it is in the case of mean. It enables more outstanding differentiation of composite indicator.

The ratio method can be characterized by the formula (2). In terms of the modification changes the formula for y_{ij} (2) into (5).

$$y_{ij} = \frac{x_{ij}}{\tilde{x}_{.j}} \quad (5)$$

Note: y is modified value, index i refer to region, index j to variable; $i = 1, \dots, 5$; $j = 1, \dots, m$; where m is number of variables; x_{ij} is original values of the variable; $\tilde{x}_{.j}$ is median of the variable.

In the situation where the lower value of indicator means better condition, there is recounted quantity y_{ij} expressed as a reversed value of ration in the formula (5).

Partial evaluation of regions in frame of selected topical indicator groups

From a view-point of evaluation of importance of every variable of the total indicator value, as the most suitable was chosen the ratio median method. This method is further used for more detailed evaluation of indicator groups for regions (NUTS 4) in frame of the Královéhradecký region (NUTS 3). The calculation was created for year 2008.

Table 5: Composite indicators according to topic groups of indicators and regions NUTS 4

Region (NUTS 4)	Demographic		Social situation		Economic- production		Infrastructural	
	CI	rank	CI	rank	CI	rank	CI	rank
Hradec Králové	2.60	2.	1.26	1.	1.03	1.-2.	1.09	2.
Jičín	2.80	1.	0.94	4.	0.96	4.	0.88	5.
Náchod	0.58	5	0.99	3.	1.03	1.-2.	0.97	4.
Rychnov nad Kněž.	0.89	4.	1.03	2.	0.90	5.	1.00	3.
Trutnov	1.03	3.	0.92	5.	0.98	3.	1.41	1.

Source: own calculations

Note: CI = composite indicator

Demographical indicators showed in complex the best values in districts Hradec Králové and Jičín where e.g. higher increase in number of population can be observed. The worst region Náchod was characterized by the negative migration balance and a higher age index value. A social situation resulting from the selected input indicators were evaluated the best in the region Hradec Králové. Here it is important to emphasize that the social situation was evaluated with an emphasis on the agricultural sector. The region Hradec is characterized by the lowest unemployment, a low share of job applicants, and an above-average wage height.

In evaluation of economic-production composite indicator, two first places fill districts Hradec and Náchod, the worst the region Rychnov. It is given by geographical and climatic conditions which reflect themselves in the extent of agriculture in the given region. The region Hradec Králové has a highest share in agricultural land and the highest ratio of arable land; agricultural production is more intensive in this region than in others.

In evaluation of infrastructural indicators, the region Trutnov gets on the first place. It is given by attractiveness of this region from a view-point of travel movement and thereby also higher numbers of accommodation capacities than in other regions. From a point of view of our indicators, the region Jičín takes the last place.

Complex evaluation of regions in frame of all selected indicator groups

Complex evaluation is made for all groups of input variables together for year 2008 and for change over years 2004 – 2008.

Table 6: Composite indicators for year 2008 and change in 2004 – 2008

Region (NUTS 4)	2004		2008		Change in 2004 - 2008*	
	CI	rank	CI	rank	CI	rank
Hradec Králové	1.062	2.	1.501	1.	1.004	2.
Jičín	1.016	4.	1.411	2	1.041	1.
Náchod	0.915	5.	0.892	5.	0.986	5.
Rychnov nad Kněž.	1.031	3.	0.954	4.	0.990	4.
Trutnov	1.075	1.	1.089	3.	1.002	3.

Source: own calculations

*CI for change between 2004 – 2008 based on average change indicator

As it is obvious from the table 5, the best results were achieved in year 2004 in Trutnov and in year 2008 in Hradec Králové. These regions embodied better results in variables such migration balance, share of people with university degree, average registered number of employees or number of health-service facilities in district. Their composite indicator was markedly above the value 1 which indicated the mean value. Ranking is closed by Náchod district, which showed worse results in mentioned variables. Hradec in 2004 and Jičín in 2008 embodied above-average results in the average wage. Náchod district is focused on the engineering and textile industry, both with lower value added.

Biggest progress is perceptible between the years 2004 and 2008 in Jičín district (table 5, columns Change in 2004 – 2008). In terms of the tracked indicators, the smallest progress was accomplished in Náchod district.

Categorization of valuated regions based and selected indicators

The position of the regions depicting the combination of the stage in certain year and change in the certain period (table 5) can be digestedly characterized by so call Diagram of the regional development (figure 1). The regions in the quadrants leaders, stagnant and catching up can be considered as those with good developing potential. Dashed line for composite indicator in the year 2008 and also for composite indicator of change between the years 2004 and 2008 represents the mean value from the composite indicators of observed regions. The best results embody those leaders where there has been the positive development provided in the years 2004 – 2008 as well as above-average height of composite indicator for the year 2008. It is Jičín district. The above-average height of composite indicator for the year 2008 and below-average improvement in the period 2004 – 2008 were characteristic for district Hradec Králové, the stagnant quadrant. Trutnov can be considered as the Catching up with encouraging development even though in the light of the state of the regions we usually locate them to the worse group of regions. In the light of the change it made huge improvement in the period 2004 – 2008. The quadrant Losing contains regions which usually reach below-average values in terms of single years, but even in terms of a change of tracked time series, the regions remain to be under-average. There are situated districts Náchod and Rychnov. Distribution of regions into particular quadrants is mostly influenced by indicators contained in all topic groups, i. e. negative migration balance, unemployment rate and registered job applicants or lower average wage in agriculture.

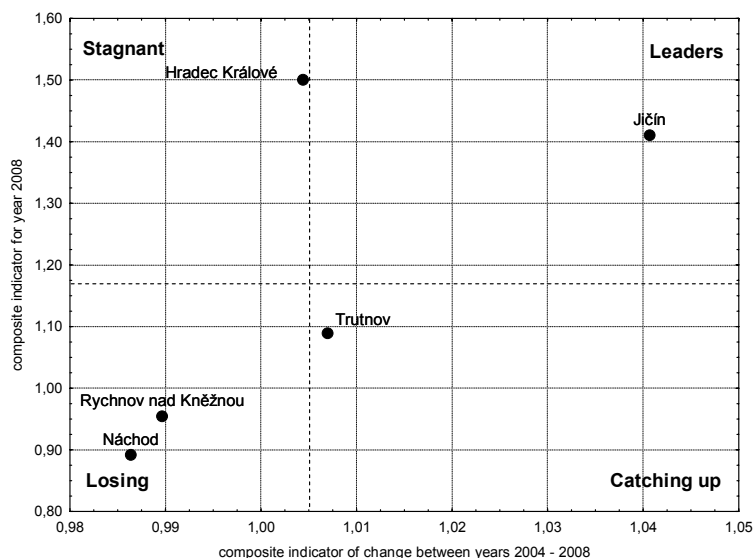


Figure 1: Regional development diagram

Source: own elaboration

Note: dashed lines mean average value of composite indicators (for year 2008 is it 1,169; for change between 2004 and 2008 is it 1,005).

Conclusion

There has been a methodical instrument for the evaluation of regional development suggested in this work. It has been verified on selected indicators of the rural and agricultural sphere. The suitable method for the evaluation of position of the regions has been chosen, the method has been modified by author to suit even better the primary requirements. The important base for the determination of the composite indicator is the quantity of data, which is important to gather for all primary indicators. The missing indicators lower the quality of analysis. For the values of composite indicators for the year 2008 and the change in the years 2004 – 2008 was diagram of regional development created, which has enabled the categorization of the regions.

The utilization of the methodological instrument for the complex evaluation of the regional development is universal and is not limited by the type of a region. The suggested methodology enabled to carry out a comparison of region collectively, on base of all selected indicators and separately according to topical indicator groups. Differences among particular regions were quantified with the help of the composite indicators and on base of found out results a ranking of regions in frame of a district was compiled.

The composite indicators are significantly influenced by a selection of used indicators, according to a type of method then by a way of calculation. Further it is essential to point out that their construction can not be created without knowledge of all input variables. The analysis was carried out at the level NUTS 4 for the reason of the necessary database absence at a lower territorial unit.

If we deal directly with the disparity analysis in the rural area, of course, it is necessary to choose the least territorial-administrative unit so that town area could be excluded. Observing of disparities among rural municipalities mutually can be a contribution for more exact definition of troubleshooting areas and more accurate revealing of these disparities causes. However, there is an absence of database connected with an economic efficiency, a significance of agriculture, indicators describing the infrastructure etc. Other troubleshooting problem of these analyses would be a question of delimitation of a rural municipality. A use of different variants of the country delimitation will lead to different results. For these reasons the author chooses an evaluation procedure of the situation in rural area at a regional level.

A situation analysis in rural areas with the help of the composite indicator can be used in creation of development programs aiming to a stabilization and further development of rural areas. The identification of regional differences and the determination of the certain rank of regions can be beneficial for the definition of trouble shooting regions and better support aiming.

According to strategic regional documents for years 2008 – 2010 and 2010 – 2013, Náchod district is supposed to focus on the rural development activity, the exploitation of brown fields and on the increase of living standard in rural

territory. The program is focused on cross-border cooperation with Poland as well. In Královéhradecký region are supported mainly two mountain rural areas – Krkonoše Mountains (Trutnov district) and Orlické hory Mountains (Rychnov district). The first named area has for the Královéhradecký region bigger importance. This importance is also connected with higher financial support. The support of the specific regional products and services from Orlické hory area is not included with high importance in strategic regional document of Královéhradecký region. Some decreasing of this disadvantage is solved partly by cooperation of Rychnov district in frame of Euroregion Glacensis as cross-border cooperation with polish partners. Development problems of Náchod district are solved in strategic documents quite good.

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