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The Spatial Differences of Employment between the Settlements of Harghita County

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Abstract. This paper contains the analysis of employment in the settlements of Harghita County, using the GIS (Geographic Information System) analysis, Spearman's correlation, principal component analysis, and the cluster analysis methods. Based on the database of a set of indicators which describe the demographic, employment, and enterprise dimensions, remarkable spatial differences were observed between the settlements. The principal objectives of the county development plan regarding the employment were analysed, and a discussion took place on the possibilities of employment development in Harghita County.

Keywords: regional employment, Geographic Information System, principal component analysis, cluster analysis, employment strategy

Introduction

In this paper, we present the analysis of employment situation in Harghita County (NUTS3) in Romania based on the databases of the settlements. Previous studies have pointed out the special situation of this county compared to the others from the Central Region and the local problems which make the analysis relevant at the level of the settlements (Madaras 2009a).

Harghita County (NUTS3 region) is predominantly a rural region with relatively high agricultural employment, as previous studies have highlighted. In Harghita County, there is typically a rural settlement structure with a relatively high number of villages, and towns with a number of inhabitants ranging between 1,600 and 43,000 in 2017, according to the official statistics of INSSE. A previous study pointed out the ageing index as well as unemployment, both being higher in the small rural settlements of Harghita County (Madaras 2014a).

Previous research highlighted the importance of municipalities in the micro-region, these having a central role in entrepreneurship and employment. The municipality of Gheorgheni also ensured a wide palette of socio-economic services for the whole micro-region – for example, education and financial institutions (Madaras 2009b).

Although a demographic decline was characteristic throughout the period after 1990 in Romania, we observed remarkable regional differences in the natural reproduction and the net change of residence of the population in the regions of Romania. The share of net settlements was significant in those regions where the average income was high and employment in industry and service sectors was the highest such as in the Bucharest-Ilfov Region and the Western Region (Madaras 2009d, 2014b). In Harghita County, the share of urban population is lower than the regional average. Is the population's established residence in the settlements in connection with employment and the development level of enterprises?

Economic development in Harghita County achieved a relatively low level. The GDP per capita decreased and reached lower values than the national average, while the net average income is also lower than the regional and national average. Another important fact: agricultural employment is high, but the agricultural areas are relatively small; and the share of small enterprises is also high, but this generally represents individual enterprises or family businesses (Madaras 2014a). The results of Mezei et al. (2009), among others, indicate a high proportion of rural inhabitants in the case of Harghita,which affects competitiveness.

In this analysis, I proposed the following hypotheses:

– the main differences in employment in the settlements of Harghita County are connected with other socio-economic factors such as entrepreneurship, demographic migration, welfare (number of dwellings), and population density. Using the dataset of settlements, the spatial differences of this hypothesis can be verified using the GIS method and Spearman's correlation, while the identification of the main factors of employment and unemployment can be performed using the Principal Components Analysis.

– based on the spatial differences of employment, the settlements of Harghita County could be grouped into clusters as the cluster analysis method makes it possible.

The regional disparities in Romania and the intraregional spatial differences at NUTS III level (within counties) of economic development and employment were analysed by Goschin et al. in 2008. Harghita County reached values under the national average in the case of all regional indicators used in their study.

Fieldsend and Kerekes (2011) analysed the situation of rural employment in Bistrița-Năsăud County in comparison with a region from the UK, as a result of which a threat was formulated regarding the Romanian region in the SWOT

analysis: 'International labour migration of the young people can lead to the depopulation of the villages.'

The principal component analysis is generally used in quantitative research based on questionnaire survey, but this method has a recognized place in regional analysis. The customers' satisfaction with tourism services was analysed using this methodology proposed by Kulcsár (2010) in a tourism marketing research implemented in Romania. The factor analysis and the cluster analysis methods were used by Bujdosó et al. (2016) in the analysis of the spatial pattern of KIBS (Knowledge-Intensive Business Services) in relation with the economic development in Romania. The role of social cooperatives in the regional economic and social growth in Italy was studied by Carini et al. (2012) using the principal component analysis.

An alternative of the commonly used methodology represents the geographically weighted principal component analysis (GWPCA) in the regional economic development analysis, as Li et al. (2016) demonstrated it.

The Principal Components Analysis (PCA) method was used by Davidescu and Strat (2014) for the identification of regional poles in Romania, focusing on regional sustainable development in a new regional policy approach, and by Savić (2006) in the analysis of the employment situation in the regions of Eastern Europe.

A previous research focusing on the employment situation in the Central Region showed, among others, the significant spatial differences between employment and unemployment, which follow the ratio of the urban population of the counties (Madaras 2009a).

Another study suggested that the labour market of Harghita County appeared more vulnerable than that of Braşov during the 2008 financial and economic crisis. This fact was highlighted by the time series analysis of the monthly unemployment rate in both counties (Madaras 2009c).

The Database of Settlements in Harghita County and the GIS (Geographic Information System) Analysis

The database containing 7 urban and 54 rural settlements was set up with six indicators which describe the demographic, employment, infrastructure, and enterprise dimensions of Harghita County. The database was relied on the complete list of settlements in Harghita County although, due to the lack of data, some of the rural areas were eliminated (*Table 1*).

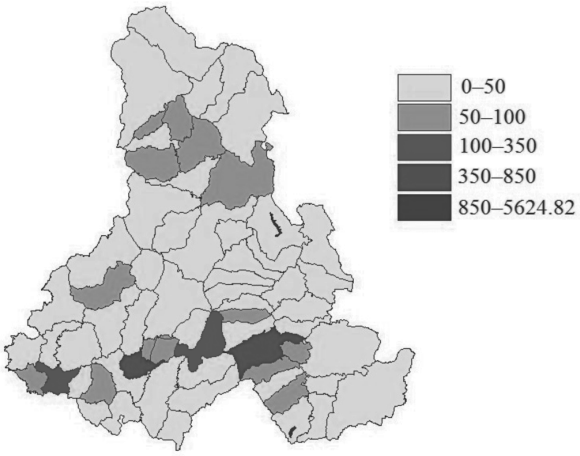
Table 1. *The settlement database statistics of Harghita County*

	Population density	Number of employees per 1,000 inhabitants	Number of dwellings on 100 inhabitants	Net changes of residence per 1,000 inhabitants	Share of the unemployed from total labour resources	Number of enterprises per 1,000 inhabitants
Year	2016	2015	2016	2016	2016	2016
Mes. Unit	Inhabitants / Km²				%	
	Popden	Empl	Dwell	Settres	Unemp	Enterp
N	61	61	61	61	61	61
Urban/Rural settlements	7/54	7/54	7/54	7/54	7/54	7/54
Minimum	8.680	24.363	32.528	- 22.942	1.100	3.901
Maximum	891.005	580.447	74.863	21.679	20.000	49.703
Mean	76.668	98.854	42.571	- 5.435	4.457	19.349
Std. deviation	152.351	108.541	7.303	8.139	3.798	10.078

Source: own calculations, INSSE

The GIS (Geographic Information System) Analysis

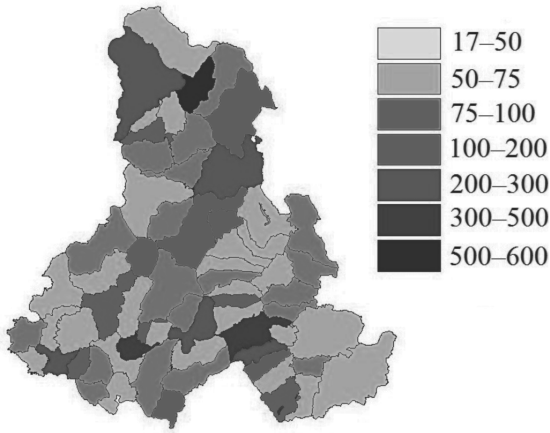
The spatial differences of the indicators included in the analysis were examined using the GIS representation. The average value of population density was 76.67 in 2016 – as we have observed, the majority of the settlements have lower values than that. The statistical map highlights the cities, municipalities, and local centres (*Figure 1*).



Source: own calculations, INSSE

Figure 1. *Population density in the settlements of Harghita County in 2016*

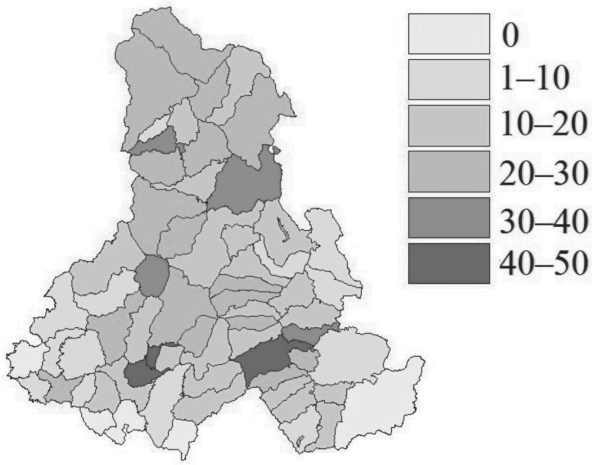
The highest concentration of employees in Harghita County in 2016 was structured in space especially in municipalities. We have observed a few cases where more than 300 employees were present in one city (in Borsec more than 500) per 1,000 inhabitants (*Figure 2*).



Source: own calculations, INSSE

Figure 2. *The number of employees per 1,000 inhabitants in the settlements of Harghita County in 2016*

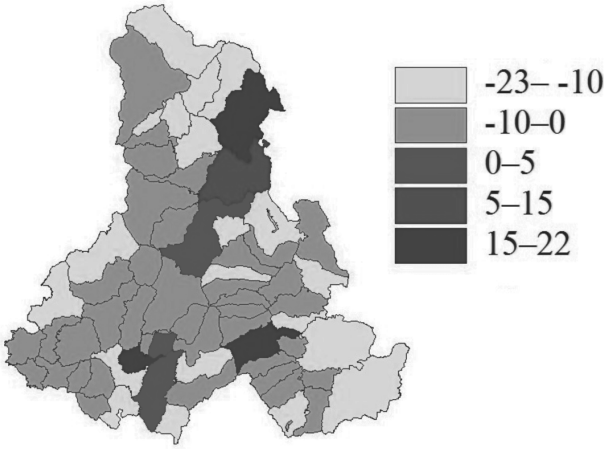
The map below shows the relative number of enterprises in the settlements of Harghita County. The enterprises are concentrated in space in the cities and municipalities and in other micro-regional centres (*Figure 3*).



Source: own calculations, INSSE

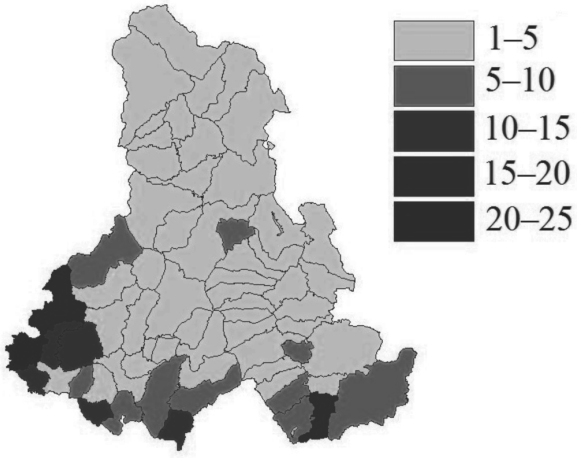
Figure 3. *The number of enterprises per 1,000 inhabitants in the settlements of Harghita County in 2016*

We presented the demographic decline in other studies (Madaras 2014a), but here we focus on the following question: which are those settlements where the population is moving out? In 2016, the net change of residence per 1,000 inhabitants indicator had positive values in 8 settlements, and in 59 settlements (88.06% from total) it had negative values (*Figure 4*).



Source: own calculations, INSSE

Figure 4. *The net change of residence per 1,000 inhabitants in the settlements of Harghita County in 2016*



Source: own calculations, INSSE

Figure 5. *The share of the unemployed from total labour resources in the settlements of Harghita County in 2016*

The relative number of the unemployed from the total labour resources reached high values in the south-eastern part of the county, in the periphery, and in the villages with long distances from the municipalities, while in the central part of Harghita it had lower values (*Figure 5*).

The Relationships between the Indicators Included in the Settlements' Database

The Spearman's correlation table was calculated in order to show the relationships between the indicators included in the settlements' database. There are no significant (close to -1 or 1) correlations between the indicators although for the tendency identification we make mention of the most important Spearman's correlation results as follows:

– between population density and the number of employees per 1,000 inhabitants is 0.559,

– between the number of enterprises per 1,000 inhabitants and the number of employees per 1,000 inhabitants is 517,

– between population density and the number of enterprises per 1,000 inhabitants is 0.421, and

– between the number of enterprises per 1,000 inhabitants and the number of the unemployed per 1,000 inhabitants is -0.405.

Table 2. *The Spearman's correlations table of the indicators included in the settlements' database*

	Popden	Empl	Dwell	Settres	Unemp	Enterp
Empl	.559**					
Dwell	-.002	-.025				
Settres	.308**	.259*	-.162			
Unemp	-.146	-.187	-.021	.056		
Enterp	.421**	.517**	-.038	.305**	-.405**	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed). *Source: own calculations, INSSE*

Principal Component Analysis and Cluster Analysis

In the next part, the principal component analysis was used to identify the main factors of employment, unemployment, and entrepreneurship. The results indicated the presence of two components, which described more than 58% of the variance (*Table 3*).

Table 3. *The principal component analysis statistics*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.322	38.693	38.693	2.322	38.693	38.693	2.309	38.484	38.484
2	1.169	19.491	58.184	1.169	19.491	58.184	1.182	19.700	58.184
3	.961	16.021	74.205						
4	.688	11.459	85.665						
5	.480	7.993	93.658						
6	.381	6.342	100.000						

Source: own calculations, INSSE

The first principal component was named *the entrepreneurship and employment component,* and it shows a relatively high positive connection with the following indicators: the number of enterprises per 1,000 inhabitants, the number of employees per 1,000 inhabitants, and population density (*Table 4*).

The second principal component, *the unemployment and the population migration component,* is connected positively with the indicators: the share of the unemployed from total labour resources and net change of residence per 1,000 inhabitants and negatively with the number of dwellings per 100 inhabitants (*Table 4*).

Table 4. *The rotated component matrix of the principal component analysis*

	Component	
	1	2
Zscore(Enterp)	.820	-.091
Zscore(Empl)	.796	.075
Zscore(Popden)	.750	.150
Zscore(Settres)	.450	.645
Zscore(Dwell)	-.031	-.616
Zscore(Unemp)	-.486	.592

Source: own calculations, INSSE

The two principal components describe the employment situation in the settlements of Harghita County: a high level of employment is present where entrepreneurial willingness and population density are also higher, while unemployment is high in settlements where inhabitants are moving out from.

We received a more accurate picture about the differences between the settlements using the cluster analysis method, i.e. the cases with the similar indicators form one group. In the following, the classification of the settlements was performed based on the K-means cluster method, for five clusters (*Figure 1* from the Appendix).

The first evaluation of the results indicates that the settlements are grouped as urban or rural areas, but the average values of the indicators included in the database highlight the differences between these clusters. In cluster number 4, where the relative number of enterprises as well as the relative number of employees is high, there are those municipalities where the population is moving in. There, the share of the unemployed registered a low value. The other, major part of settlements are grouped in three clusters based on the differences between the relative number of enterprises and the share of the unemployed from total labour resources (*Table 5*).

Table 5. *The statistics of the clusters in the settlements of Harghita County, 2016*

		Population density	Net changes of residence per 1,000 inhab.	Share of unempl. from tot. labour res.	Nr. of enterprises per 1000 inhab.	Nr. of employees per 1000 inhab.
Settlements/ Number of Cases	Nr. Clust.	Pop.den. average	Sett.res. average	Unemp. average	Enterp. average	Empl. average
Mun. Miercurea Ciuc. Mun. Gheorgheni; Mun Odorheiu Secuiesc; Tulghes	4	319.375	16.117	2.650	37.987	293.705
Băile Tuşnad; Borsec	1	468.065	-12.390	1.600	26.040	455.604
7	2	40.219	-4.876	13.157	8.307	71.175
4	3	27.089	-4.504	7.000	14.681	75.688
44	5	47.119	-7.252	3.136	19.531	71.434

Source: own calculations, INSSE

The clusters are presented on a GIS map. Cluster 1 includes the towns Băile Tuşnad and Borsec, which are in a special situation, both of them being touristic destinations.

– In Cluster 2, we can observe the lowest relative number of enterprises, while the share of the unemployed was the highest. Geographically, this is formed by the settlements from the south, south-western part of Harghita County.

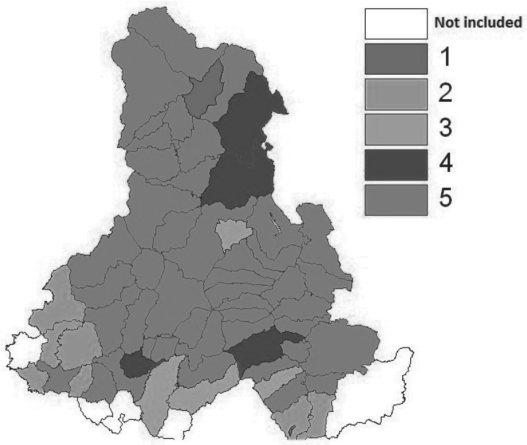
– In Cluster 3, the population density is the lowest.

– Cluster 4 is formed from three municipalities and one village, but there the net changes of residence per 1,000 inhabitants was positive.

– Cluster 5 contains the remaining 44 settlements from the database.

From the socioeconomic situation of Harghita County's settlements, we obtain more important information by examining Cluster 5 because this one contains 44

rural settlements. There, the relative number of net changes of residence in average has a negative value, unemployment rate and the relative number of enterprises are relatively low, and a little more than 71 per 1,000 inhabitants work.



Source: own calculations, INSSE

Figure 6. *The cluster membership of the settlements*

Strategic Objectives of Employment in the Medium-Term Economic Development Programme 2012–2020 for the Council of Harghita County

This 2012–2020 Economic Development Programme was elaborated in 2012. In the following, we will analyse the strategic objectives regarding the employment. The strategic document gives a comprehensive analysis of the socioeconomic situation; here are some relevant statements we wish to draw attention to:

– The development plan highlights the relatively low activity and employment rate in Harghita County.

– This plan identifies the wood industry and the food industry as main job-creating sectors, but the other sectors, such as tourism, are presented as job-creating possibilities.

– It attaches high importance to local products where self-employment is high.

– The plan contains the micro-regional analysis of the employment.

– The relatively high HDI index is compared to the regional level.

– It reveals a low level of unemployment.

– There is a lack of large companies in the country, and this has a negative effect on occupation (source: Medium-Term Economic Development Programme 2012–2020 for the Council of Harghita County).

Some of the components of the SWOT analysis in connection with employment are presented in the following:

Human resources.

– existence of the local education institutions and other professional training programmes,

– good relationship to work (high work ethic).

Possibilities.

– the promotion for knowledge-based and innovative enterprises,

– the synchronization of professional training systems according to the market needs (source: Medium-Term Economic Development Programme 2012–2020 for the Council of Harghita County).

The 7th priority of the development plan entitled *Employment and Labour Market Integration* enumerates those actions which could be done in the future to reduce the negative impact of the 2008 financial and economic crisis on local employment: the development of the education systems as well as of the professional training systems, including practical professional trainings; the development of the education possibilities for the wood industry; the labour training integration actions for the ethnic Roma population of the county (source: Medium-Term Economic Development Programme 2012–2020 for the Council of Harghita County).

Discussion about the Employment Situation and the Possibilities of Workplace Creation in Harghita County

The results above highlight the importance of the municipalities related to employment in Harghita County. The relative number of enterprises as well as the number of employees per 1,000 inhabitants show a concentration in these settlements. A previous research has pointed out that the ageing index and unemployment are higher in small rural settlements situated far from municipalities (Madaras 2014a). One important question has to be answered in the future: why do people move out from such rural areas of Harghita County?

What is the situation of the employees in this region? The statistical data from 2016 showed the relatively low proportion (65.18%) of employees in the private sector in Harghita County. The high share of services (57.33%) includes those working in public administration (4.1% from total), education (9.8%), and human health and social activities (7.92%), i.e. those who are public or state employees (34.82% from total) (own calculations, INSSE –*Table 6*).

Table 6. *The number of employees by activity of national economy and the by ownership types in the Central Region and Harghita County in 2016*

Economic sectors		
	Central Region	Harghita County
	(%)	(%)
Agriculture	2.3	2.76
Industry	35.8	33.63
Construction	7.04	6.28
Services	54.86	57.33
Hotels and restaurants	4.01	4.34

Ownership types		
	Central Region	Harghita County
	(%)	(%)
Private	58.77	65.18
Other (public, state, mixed)	41.23	34.82

Source: own calculations, INSSE

The tourism sector was considered a growth point in rural areas in the analysis of the Gheorgheni micro-region in Harghita County, but additional analyses have pointed out that this sector does not create the required number of jobs in rural areas (Madaras 2014c). In 2016, a relatively low number of employees were registered (4.34% from total have worked in the hotels and restaurants sector) (own calculations, INSSE).

Municipalities have a central role regarding micro-regions as in the case of the Gheorgheni micro-region has been proved through the large number of social, educational, economic, and financial services operated. The analysis of the employment structure in the Gheorgheni micro-region highlighted the fact that the workplaces are concentrated in the municipium, which means that the employees in some sectors are moving in from other settlements in the area (Madaras 2009b).

In municipalities, the innovating enterprises in the IT sector are also present. In Harghita, Covasna, and Mureş counties, the enterprises in the IT sector formed a professional association named IT Plus Cluster, which includes more than 30 firms and has provided jobs to approx. 350 workers in the field of computer science. According to the statistical reports of 2016, in Harghita County, there were 1,354 employees registered (2% from the total number of employees; source: INSSE) in the information and communication sector, part of them being IT specialists.

Most of the enterprises in rural areas operate in the wood industry, food industry, construction, and tourism sector. There are also a growing number of family businesses producing local products (food, handicraft, and others). Previously, the importance of professional training was analysed, and a dynamic

approach of education in Harghita County was highlighted (Madaras 2014a). Complemented with the analysis of the present situation, we can state that the workplace-creating possibility through a local employment development action plan could be achieved in the following two ways:

– professional training and education with education institutions adapted to market conditions in municipalities and other settlements included in clusters 1, 2, 3, and 4;

– development of tourism in settlements included in clusters 1 and 4;

– development of enterprises and local products, including the marketing activities in rural settlements as included in Cluster 5.

In this way, the central role of municipalities and other micro-regional centres mentioned above could be extended to human resource development, but initiatives launched in rural areas are embraced as well.

Conclusions

The aim of this paper was to analyse the spatial differences and the impact of these on employment in Harghita County using the GIS method as well as cluster analysis based on the dataset of the settlements. In the database of the settlements, six indicators were included regarding the demographic, employment, infrastructural, and enterprise dimensions of this county for a total of 61 cases representing the 7 cities or municipalities and the 53 villages.

GIS analysis results indicate the important role of the municipalities and other micro-regional centres in entrepreneurship and employment. Besides that, we charted the presence of settlements in rural areas where unemployment rate is high and where the population is moving out from. Spearman's correlation table results did not show significant relationship between the indicators.

Two components resulted from the principal component analysis, which describe the employment and unemployment situation in Harghita County. These are *the entrepreneurship and employment component*, having a highly positive connection with entrepreneurship, the relative number of employees, and population density; *the unemployment and population migration component* are positively connected with the relative number of the unemployed and the net change of residence per 1,000 inhabitants and negatively connected with the number of dwellings per 100 inhabitants.

The hierarchical cluster analysis results showed the real differences between the settlements: the five groups were formed, including the three municipalities and one village in Cluster 4, where the net settling indicator was positive; in another cluster, the touristic destination towns Băile Tuşnad and Borsec, which are in a special situation; in Cluster 2, the settlements where the relative number

of enterprises was the lowest and the share of the unemployed the highest; thirdly, one cluster for those settlements where population density is the lowest; and, finally, in one cluster, the remaining 44 settlements from the database.

Remarkable differences were identified between the settlements: not only in the urban–rural, or central–peripheral term but primarily regarding employment and job-creating capacities. Concerning this topic, we have found two categories: the municipalities, where the predominant part of the enterprises are (an emerging and innovative IT sector, investments, innovations, and developments are also present there) and, secondly, the micro-regional centres where enterprises and workplaces are concentrated.

The negative value of the net change of residence per 1,000 inhabitants in the villages of Harghita County are in line with Fieldsend and Kerekes's (2011) findings for Bistrița-Năsăud County.

The surprising results of the GIS research consist in the identification of those rural settlements where the net change of residence per 1,000 inhabitants was negative (*Figure 4*) and unemployment was high (*Figure 5*), which indicates that in the period under study the population was moving out especially from those villages where there was a lack of workplaces and enterprises. The results of the cluster analysis proved this statement although primarily those groups of settlements were identified where on average high values were reached for population density, the relative number of enterprises, the relative number of employees, and touristic potential. From this approach, the GIS analysis and the cluster analysis complement each other because the first one gives more information about the rural settlements included in Cluster 5.

The possibilities of workplace creation through a local employment development action plan were discussed in the final part of the paper, where two possible ways were specified: 1) market-adapted professional training and education in urban areas and 2) the tourism of local product development in rural areas.

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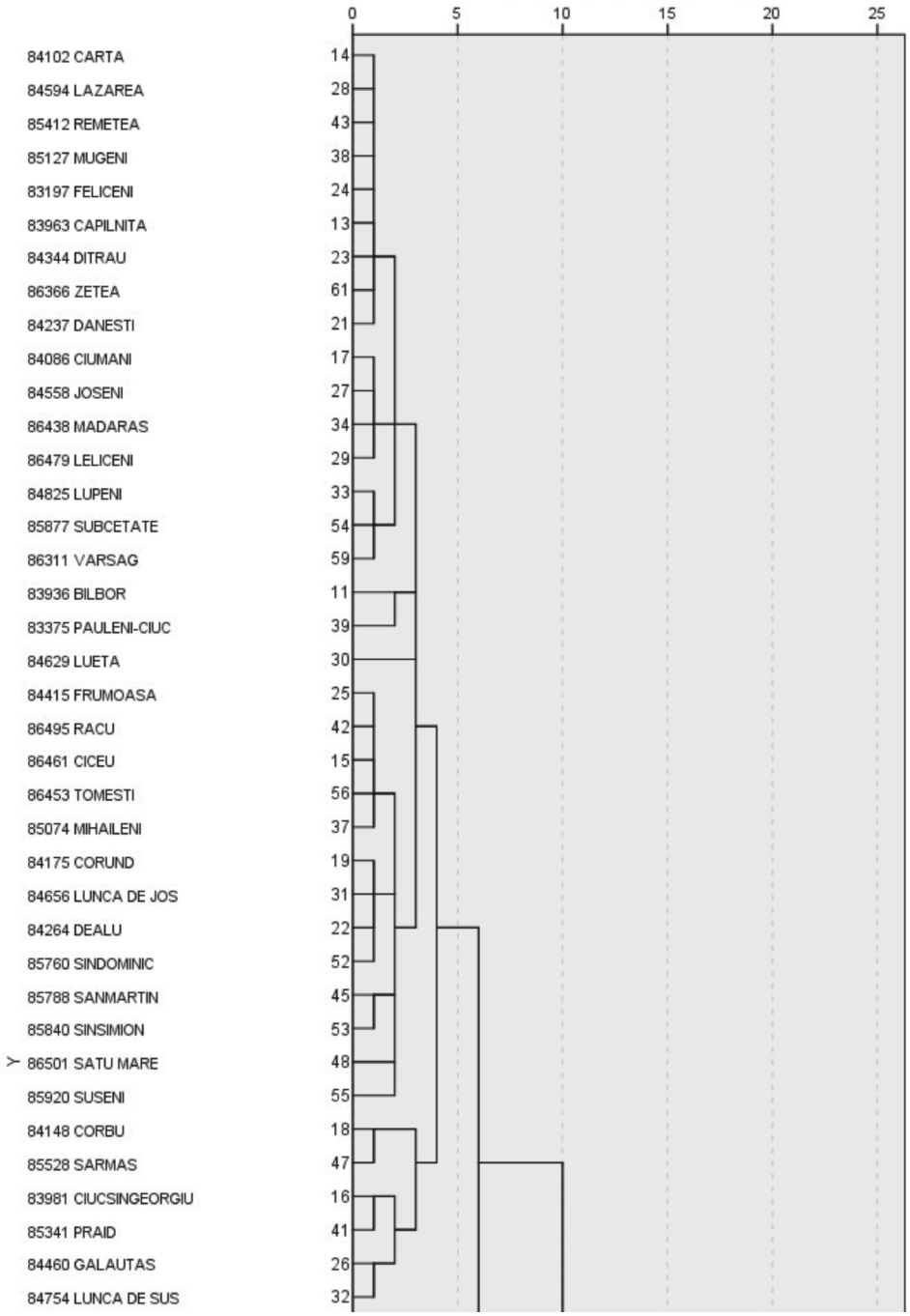
Appendix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86366 ZETEA 61
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84086 CIUMANI 17
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86479 LELICENI 29
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85877 SUBCETATE 54
86311 VARSAG 59
83936 BILBOR 11
83375 PAULENI-CIUC 39
84629 LUETA 30
84415 FRUMOASA 25
86495 RACU 42
86461 CICEU 15
86453 TOMESTI 56
85074 MIHAILENI 37
84175 CORUND 19
84656 LUNCA DE JOS 31
84264 DEALU 22
85760 SINDOMINIC 52
85788 SANMARTIN 45
85840 SINSIMION 53
Y 86501 SATU MARE 48
85920 SUSENI 55
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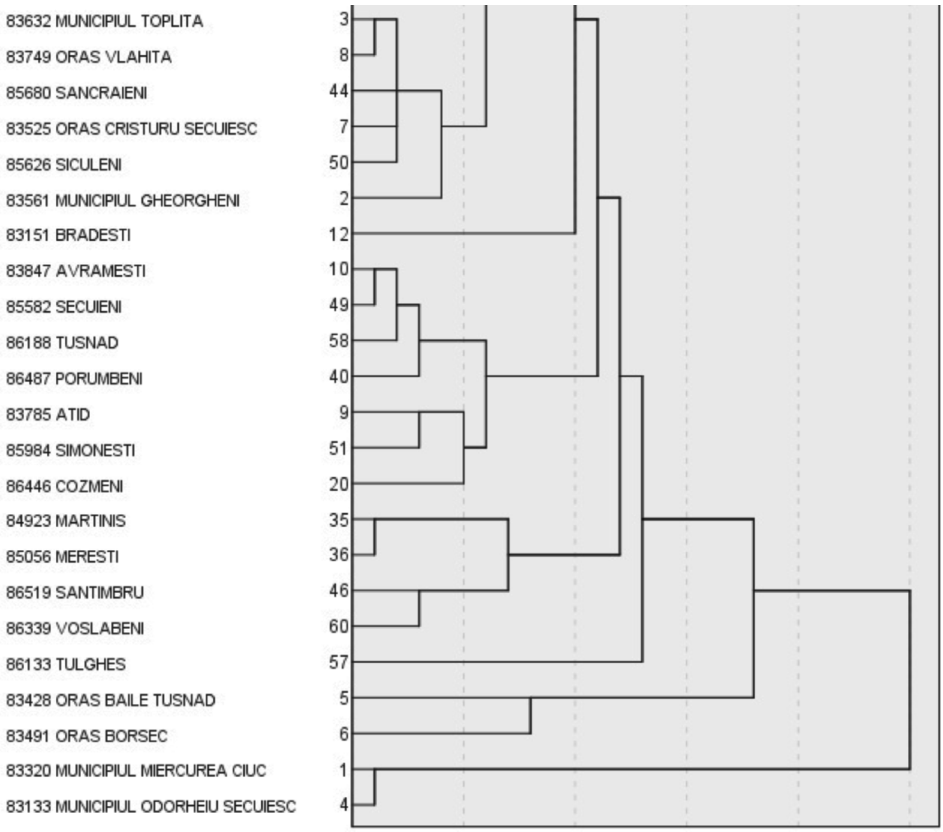

Source: own calculations, INSSE

Appendix 1. *The dendrogram of K-means hierarchical clustering of the settlements; Harghita County, 2016*