The increase of rural development measures efficiency at the micro-regions level by cluster analysis. A Romanian case study

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Abstract

The aim of this paper is to demonstrate the role of cluster analysis of rural localities as the basis for a more efficient way of choosing the rural development measures to be used to stimulate rural socio-economic growth. We present evidence of the typologies of rural localities determined by hierarchical cluster using the Ward method. We used five groups of criteria: 1. characterising labour force supply (10 indicators); 2. those which describe the structure of employment via economic activities (5 indicators); 3. characteristics of living standards (7 indicators), 4. labour force, natural resources and local income characteristics (11 indicators). All of these indicators, used in the first stage of factor analysis, and in the second stage in the cluster analyses, permit classification of rural localities in different clusters, which, generally need different measures for rural employment growth. We offer a short description of the groups of localities which belong to different clusters. This information can help local, county and regional level decision makers to identify the most efficient approaches to stimulating rural development.

Key words: global-local, rural localities typologies, factor analysis, cluster analysis, North-West region, Bistriţa-Năsăud county of Romania

JEl Classification: R11, J21, J43, O18, C38

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1. Introduction

EU cohesion policy measures aim to overcome interregional disparities and strengthen backward regions, while rural development policy should contribute to a better standard of life of rural inhabitants. To achieve synergy between these policies (and many others), a stronger linkage is needed between the development strategies of regions and those formulated by component localities. Competitiveness has become a key term in economic theory in general, (M. E. Porter 1990, Hunya G., 2000, Lengyel I., 2002) etc.) and in the EU in particular, after the Lisbon Strategy was proclaimed by the European Council in March 2000.

The two basic questions of territorial competitiveness studies are: 1. How can the level of territorial competitiveness be measured? 2. By which means can it contribute to the improvement of the territorial competitiveness of a region? One group of economists has argued that productivity and growth rates are the main indicators of success in global competition. Others put the accent on social aspects, therefore on high employment rate and on improvement of standards of living along side the purely economic factors. In the general sense, a region is competitive if it can generate relatively high and sustainable levels of income and employment. This definition makes it relatively easy to find indicators and make quantitative characterisation of the regional competitiveness.

Our working assumption is the necessity to correlate the local and global point of view in territorial development. Rural development is a local action, but its foundation requires not only profound knowledge of the local situations but knowledge of the socio-economic situation at higher levels (county, region, country, EU). Despite some common features, rural areas cannot be considered homogeneous. They are much more heterogeneous than a generalised comparison with urban areas might suggest. Rather, they have specific characteristics which differ within the studied county and even more across regions and countries. Therefore, in order to design concrete rural development, specifically rural employment policy measures adapted to the peculiarities of the specific localities, the analysis only on NUTS2 and NUTS3 territorial level is not sufficient.

Only this complex approach provides a basis for choosing the most efficient local actions regarding rural development. In Romania a better foundation of the rural development objectives and measures is necessary (a) within the regional development strategies; (b) within the county strategies; (c) within the groups of communes (Intercommunity Development Associations, Microregional Associations, LEADER groups etc) and (d) within the development strategies of the communes. It requires a more profound research on the situation of every commune, respectively the situation of every group of communes but in the context of the county and the region. The horizontal and

the vertical interdependence of territorial units must be more respected concerning programmes and projects of rural development.

This paper offers a means for more efficient grounding of rural development strategies at NUTS2, NUTS 3 and LAU2 levels by better correlation among them. We present a case study application concerning the rural employment problems in the 58 communities of Bistriţa-Năsăud county in correlation with the strategic objective of growth of competitiveness of the North-West region of Romania. In the first part of the paper we analyse the differences in competitiveness of counties, emphasising the main bottlenecks of economic structures. In the second part, after the clear vision about the "mainstream" problems at the county level, we analyse the concrete state of rural localities, their strengths and weaknesses. We used cluster analysis carried out for the rural localities, first at the regional level and then at the county level, in order to obtain more detailed knowledge of local patterns within one county. The 58 rural communities are classified by different criteria by factor analysis and then by cluster analysis and we explain the differences between the level and evolution of competitiveness of this region mainly by the differences of the situation about the territorial labour employment.

2. Methodology

2.1. Components of regional competitiveness

In the territorial approach of the evolution of competitiveness, a classical methodology exists based on decomposition of GDP/capita (or GVA/capita) which can be applied at the national, regional and county level, where we can find data for indicators. The direct decomposition method cannot be applied at the settlement level, because at the moment we do not have the necessary database for this analysis. In order to measure the competitiveness of the North-West region we have to use territorial statistics. The National Regional Accounting offers a database at the branch level and we have to limit our calculations to the year 2005. Thus we used per capita income of the population, expressed by GDP per capita, as a measure of the territorial (regional and county level), economic and social competitiveness. This indicator could be expressed by the combination of the following interrelated factors: labour productivity, employment rate and the share of working age population.

The general relation is: $\frac{GDP}{P} = \frac{GDP}{E} \cdot \frac{E}{P_{Wa}} \cdot \frac{P_{Wa}}{P}$,

where P = total population; E = employment; P_{Wa} = population at working age; $\frac{GDP}{P}$ =income per capita; $\frac{GDP}{E}$ = labour productivity; $\frac{E}{P_{Wa}}$ = rate of employment; $\frac{P_{Wa}}{P}$ = the working age share in total population.

The simplified form of relation is: $\frac{GDP}{P} = \frac{GDP}{E} \cdot \frac{E}{P}$.

In the following we present different types of decompositions of the general measure of economic and social competitiveness (GDP/P) and so we try to find its main factors of influence.

At first, the analysis of competitiveness is done by structure of economic activities (sectors):

$$\frac{GDP}{P} = \sum_{k=1}^{m} \frac{GDP_k}{E_k} \cdot \frac{E_k}{P};\ k = \overline{1,..m}, \text{ economy activities; if } \begin{cases} GDP = \sum_{k=1}^{m} GDP_k \\ E = \sum_{k=1}^{m} E_k \end{cases}$$

In this decomposition, the main factors of competitiveness are the labour productivity at the level of economic activities, weighted by the employment as compared to the total population.

In the paper we take into consideration the main economic activities, in this case the relation is:

$\frac{GDP}{P} = \frac{GDP_a}{E_a} \cdot \frac{E_a}{P} + \frac{GDP_i}{E_i} \cdot \frac{E_i}{P} + \frac{GDP_s}{E_s} \cdot \frac{E_s}{P}$, k = a – agriculture, k = i – industry (+ construction),
k = s – services.

The territorial competitiveness is high if the sector with a high level of labour productivity employs a bigger part of population.

The interdependence between the regional and the county level competitiveness could be formulated in the same way as in the sectored analysis: $\frac{GDP}{P} = \sum_{j=1}^{6} \frac{GDP_j}{P_j} \cdot \frac{P_j}{P}$; if $GDP = \sum_{j=1}^{6} GDP_j$ for NW region with j=1,...,6 counties.

The measure of regional competitiveness can be expressed as the sum of the county level competitiveness weighted by the rates of the counties' population in the total population of the region.

Thus in each county the relation is valid: $\frac{\mathrm{GDP_j}}{\mathrm{P_j}} = \frac{\mathrm{GDP_j}}{\mathrm{E_j}} \cdot \frac{\mathrm{E_j}}{\mathrm{P_j}};\ j = \overline{1,6}$.

Other forms of interdependence between regional competitiveness and the counties' indicators are the following: $\frac{GDP}{P} = \sum_{j=1}^{6} \frac{GDP_j}{E_j} \cdot \frac{E_j}{P};\ \mathrm{j} = \overline{1,6}$. The sum of the labour productivities at the county level weighted by the rates of the counties' employment compared to the total population amounts to the regional competitiveness.

A complex analysis of the regional competitiveness by counties and by structure of economic activities can be put into practice on the basis of the following relationships:

$$\frac{\mathrm{GDP}}{\mathrm{P}} = \frac{\frac{\mathrm{GDP_{j_k}}}{\mathrm{E_{j_k}}} \cdot \frac{\mathrm{E_{j_k}}}{\mathrm{P}}}{\frac{\mathrm{GDP_{j_k}}}{\mathrm{GDP}}} \quad \text{or} \quad \frac{GDP}{P} = \frac{\sum_{j=1}^{6}\sum_{k=1}^{3} \frac{GDP_{j_k}}{E_{j_k}} \cdot \frac{E_{j_k}}{P}}{\sum_{j=1}^{6}\sum_{k=1}^{3} \frac{GDP_{j_k}}{GDP}} \quad \text{or}$$

$$\frac{GDP}{P} = \sum_{j=1}^{6}\left(\sum_{k=1}^{3} \frac{GDP_{jk}}{E_{jk}} \cdot \frac{E_{jk}}{P_j}\right) \cdot \frac{P_j}{P}.$$

These relationships emphasise the main factors of regional competitiveness:

- the structure of the total population in the counties;
- the structure of employment by economic activities in the total population at the county level;
- the structure of labour productivity by counties and by economic activities;
- the structure of total GDP by counties and by economic activities.

In economic analyses it could be important to quantify the variation in time of competitiveness, as a function of their factors.

2.2. Cluster analysis

In order to categorise rural communities with respect to several characteristics (variables), hierarchical clustering methods were applied using the statistical program SPSS. (Baum S., et al., 2004)). The aim of cluster analysis is to „partition a set of observations into a distinct number of unknown groups or clusters in such a manner that all observations within a group are similar, while observations in different groups are not similar" (Timm 2002, p. 515). The degree of similarity in one group is defined by the distance between

the observations (here: communities) within a multidimensional co-ordinate system where each axis represents one feature (such as total population, share of young people etc.). According to its characteristics, each community is positioned in this multidimensional space. The closer to each other communities are, the more likely they are to be grouped into the same cluster. The distance between communities can be measured differently. In this paper, the squared Euclidian distance was used, assuming that the variables considered are linearly independent. In the analysed case, they are correlated so it was necessary to carry out a factor analysis prior to the cluster analysis. As an algorithm for clustering, the Ward method was chosen, which usually is well-suited to result in internally homogenous and externally distinguishable groups and regional types, respectively.

A hierarchical cluster analysis does not automatically result in one optimal number of clusters. The main approach is that the number of clusters is reduced one by one by merging two existing clusters. In the first stage, each community represents a single cluster. A dendrogram visualises the steps in a hierarchical clustering procedure. There is no singular measure to decide on the most appropriate number of clusters for the research problem investigated. There are some criteria which give an indication of the stage at which to stop the clustering procedure. Since the expert is given the responsibility of choosing the distance measure and the clustering algorithm, as well as the most appropriate number of groups, the results of a cluster analysis are always subjective to some degree.

The variables used for the typology were selected according to their relevance to rural development and their spatial distribution, as well as for questioning whether rural areas can indeed be characterised, as they often are, as having:

- a low population density, which induces few incentives for investment and difficulties in providing sufficient infrastructure;
- an unfavourable age structure of the population due to higher birth rates and the emigration of young, skilled people;
- high dependence on agriculture;
- a low income per capita;
- lacking non-agricultural income opportunities and high unemployment;
- low educational level.

All of these items are reflected in the 23 variables used in the factor analysis. (Table 11). All variables were standardised by a Z-transformation to ensure equal weighting in the analysis. Data are taken from multiple sources, mostly from the TEMPO database of NIS Romania and from the general Census of population, 2002.

3. Results and discussion

3.1. The general characteristics of the North-West region

The Romanian regions (which have no administrative roles) were set up on the basis of the Law 151/1998 (modified by Law 315/2004) through the voluntary association, in the case of North-West region, of the local public administrations from the counties of Bihor, Bistriţa-Năsăud, Cluj, Maramureş, Satu-Mare and Sălaj. The North-West region has an area of 34,159 km^2 and a population of 2,729,200 inhabitants. According to the OECD criteria, the North-West region is an intermediate rural region. In recent years the region faced a demographic decline, caused by the low birth rate and the massive emigration of the population (especially of the young, active population). Natural population increase has been negative since 1992. The paper published in 2003 (Vincze M., 2003) offers a picture of the level and evolution of regional competitiveness in the period 1994-2000. A more detailed analysis of the regional competitiveness has been made for the period 2000-2005. (Table 1-4)

Table 1. The GDP per inhabitant at current market prices, (EUR)

Year	Romania	North-West
2000	1798.4	1682.8
2005	3680.5	3499.1
I 2005/2000 %	204.7	207.9

Source: Eurostat

The analysis of the regional GDP/inhabitant during the period 2000-2005 shows that although the regional GDP/inhabitant increased in the North-West Region, it is below the national average.

Next, we analyse the structure by economic activities of the GDP, employment, labour productivity and the share of employment in the total population.

Table 2. The GDP and employment distribution on national and regional level by sectors

Country Region	Year	$\frac{GDP_{ja}}{GDP_j}$ (%)	$\frac{GDP_{ji}}{GDP_j}$ (%)	$\frac{GDP_{js}}{GDP_j}$ (%)	$\frac{E_{ja}}{E_j}$ (%)	$\frac{E_{ji}}{E_j}$ (%)	$\frac{E_{js}}{E_j}$ (%)
Romania	2000	11.1	35.6	51.2	41.4	23.2	35.4
	2005	9.5	35.2	55.3	31.9	29.0	39,1
North-West	2000	13.8	35.1	51.1	45.9	22.2	31.9
	2005	11.4	33.9	54.7	35.0	29.2	35.8

Source: Own calculations on the basis of Territorial Statistics, 2002, 2007 NIS. (i=industry+construction)

Table 3. The gap in labour productivity by territories (j) and by sectors (RON/empl)

Country Region	Year	$\frac{GDP_j}{E_j}$	$\frac{GDP_{j_a}}{E_{j_a}}$	$\frac{GDP_{j_i}}{E_{j_i}}$	$\frac{GDP_{j_s}}{E_{j_s}}$
Romania	2000	9.314	2.494	10.952	14.635
	2005	34.346	9.070	36.729	46.320
North-West	2000	8.120	2.440	9.137	13.014
	2005	30.223	8.704	30.970	40.817

Source: Own calculations on the basis of Territorial Statistics, 2002, 2007 NIS. (a = agriculture, i = industry+construction, s = service)

Table 4. The share of employment in total population by region and by sectors (%)

Country Region	Year	$\frac{E_j}{P_j}$	$\frac{E_{j_a}}{P_j}$	$\frac{E_{j_i}}{P_j}$	$\frac{E_{j_s}}{P_j}$
Romania	2000	38.5	15.9	8.9	13.6
	2005	38.7	12.3	11.3	14.0
North-West	2000	41.1	18.9	9.1	13.1
	2005	41.8	14.6	12.2	14.9

Source: Own calculations on the basis of Territorial Statistics, 2002, 2007 NIS.

The differences between the structure of employment on the one hand, and the structure of GDP by economic activities on the other, explain the competitiveness gap between Romania on the average and the North-West region.

3.2. Regional competitiveness as a function of the counties' indicators

In this section, we analyse the level of competitiveness of North-West region as a function of the counties' competitiveness indicators (Vincze M. et al. 2009). Only on the basis of similar calculations (Table 5-7) can the intra-regional territorial differences be observed, and can, on the one hand, the regional results and, on the other, the strengths and weaknesses of different counties be explained. Important intra-regional differences can be observed.

Table 5. The level of the competitiveness and its direct factors in the North-West region and its counties in 2005, and the evolution between 2000-2005

	Units of measurement	North-West	Bihor	Bistrița-Năsaud	Cluj	Maramureș	Satu Mare	Sălaj
GDP/P	RON/cap	12,623	13,655	10,863	16,267	9,778	11,008	10,455
GDP/P	I 2005/2000	379	396	375	363	384	379	395

	%							
GDP/E	RON/cap	30,223	29,910	28,533	36,652	25,197	27,875	26,593
GDP/E	I 2005/2000 %	372	392	359	336	392	386	411
E/P_{Wa}	%	65.3	72.5	60.5	67.8	60.1	61.0	64.4
E/P_{Wa}	I 2005/2000 %	94.3	93.6	96.6	100.5	90.8	91.0	88.0
P_{Wa}/P	%	64.0	63.0	63.0	65.4	64.5	64.7	61.0
P_{Wa}/P	I 2005/2000 %	108	108	108	108	108	108	109

Source: Own calculations on the basis of Territorial Statistics, 2002, 2007 NIS.

The highest level of indices could be observed in Cluj county but its growth rates in the analysed period are the lowest among the six counties so we can conclude on a "convergence" of counties.

Table 6. The share of the counties in regional indicators of competitiveness, 2005

County	Units	GDP/P	GDP/E	E/P_{Wa}	P_{Wa}/P
Bihor	%	108.2	99.0	111.0	98.4
Bistrița-Năsaud	%	86.1	94.4	92.6	98.4
Cluj	%	128.9	121.3	103.8	102.2
Maramureș	%	77.5	83.4	92.0	100.8
Satu Mare	%	87.2	90.0	93.4	101.1
Sălaj	%	82.8	88.0	98.6	95.3

Source: Own calculations on the basis of Territorial Statistics, 2002, 2007 NIS.

Cluj and Bihor are the most developed counties, with higher level of indices than the average of the NW region, Maramureș and Sălaj are at the lowest level of competiveness and labour productivity, and Bistrița-Năsaud and Satu-Mare counties are between these extreme positions. The intra-regional differences are higher than the differences between the regions (the Bucurest-Ilfov region is obviously excepted).

Table 7. The structure of the GDP and of the employment by economic activities at the level of the North-West region and its counties, 2005

	Units	North-West	Bihor	Bistrița-Năsaud	Cluj	Maramureș	Satu Mare	Sălaj
GDP_a/GDP	%	11.4	10.9	16.0	8.0	11.8	14.9	15.6
GDP_i/GDP	%	27.8	29.3	30.6	24.7	27.2	30.7	30.0
GDP_c/GDP	%	6.1	4.0	5.0	9.8	4.5	4.3	3.4
GDP_s/GDP	%	54.7	55.8	48.4	57.5	56.5	50.1	50.9
E_a/P	%	14.6	15.9	15.1	11.4	15.6	15.5	15.4
E_a/E	%	35.0	34.8	39.7	25.8	40.1	41.6	39.2
E_i/P	%	10.5	12.4	8.8	10.9	9.3	10.4	9.7
E_i/E	%	25.1	27.2	23.1	24.6	24.1	25.3	24.6
E_c/P	%	1.7	1.5	1.5	2.8	1.2	1.8	0.9

E_c/E	%	4.1	3.4	3.9	6.4	3.1	3.6	2.4
E_s/P	%	14.9	15.8	12.7	19.2	12.7	12.4	13.3
E_s/E	%	35.8	34.6	33.3	43.3	32.6	29.5	33.9
GDP_a/E_a	RON/Inh	8.704	8.271	10.160	10.019	6.643	8.813	9.364
GDP_i/E_i	RON/Inh	29.649	28.315	33.405	32.505	25.384	29.854	28.605
GDP_c/E_c	RON/Inh	38.956	31.467	32.617	49.462	32.048	29.057	33.609
GDP_s/E_s	RON/Inh	40.817	42.489	36.664	42.829	38.959	41.852	35.220

Source: Own calculations on the basis of Territorial Statistics, 2002, 2007 NIS.

Relatively high differences in the structure of economy activities, between counties, and, at the same time, important divergence of the labour productivity at the sectors' level, mainly between agriculture and services can be observed. However, although from national to regional and to county territorial levels, the decomposition of competitiveness indicators on its direct factors can be realised as demonstrated here, a detailed analysis at the settlements' level is more difficult, mainly due to the poor official database at this level.

3.3. Selection of a county for detailed studies

We then have to select a county where we will continue our studies at the rural locality level. Since in our case study the main subject is the analysis of the labour force market situation, concerning new jobs creation in a mostly rural area, it is evident that we should concentrate our attention on a county where the labour force supply is high (Vincze M. et al. 2010 a). Thus the first reason to choose Bistriţa-Năsăud county as a study area was that it has the highest share of rural population and the lowest population density within the counties of the North-West region (Table 8) and therefore finding a solution for the problem of rural employment is more difficult.

Table 8. Population, by county and area in North-West Region on July 1, 2009

Region County	Total	Urban		Rural		Total area (km2)	Pop. dens. (inh/km2)
		No. pers.	%	No. pers.	%		
North-West	2,718,648	1,449,002	53.3	1,269,646	46.7	34,160	79.6
Bihor	593,055	297,923	50.2	295,132	49.8	7,544	78.6
Bistriţa-Năsăud	317,205	117,871	37.2	199,334	62.8	5,355	59.2
Cluj	690,299	459,865	66.6	230,434	33.4	6,674	103.4
Maramureş	511,311	300,721	58.8	210,590	41.2	6,304	81.1
Satu Mare	364,938	173,110	47.4	191,828	52.6	4,418	82.6
Sălaj	241,840	99,512	41.1	142,328	58.9	3,864	62.6

Source: NIS: Tempo Online Time Series

The second criterion has been the higher share of the young- and of the working age population as compared to the national average, so the labour force supply is a sufficient and a necessary condition for our attention (Table 9).

Bistriţa-Năsăud county has gone through the same demographic processes as other counties in Romania: as a whole, Romania's rural society is getting older. But Bistriţa-Năsăud county seems to be having more optimistic prospects; the county, in spite of the massive international emigration (mostly to Spain and Italy), still has a more numerous younger and active population, and the percentage of the elderly (over 65+) is not as high as in the North-West region as a whole or even for the whole of Romania.

Table 9: Population in Bistriţa-Năsăud County and Romania, by areas and age groups

County Country		Total population no.of persons		% population aged 0-14		% population aged 15-64		% population aged 65+	
		2002	2008	2002	2008	2002	2008	2002	2008
Bistriţa-Năsăud	R	198,738	199,976	21.0	18.3	63.1	65.6	15.8	16.1
	U	112,919	116,811	19.8	15.6	73.2	76.7	7.0	7.7
Romania	R	10,186,058	9,669,114	19.2	17.2	62.8	60.9	18.0	18.6
	U	11,608,735	11,835,328	15.7	13.5	73.7	74.7	10.6	11.8

Source: NIS, Tempo Online

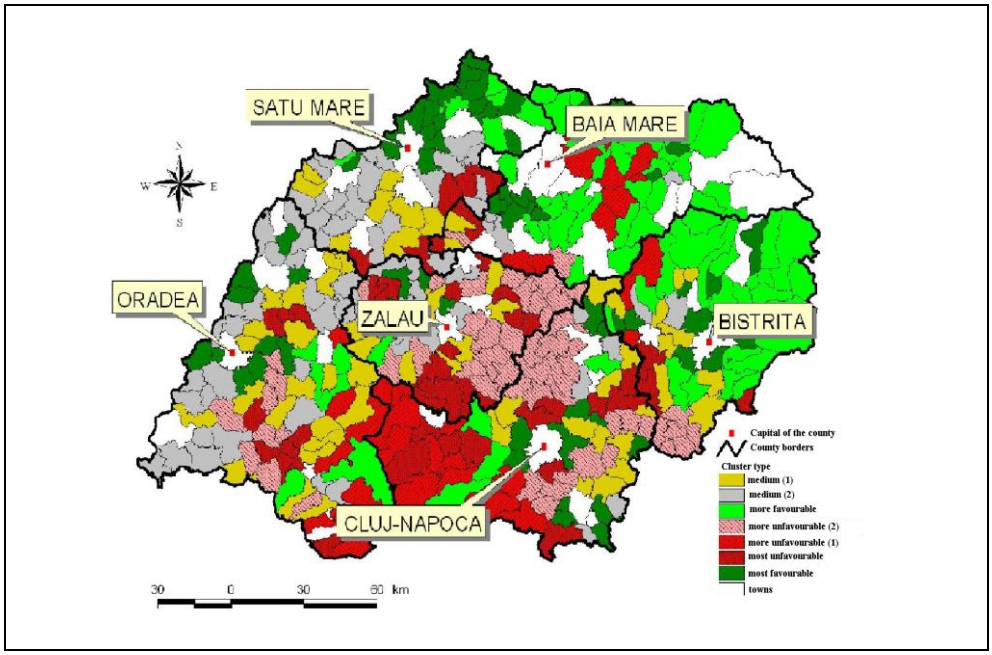
The information from Tables 5-9 shows the position of Bistriţa–Năsăud county in the North-West region on the basis of demographic and employment criteria, but more detailed information is available from the study of Vincze M. *et al*, 2009 and 2010 b. The typology of the 401 rural localities of North-West region at the same time emphasised the most favourable situation of the labour force supply in Bistriţa-Năsăud county. In this study we used as criteria of grouping of the rural localities of the North-West Region the following indicators: population density; relative numerical variation of the population in the period 1992-2002; relative numerical variation of the population in the period 2002-2006; share of population aged 0-14; share of population aged 15-59; rate of natural increase at 1000 inhabitants; share of arable land in total agricultural surface; dependency ratio. The sources of data were TEMPO-NIS, Population and Housing Census 2002, and own calculations.

From the grouping of the rural localities of the North-West region on the basis of the criteria quantified by these indicators, it can be observed that the rural area of the Bistriţa-Năsăud county is characterised by more favourable conditions from the point of view of the availability of the workforce than the other counties in the region. So our decision to conduct a more detailed research on the rural areas of Bistriţa-Năsăud county is well founded.

It is then necessary to clarify two questions:

- which are the strengths and weaknesses of the Bistriţa-Năsăud county regarding the increase of competitiveness of the North-West Region?
- which typologies of the rural communes have to be presented based on different criteria in the context of the employment issues?

Figure 1. Typology of the communes by labour force availability



The answer to the first question can be obtained from the indicators of competitiveness, labour productivity, employment and demographics in Tables 5 and 7. The general conclusions regarding the position of Bistrița-Năsăud county in the North-West Region are:

- Competitiveness of the Bistrița-Năsăud county is below the regional average;
- The share of agriculture in employment and in GDP, with relatively low labour productivity is high in the economic structure of the county, about 5% higher than the regional average;
- The share of services with relatively high labour productivity is lower than the regional average;
- In order to increase competitiveness it is necessary to act relating to the increase of the employment rate and labour productivity in the county;
- The creation of new workplaces in industry and in the services sector will lead to an increase of the competitiveness of the county.

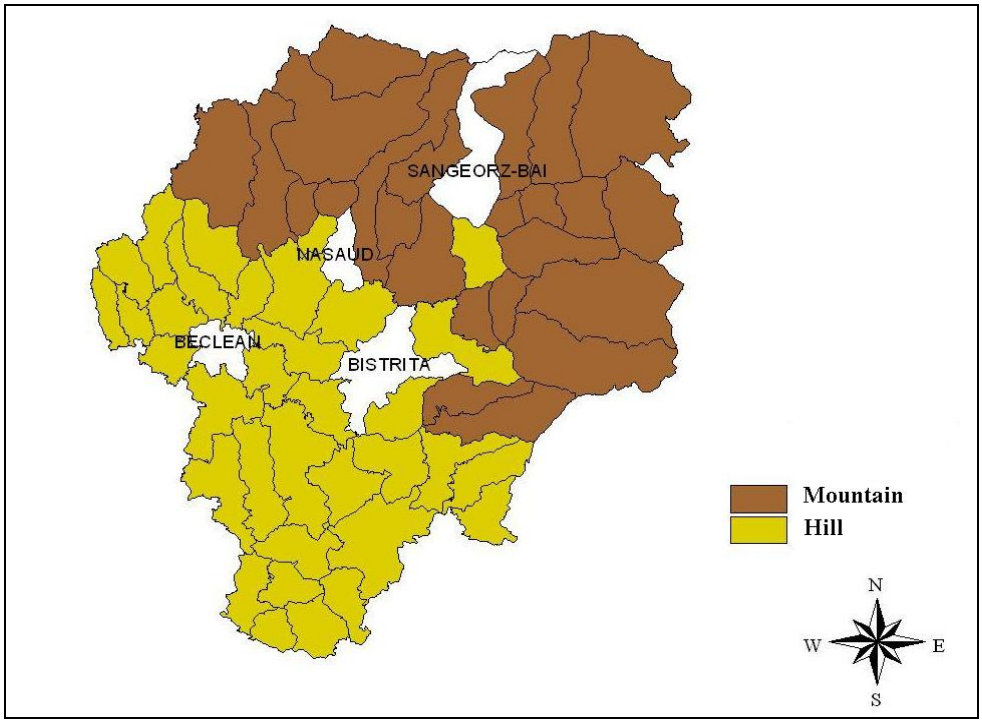
The increase of the share of the services sector could be the key to success. The first result of our research is that we can define the overall direction of rural development: an increase in the employment rate in non-agricultural activities, increase in labour productivity, mainly in services, and a change in the structure of economic activities in favour of services.

3.4. Typologies of rural localities of the Bistrița-Năsăud county based on different criteria

In this part of the paper we elaborate the typology of rural localities and show the characteristics of different types of clusters, which offer a basis for the decision on the most appropriate measures to be applied for the growth of competitiveness of localities, of the county and of the region.

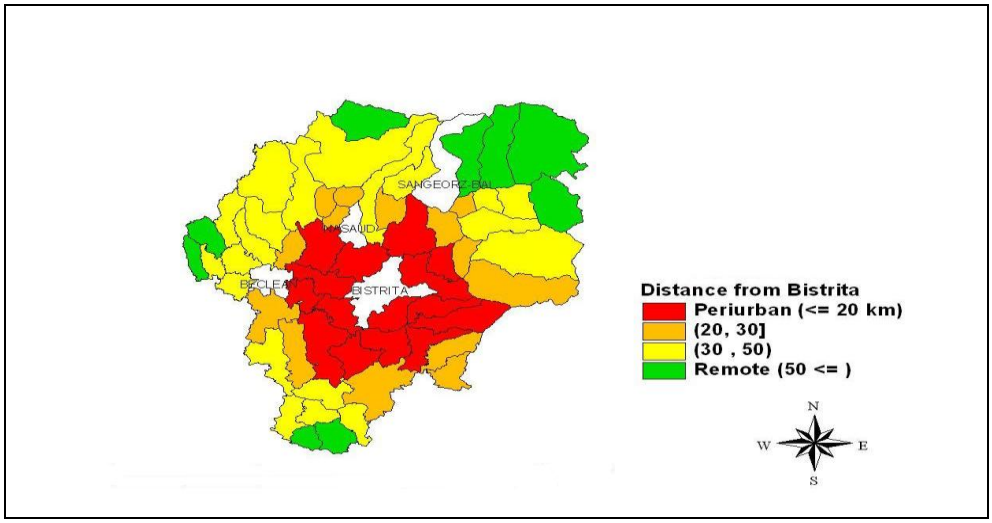
- Relief
- Accessibility to the growth centres
- Combination of the quantified indicators

Figure 2. Groups of communes by relief



Clear interdependence can not be observed between the relief (Figure 2) and the characteristics of rural employment (Figure 1) in the case of Bistriţa-Năsăud county.

Figure 3. Groups of communes by the accessibility of growth centre



The types of communities by accessibility are shown in Figure 3. In our factor- and cluster analysis we have not explicitly included the distance to Bistrita, (the only growth pole in the county, with more than 50,000 inhabitants) but our cluster analysis results highlight the important role of accessibility with respect to rural employment.

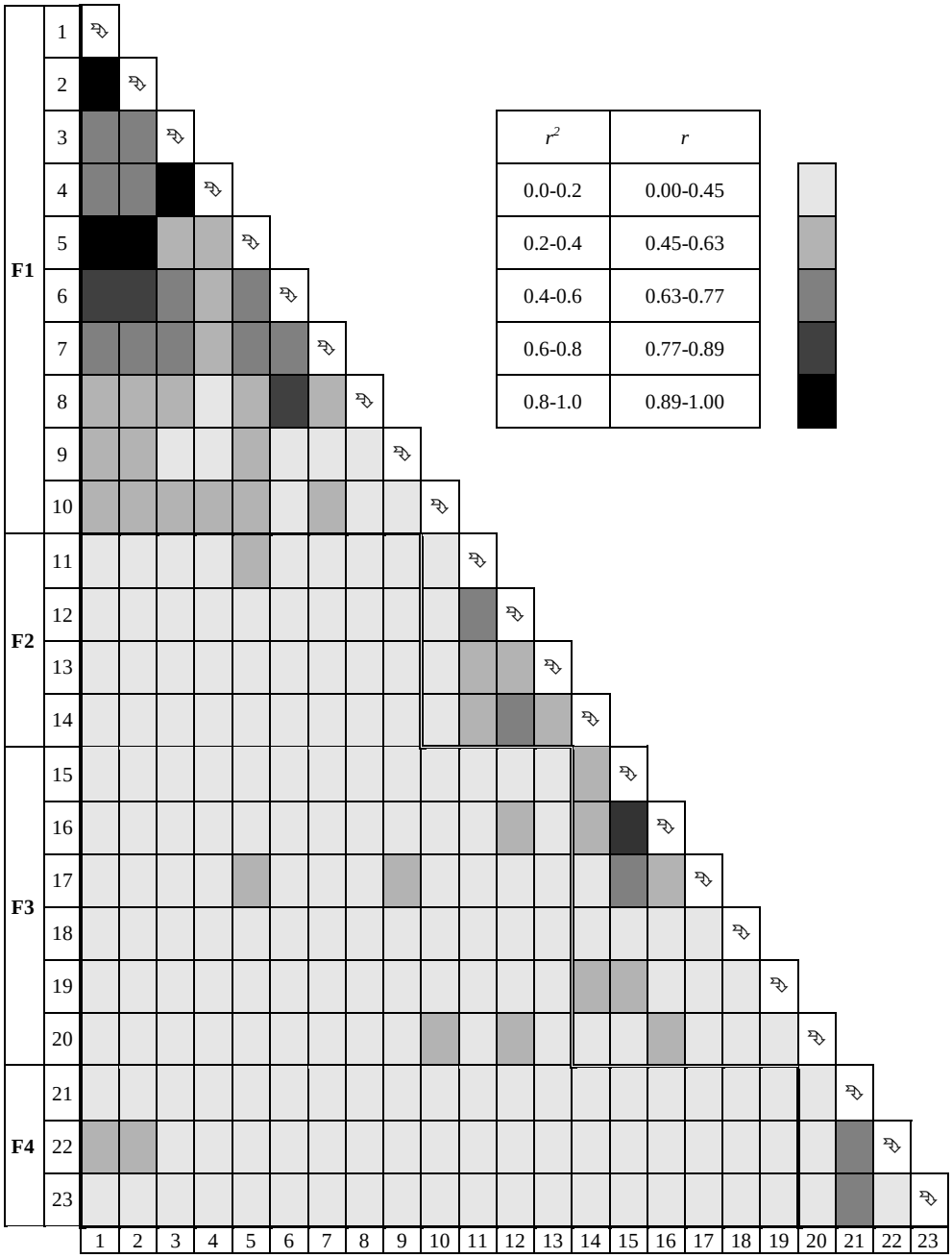
3.5. Factor analysis

In the next part we realised the typology of the 58 communities of Bistrița-Năsaud county on the basis of the combination of a set of 23 indicators which are characteristics of the rural employment situation at the community level. At first we realized the factor analysis of indicators and on the base of independent "factors" the cluster analysis has been performed.

Table 10 characterised the interdependence of the 23 variables. A relatively low connection between the indicators can be observed, which is explained by the fact that we tried to represent different aspects of the rural development problem, and used indicators which generally did not have a direct cause-effect relationship.

As the share of the employed in non-agricultural sectors (%) and the share of primary sector in employment (%) are closely correlated indicators (Table 10), job creation in non-agricultural sectors and a reduction in agricultural employment could strongly influence the rural employment problem in Bistrița-Năsăud county.

Table 10. Correlations of indicators. (For definitions of indicators see Table 11).



In Table 11 we synthesised the main results of the factor analysis on the basis of the 23 indicators, grouped into categories representing the availability of the rural labour force, quality of life, natural- and financial resources etc. Four factors could be extracted which together explain 69.4% of the total variance of all 23 variables included in the data set. The correlations of each standardised variable and the factors, presented in Table 11, permit us to explain and name the factors.

Table 11. Factor loadings and eigenvalue

Variable	Factor				Com-mu-nality	MSA[1]
	1. Employment	2. Quality of life & existing labour supply	3. Potential of labour supply	4. Incomes		
1.Share of employed in non-agricultural sectors (%)	**0.899**	0.333	0.067	0.044	0.926	0.818
2. Share of primary sector in employed (%)	**–0.896**	–0.336	–0.061	–0.049	0.922	0.819
3. Share of employed in population: age 15 and over (%)	**–0.880**	0.277	0.168	–0.200	0.920	0.554
4. Share of non-economically active population in total population (%)	**0.851**	–0.349	0.070	0.161	0.877	0.516
5. Share of secondary sector in employed (%)	**0.813**	0.369	0.134	0.026	0.816	0.889
6. Share of quaternary sector in employed (%)	**0.804**	0.317	–0.217	0.075	0.800	0.879
7. Unemployment rate (%)	**0.782**	0.200	–0.020	0.175	0.684	0.580
8. Share of population with high educational level in total population (%)	0.588	0.418	–0.444	0.025	0.718	0.777
9. Migration growth (‰)	0.586	0.226	0.050	–0.394	0.552	0.748
10.Share of housewives in non-economically active population (%)	0.577	–0.022	0.544	0.279	0.707	0.885
11. Share of dwellings supplied with drinking water in total dwellings (%)	0.180	**0.823**	0.082	0.099	0.725	0.733
12. Share of population aged 15-64 (%)	0.094	**0.703**	0.396	0.295	0.747	0.786
13. Share of population with low educational level in total population (%)	–0.253	**–0.703**	–0.124	0.163	0.600	0.733
14. Agricultural area per inhabitant (ha/inh.)	–0.071	–0.683	–0.435	–0.184	0.694	0.825
15. Share of population aged 0-	–0.118	0.217	**0.874**	–0.062	0.828	0.429

14 (%)						
16. Natural increase (‰)	0.002	0.401	**0.813**	0.051	0.825	0.813
17. Population growth between 2002 and 2007 (%)	0.303	0.238	0.676	–0.352	0.729	0.791
18. Forest area per inhabitant (ha/inh.)	–0.100	–0.123	0.519	0.309	0.390	0.687
19.Area of rooms per inhabitant (m^2/inh.)	0.255	–0.138	–0.446	–0.279	0.361	0.644
20. Total population in 2002	0.303	0.337	0.399	0.130	0.382	0.690
21. Share of employees in population: age 15 and over (%)	0.195	0.379	–0.122	**0.712**	0.703	0.738
22. Local budget tax (RON/inh.)	0.355	0.257	0.070	**0.628**	0.591	0.694
23. Local budgets own (RON/inh.)	0.086	–0.097	0.251	**0.616**	0.460	0.557
Eigenvalue[2]	6.607	3.687	3.561	2.099	Total: 15.954	
Percentage of trace[3] (trace=23)	28.73	16.03	15.48	9.13	Total: 69.37%	

[1] The Measures of Sampling Adequacy.

[2] The eigenvalue is the sum of the squared factor loadings over all variables.

[3] The percentage of trace is the percentage of the variance in all variables explained by the factor.

The measure of sampling adequacy (Kaiser-Meyer-Olkin criterion) reaches 0.718, which is a mid-range value. The first factor named ‘employment’ explains 28.7% of the total variance of the variables.

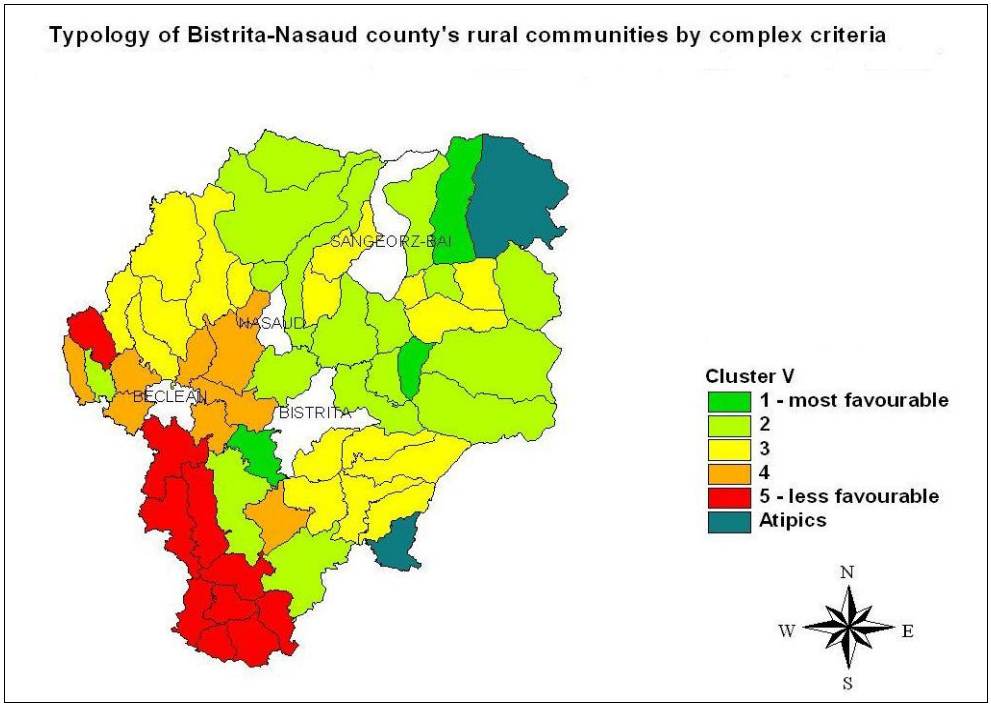
Amongst the seven high-loading variables (>0.7), two have negative sign, emphasising on the one hand, the complementarity of the primary sector to non-agricultural sectors and, on the other, the lower rate of employment in localities with higher non-agricultural employment. The second factor explains 16.0% of the total variance and is characterised by three high loading variables of the quality of life and the quantity and quality of the existing labour force. The third factor, named ‘potential of labour supply’ explains 15.5 % of the total variance. The last extracted factor has three high-loading variables which can be named ‘incomes’, and explain 9.1% of the total variance. It is evident that we have the possibility to identify the localities where the different factors are more characteristic.

In this paper we used a particular form of factor analysis, named principal component method, a branch of multivariate analysis in which the observed n variables are supposed to be expressible in terms of a number m<n factors (components). The use of factor analysis was necessary to eliminate the multicollinearity of the variables, the factors are not correlated among them. Only on the base of independent factors (components) the cluster analysis be realized.

3.6. Communities of different clusters and cluster characterisations

To provide insight on the similarities of, and differences between rural localities, an additional cluster analysis at the LAU2 level, including the 58 rural localities of Bistrița-Năsaud county was carried out. The results reveal large differences in the socio-economic characteristics between the rural localities. Five clusters of communities were identified (Figure 4). Monor and Sant were atypical, i.e. they did not fit with any of the five clusters. A summary of the features of each cluster is as follows:

Figure 4. Typology of Bistriţa-Năsăud county's rural communities by complex criteria



The results reveal large differences in socio-economic characteristics between the rural localities. A summary of the features of each cluster is as follows (Tables 12a, 12b, 12c):

Table 12a. Characteristics of the five clusters and two atypical communities with 25 variables (1/3)

Cluster (number of communities with characteristics)		Included in the cluster analysis								
		Total population	Natural increase (‰)	Migration growth (‰)	Population growth 2002-2007 (%)	Share of population aged 0-14 (%)	Share of population aged 15-64 (%)	Share of pop. with high educational level in total population (%)	Share of pop. with medium educational level in total pop (%)	Share of pop. with low educational level in total population (%)
		2002	2006-2007	2006-2007	2002-2007	2002	2002	2002	2002	2002
Cluster **1** (3)	Average*	5,526	0.85	1.78	3.41	22.6	65.7	3.7	56.0	26.2
	Minimum	3,881	–0.91	–2.97	1.03	20.3	61.9	1.4	53.6	24.2
	Maximum	6,385	2.92	8.15	6.39	25.5	67.6	5.2	58.1	29.4
	Variat. coeff.	0.258	2.265	3.220	0.800	0.119	0.050	0.544	0.041	0.108
Cluster **2** (17)	Average*	4,620	0.71	–2.16	1.71	22.2	64.6	2.0	55.1	29.0
	Minimum	1,755	–4.35	–6.34	–1.89	19.2	61.3	0.7	48.2	23.2
	Maximum	7,382	6.11	7.31	8.83	27.4	67.6	3.4	61.1	35.1
		0.378	4.289	–1.625	1.818	0.093	0.031	0.341	0.061	0.107
Cluster **3** (17)	Average*	2,882	–2.12	–3.50	1.37	22.6	62.6	1.4	54.0	30.3
	Minimum	1,430	–10.43	–15.39	–3.16	18.7	59.8	0.1	42.5	20.5
	Maximum	4,051	7.03	9.50	8.69	30.7	66.1	2.2	65.8	44.1
	Variat. coeff.	0.253	–2.227	–1.910	2.446	0.150	0.031	0.364	0.104	0.196
Cluster **4** (9)	Average*	3,112	–6.31	3.13	0.11	17.9	61.6	3.5	59.3	25.5
	Minimum	1,353	–12.20	–1.09	–3.59	14.4	58.7	2.1	53.3	18.7
	Maximum	5,522	–2.06	11.17	2.88	21.4	67.2	4.8	68.4	31.3
	Variat. coeff.	0.382	–0.437	1.237	23.623	0.118	0.044	0.252	0.077	0.147
Cluster **5** (10)	Average*	2,168	–10.90	–6.09	–4.13	15.7	58.4	2.1	51.5	36.1
	Minimum	1,221	–18.92	–16.00	–6.81	12.3	54.8	1.6	42.8	27.2
	Maximum	3,567	–5.69	3.73	–1.20	18.2	61.5	2.6	59.2	43.0
	Variat. coeff.	0.388	–0.350	–0.858	–0.365	0.134	0.040	0.190	0.107	0.138
All communities (56)	Average*	3,461	–3.34	–2.21	0.40	20.5	62.5	2.2	54.9	29.9
	Minimum	1,221	–18.92	–16.00	–6.81	12.3	54.8	0.1	42.5	18.7
	Maximum	7,382	7.03	11.17	8.83	30.7	67.6	5.2	68.4	44.1
	Variat. coeff.	0.458	–1.669	–2.610	9.031	0.183	0.050	0.490	0.093	0.185
Atypical: MONOR		1,608	–7.43	–0.33	–4.79	13.7	61.6	3.9	57.2	29.7
Atypical: SANT		3,330	1.16	–2.63	2.97	24.8	63.7	2.2	54.9	26.9

** Unweighted arithmetic mean value*

Table 12b. Characteristics of the five clusters and two atypical communities with 25 variables (2/3)

Cluster (number of communities with characteristics)		Included in the cluster analysis: Share of non-economically active population in total population (%)	Share of housewives in non-economically active population (%)	Share of employed in population: age 15 and over (%)	Share of employees in population: age 15 and over (%)	Unemployment rate (%)	Local budget tax (RON/inh.)	Local budgets own (RON/inh.)	Share of employed in non-agricultural sectors (%)
		2002	2002	2006-2007	2006-2007	2006-2007	2006-2007	2006-2007	2002
Cluster 1 (3)	Average*	56.9	20.1	47.3	16.2	14.7	96.3	444	53.4
	Minimum	48.3	15.7	39.7	12.9	11.6	58.6	297	47.2
	Maximum	65.9	22.7	57.3	22.8	19.2	121.6	653	58.2
	Variat. coeff.	0.155	0.192	0.191	0.353	0.275	0.346	0.419	0.106
Cluster 2 (17)	Average*	50.4	17.4	58.7	9.8	7.9	49.1	368	29.1
	Minimum	42.8	9.9	45.0	3.9	1.9	28.4	134	18.3
	Maximum	59.6	28.0	70.1	25.2	12.7	91.0	910	41.3
	Variat. coeff.	0.098	0.315	0.117	0.635	0.410	0.315	0.511	0.224
Cluster 3 (17)	Average*	40.2	9.2	74.4	5.2	3.7	33.9	262	16.0
	Minimum	29.9	1.3	65.8	3.5	2.0	23.0	140	6.2
	Maximum	47.8	16.8	86.7	7.3	10.0	59.1	747	28.1
	Variat. coeff.	0.137	0.533	0.078	0.199	0.512	0.304	0.538	0.395
Cluster 4 (9)	Average*	53.2	12.6	51.2	5.0	10.4	38.0	281	36.2
	Minimum	47.8	5.8	36.3	3.8	5.9	23.6	198	25.2
	Maximum	63.2	19.7	60.2	8.0	16.5	64.4	395	49.4
	Variat. coeff.	0.099	0.383	0.145	0.289	0.365	0.317	0.274	0.223
Cluster 5 (10)	Average*	51.1	8.8	55.0	7.6	5.1	42.0	252	19.4
	Minimum	42.8	3.9	43.5	6.0	1.2	29.5	157	11.2
	Maximum	61.8	13.3	63.3	10.1	10.5	83.4	454	29.0
	Variat. coeff.	0.109	0.437	0.112	0.168	0.510	0.381	0.376	0.285
All communities (56)	Average*	48.3	12.7	61.0	7.6	6.9	44.0	305	25.8
	Minimum	29.9	1.3	36.3	3.5	1.2	23.0	134	6.2
	Maximum	65.9	28.0	86.7	25.2	19.2	121.6	910	58.2
	Variat. coeff.	0.159	0.487	0.187	0.614	0.604	0.455	0.498	0.457
Atypical: MONOR		33.7	8.3	75.2	24.9	2.1	235.6	1,919	22.4
Atypical: SANT		47.1	13.7	66.0	39.8	6.2	59.0	582.0	26.0

** Unweighted arithmetic mean value*

Table 12c. Characteristics of the five clusters and two atypical communities with 25 variables (3/3)

Cluster (number of communities with characteristics)		Included in the cluster analysis: Share of primary sector in employed (%)	Share of secondary sector in employed (%)	Share of tertiary sector in employed (%)	Share of quaternary sector in employed (%)	Area of rooms per inhabitant (m^2/inh.)	Share of dwellings supplied with drinking water (installations) in total dwellings (%)	Agricultural area per inhabitant (ha/inh.)	Forest area per inhabitant (ha/inh.)
		2002	2002	2002	2002	2002	2002	2006-2007	2006-2007
Cluster 1 (3)	Average*	47.0	27.9	12.7	12.4	14.5	41.2	0.91	0.75
	Minimum	42.1	21.7	10.0	9.4	13.5	20.7	0.39	0.28
	Maximum	53.1	34.6	17.3	15.1	16.1	52.1	1.30	1.59
	Variat. coeff.	0.119	0.232	0.316	0.233	0.096	0.432	0.519	0.977
Cluster 2 (17)	Average*	71.6	12.8	7.8	7.8	13.9	25.5	1.07	1.31
	Minimum	59.2	5.4	4.9	5.7	11.1	9.8	0.52	0.20
	Maximum	81.9	21.2	18.4	11.0	15.6	40.8	1.69	4.21
	Variat. coeff.	0.091	0.388	0.431	0.182	0.090	0.351	0.374	0.947
Cluster 3 (17)	Average*	84.4	6.9	3.4	5.4	14.1	19.1	1.50	0.82
	Minimum	72.1	0.9	1.4	2.1	9.6	6.4	0.77	0.24
	Maximum	93.8	15.2	6.3	7.6	18.2	59.8	2.41	2.01
	Variat. coeff.	0.075	0.590	0.446	0.249	0.156	0.639	0.303	0.737
Cluster 4 (9)	Average*	64.4	14.5	10.0	11.1	15.3	20.5	1.26	0.38
	Minimum	51.3	9.3	4.9	7.1	13.5	11.4	0.64	0.07
	Maximum	75.2	26.5	21.9	14.2	16.6	38.4	2.03	0.69
	Variat. coeff.	0.123	0.359	0.507	0.227	0.072	0.383	0.334	0.545
Cluster 5 (10)	Average*	81.0	7.7	4.3	7.1	15.3	9.7	2.38	0.32
	Minimum	72.0	2.4	2.5	5.7	12.9	2.8	1.77	0.08
	Maximum	88.8	14.9	7.6	10.6	18.9	22.1	3.47	0.94
	Variat. coeff.	0.065	0.466	0.397	0.203	0.137	0.789	0.207	0.752
All communities (56)	Average*	74.7	11.2	6.4	7.7	14.5	20.8	1.46	0.81
	Minimum	42.1	0.9	1.4	2.1	9.6	2.8	0.39	0.07
	Maximum	93.8	34.6	21.9	15.1	18.9	59.8	3.47	4.21
	Variat. coeff.	0.157	0.603	0.646	0.355	0.124	0.589	0.436	1.066
Atypical: MONOR		77.6	12.0	4.9	5.6	19.1	49.9	2.65	0.45
Atypical: SANT		74.6	17.1	3.0	5.3	13.7	31.7	2.60	3.45

** Unweighted arithmetic mean value*

On the basis of this information we can characterise the present state of the groups of localities and the main problems concerning rural employment as described below. In the case of each cluster shown in Figure 4 we tried to formulate a "strategy" for the solution of the problems which exist.

3.6.1. Cluster one

Communities:

- Prundu Bargaului, Rodna, Sieu-Magherus

The present state characterisation:

- The best non – agricultural employment situation;
- Bigger, more agglomerated rural localities, with positive natural increases of population;
- The highest comfort at the county level (share of dwellings supplied with drinking water);
- Most developed non agricultural sector;
- The highest local incomes;
- Higher educated population.

Problems:

- The lowest level of agricultural land potential;
- The lowest employment rate (lack of agricultural employment buffer);
- The highest unemployment rate;
- The high vulnerability of jobs in industrial services (by decision of international firms to changes of localisation of plants).

Strategies:

- Increase of the rate of employment, decrease of unemployment rate;
- The more efficient use of the highly educated persons;
- Extension of agricultural services activities (logistics, extension, marketing);
- Efficient use of the relatively high local budget for support of new SMS enterprises in non-agricultural activities;
- Reduction of vulnerability, strategy of risk management.

3.6.2. Cluster two

Communities:

- Bistrita Bargaului, Cosbuc, Dumitra, Feldru, Ilva Mica, Josenii Bargaului, Lechinta, Livezile, Lunca Ilvei, Magura Ilvei, Maieru, Petru Rares, Rebrisoara, Romuli, Teaca, Telciu, Tiha Bargaului

The present state characterisation:

- Relatively big rural localities, with positive natural increases of population;
- More equilibrated agricultural and non-agricultural employment;
- The life comfort is higher than the average of the county, but generally low (about 25% of dwellings are supplied with drinking water);
- The employment-, and unemployment rates are on the average national level;

- The income is on the average county level.

Problems:

- The rate of employment is lower and the unemployment rate is higher than the county average;
- Lower than average agricultural land resources;
- The highest forest area per inhabitant.

Strategy:

- Investment projects for SMM for better utilisation of the forest resources, of rural tourism possibilities;
- Training for young population with low education level;
- Increases of services in education, health care and in public administration.

3.6.3. Cluster three

Communities:

- Budacu de Jos, Caianu Mic, Cetate, Dumitrita, Ilva Mare, Lesu, Mariselu, Negrilesti, Parva, Poiana Ilvei, Rebra, Runcu Salvei, Sieu, Sieut, Spermezeu, Tarlisua, Zagra

The present state characterisation:

- The low decreasing of population by natural decreases and by negative net migration in conditions of lowest non-agricultural employment and the highest agricultural employment;
- In conditions of average agricultural and forest land resources disposability.

Problems:

- The highest agricultural employment and lowest non-agricultural employment (low diversification of rural economy);
- Low education level of active population.

Strategy:

- Diversification of local economy, creation of SMS enterprises in industry and services;
- Extension of activities of households for new income source, complementary to agricultural income;
- Increase of the comfort level to maintain young people in communities;
- Training programmes to increase educational and skill levels of the active population.

3.6.4. Cluster four

Communities:

- Branistea, Chiuza, Ciceu-Mihaiesti, Galatii Bistritei, Nimigea, Salva, Sieu-Odorhei, Sintereag, Uriu.

The present state characterisation:

- The natural decreases equilibrated by net positive migration;
- Employment structure is best as average;
- Lower employment rate and higher unemployment rate;
- Higher level of well educated people.

Problems:

- Higher natural decreases than the average of the county, low share of young people in the population;
- Low natural resources, mainly forest area;
- Low employment rate, high unemployment rate.

Strategy:

- To maintain and increase the young population;
- To increase of the natural increase by creating new jobs and social infrastructure (kindergarten, school etc.);
- Assuring increase of comfort by utilities programmes;
- More efficient use of the well educated persons (extension services, SMS enterprises in services, etc.);
- The use of experiences of persons returned to rural area.

3.6.5. Cluster five

Communities:

- Budesti, Chiochis, Ciceu-Giurgesti, Matei, Micestii de Campie, Milas, Nuseni, Sanmihaiu de Cimpie, Silivasu de Cimpie, Urmenis.

The present state characterisation:

- Very high decreases of population, pure diversification of rural economy;
- Very poor comfort level;
- Relatively high agricultural land resources on inhabitant, (but this 2.4 ha/inhabitant use in individual farms can not generate well being).

Problems:

- Danger of depopulation of rural localities;
- Subsistence agriculture is the buffer of employment;
- Low level of the young population;
- High share of the low educated persons;
- The poor comfort conditions.

Strategy:

- Part time jobs creation for farmers;
- Better agricultural infrastructure;
- Development of utilities;
- Maintain and increase the number of young people by special support, if possible.

Monor and Sant are atypical communities, - here the level of some indicators are different against average values. In Monor there is a big milk processing plant and in Sant a modern wood processing factory, so the share of non-agricultural employment is relatively high.

All these information could represent a good basis for a detailed analysis of the economic-social sustainability of localities. In the case of Bistriţa-Năsăud county, it demonstrates the need for a broadly-based, yet carefully targeted approach towards rural employment creation. The rural areas of the county exhibit a diversity of situations which demands a diversity of solutions. For example, the communities of Cluster five (Figure 4) are mostly located in the south-west of the county and are physically isolated from the town of Bistrita, and from the main Dej-Bistrita road by the river Bistrita. They are clearly suffering from economic isolation and decline. By contrast, those in cluster one are exhibiting population growth through both natural increase and in-migration, a high percentage of economic activity in the population and a relatively diversified economy.

The traditional approach to rural development of supporting the agricultural sector (through infrastructure improvements and better extension of services) is only one of a number of proposed strategies. Agriculture by itself will not solve the rural employment problem. Diversification of the economy through the development of non-agricultural SMEs (in the forestry, tourism, industry and services sectors, for example), or through on-farm economic diversification is recommended. The experiences of returning migrants could be a major driver in this process. Economic development needs to be supported through improvements in the workforce through more education and skills training. An important aspiration is to improve the ability of rural areas to retain younger, skilled people, but this is an exceptionally difficult challenge. It requires a significant increase in the quality of life of rural areas through improvements in utilities, healthcare and other services.

Whilst it is unlikely that all rural settlements of Bistriţa-Năsăud county could be transformed into economically viable, vibrant communities in the foreseeable future, it is evident that, by means of a better understanding of the underlying problems, the rate of progress will be increased.

4. Conclusions

We highlight a relatively easy way for linking the analysis on different territorial levels: national, regional and local. In the first phase we compare the synthetic indicators for regional against national level, in the second phase we draw a comparison of the competitiveness indicators of the counties against the regional average and we conclude about the relative position of counties and about the relative role of the economy activities sectors. Finally, we create typologies of the rural communities and on the base of indicators used in cluster analysis we have the possibility to characterize the state of localities in a cluster, to determine their main problems and, on this aspect, to formulate the development strategy.

The paper demonstrates the role of cluster analysis of rural localities as the basis for a more efficient way of choosing the rural development measures to be used to stimulate rural socio-economic growth. This information can help local, county and regional level decision makers to identify the most efficient approaches to stimulate development on different territorial levels.

Obviously, the factor-, and the cluster analysis cannot give a general solution to measure and quantify the spatial development, because there are some problems of abstractions (ex. dimensions, the choice of variables, of factors, associations). Nevertheless all of this information could represent a good basis for a detailed analysis of the economic-social sustainability of localities. The case study demonstrates the need for a broadly-based, yet carefully targeted approach towards rural development measures.

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