Notatki naukowe
Progress reports

PRZESTRZEŃ Społeczna nr 2/2015 (10) Social SPACE
socialspacejournal.eu

An analysis of complex development in the micro-region of Gyöngyös[1]

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Abstract

The development level of settlements is an essential aspect of determining the utilisation of funds provided by the European Union. The aim of the present study is to compare the 25 settlements of the micro-region of Gyöngyös by the use of the complex development index. In order to determine the indicators that describe the development level of the settlements, 29 indicators were analysed. Based on the indicators, the developmental order of the municipalities was determined for 2001 and 2010. The analysis of the complex development indicators showed that Gyöngyös was the most developed municipality in the micro-region at the beginning of the investigation. A significant change was experienced by 2010. Gyöngyös kept its leading position in the micro-region.

According to the GIS display, it can be concluded that none of the settlements was classified into the category of strongly developing municipality on the basis of the complex development index in 2001. In 2010, Gyöngyös was strongly developing while 17 other municipalities were not so.

Based on the results of the function calculations, the accessibility of motorways, the proportion of employees in the service sector and the number of active enterprises per 1000 inhabitants had the greatest impact on the CDI in 2001. In 2010, the share of employment in the service and agricultural sectors, as well the number of enterprises had the most significant impact.

Overall, one can say that the micro-region moderately developed in 10 years on the basis of CDI. The results of this study demonstrate that the test method is suitable for comparing the development of LAU 1, 2, 3 and 4 regions.

Key words: Gyöngyös micro-region, complex development, geoinformatics, rural development

[1] The editors of the *Przestrzeń Społeczna (Social Space)* journal contributed considerably to the improvement of the original version of this text.

1. Introduction

Nowadays, rural areas are associated with lagging, impoverishment, aging population, the residence of the poor, and the degradation of the industrial and agricultural sector. Simultaneously, forums, studies and publications concerned the topic of rural development emphasise the importance of the convergence and the development of rural areas and the struggle with aging and impoverishment. The elaboration of rural development programmes requires working with a wide variety of data and information on an ongoing basis. Studies in municipal development based on objective calculations require an annual review by policy makers and the governing bodies of municipalities (Oláh 2003). The accumulated information provides several opportunities for utilisation to demonstrate the natural, economic and social situation in the region and to formulate the strategic directions of development.

During the research, it was examined whether the complex development indicators, as well as the models based on them, facilitate the comparison of the different settlements at as the economy, society, the environment and technological development (OECD 2008). The methods for measuring development have changed parallelly with the theoretical approaches to development and underdevelopment. According to M. Freudenberg (2003), the three steps of forming complex indicators are the following:

(1) theoretical foundations;

(2) data collection (data estimation);

(3) the selection of the appropriate methodology.

A number of indicator sets are available for measuring complex regional development both in Hungary (Faluvégi 2000; Dobosi 2003) and on the international level (McGranahan 1972; Seers 1972).

According to M. Saisana and S. Tarantola (2002), the advantage of applying complex indicators is that they help decision-makers by simplifying multi-dimensional phenomena, and making them more transparent without a loss of information. It is also justified by M. Lukovics (2007). M. Nardo *et al*. (2005) mentions

difficult quantification, incomplete and/or badly structured databases and the subjectivity of the choice of the included indicators as arguments against their utilisation.

There is a consensus about the importance of micro-regions in Hungarian professional literature, which is justified by A. Faluvégi (2004). The micro-regional level was designed according to the requirements of analytical or functional regions (Rechnitzer 2005).

E. Kovacs (2000) investigated the development of 79 Slovakian districts using factor analysis of eight indicators. Based on this complex assessment, he stated that the spatial structure of the country is divided into a more stable western and a depressed eastern part.

D. Dumitrescu (2008) used the same 18 indicators to determine the developmental differences between the counties of Romania. I. Nagy (2010) grouped the Romanian counties applying the rank method using 20 indicators. However, he got a distorted order – even according to his own admission – as he was not using a proper weighting method.

In the present author's opinion, it is the weakness of the complex development index that, on the one hand, it ignores territorial peculiarities, and, on the other, it leaves the developmental potentials of settlements out of account. Despite these faults it is a useful indicator; moreover, the data necessary for calculating it are also available on the level of individual settlements.

2. Methodology

2.1. Complex Development Index

The complex development index shows how large the development disparities are between settlements by taking several indicators into account. For the analysis, the indicators listed in Annex 3 of National Assembly resolution No. 67/2007 (VI. 28) and National Assembly resolution No. 1/2014 (I.3) were used. These resolutions contain the data that are used when calculating the complex indicator that measures the socio-economic and infrastructural development/underdevelopment of micro-regions and municipalities. The Regional Statistics of the Dissemination Database of the Hungarian Central Statistics Office (HCSO) and the database of the National Re-

gional Development and Spatial Planning Information System (RDSPIS) were also applied to compile municipal indicators. Twenty-nine indicators from the group of economic, infrastructural, societal, social and employment indices were taken into account to work out the complex development index (Table 1).

In order to compare the 29 variables applied for determining the development of settlements, a scale coordinate transformation was carried out. Formula (1) of T. Molnár (2001) was used for the transformation:

$$cdi = \Sigma \frac{x_i - x_{\min}}{T_x} \tag{1}$$

where:

cdi – the complex development index of the investigated settlement,

x_i – the value of variable x at the investigated settlement,

x_{min} – the minimum value of variable x at the settlements of the investigated region,

T_x – the range of variable x.

In case of the variables that have a negative impact on the development of settlements, Formula (2) was modified as follows:

$$cdi = \Sigma \frac{x_{\max} - x_i}{T_x} . \tag{2}$$

The revised formula was used for the following indicators:

(1) general accessibility indicator;

(2) mortality rate;

(3) average number of the recipients of regular social assistance from the local government per 1000 inhabitants per year;

(4) number of recipients of extraordinary child protection support provided by the local government per 1000 inhabitants;

(5) proportion of registered jobseekers in the working-age population;

(6) proportion of permanently registered (>180 days) jobseekers in the working-age population.

By using the formula (2), every variable got to the same measuring scale, so they became comparable. The complex development indicators were calculated from the municipal data of the variables as presented by B. F. Ilk (2010). The complex development index (CDI) of the settlements in the micro-region of Gyöngyös was produced as a simple arithmetic average of these indicators. The developmental order of the municipalities could be determined by these indices. For the annual comparison of municipalities, coefficient of variation calculations were applied to detect the relative standard deviation of the data.

Table 1. Indicators used for the study of complex development

Indicators		Measuring unit	Database
Economic			
x_1	Number of active enterprises per 1,000 inhabitants	pcs	HCSO
x_2	Number of guest nights spent at private and commercial accommodations per 1000 inhabitants	pcs	HCSO
x_3	Number of retail shops per 1000 inhabitants	pcs	HCSO
x_4	Share of employment in agriculture*	%	RDSPIS
x_5	Share of employment in the service sector*	%	RDSPIS
x_6	Changes in the number of active enterprises	%	HCSO
x_7	Local governments' revenue from local taxes	1000 HUF	HCSO
Infrastructural			
x_8	Number of households connected to the public water network	%	HCSO
x_9	Number of households connected to the public sewer network	%	RDSPIS
x_{10}	Proportion of households with pipeline gas	%	HCSO
x_{11}	Proportion of households involved in regular waste collection*	%	HCSO
x_{12}	General accessibility indicator	minute	RDSPIS
x_{13}	Number of telephone main stations per 1000 inhabitants (including ISDN)*	pcs	HCSO
x_{14}	Number of cable TV subscribers per 1000 inhabitants	pcs	HCSO
x_{15}	Number of broadband Internet subscribers per 1000 inhabitants*	persons	RDSPIS
x_{16}	Motorway accessibility indicator	minute	RDSPIS
Societal			
x_{17}	Proportion of newly built dwellings with ≥3 bedrooms at the end of the investigated period	%	HCSO
x_{18}	Number of passenger cars per 1000 inhabitants	pcs	RDSPIS
x_{19}	Net migration; the mid-period annual average per 1000	persons	HCSO

x_{20}	Mortality rate (the number of deaths per 1,000 inhabitants)	pcs	HCSO
x_{21}	Personal income tax base per resident	HUF	RDSPIS
x_{22}	Population density	persons/km^2	HCSO
Social			
x_{23}	Rejuvenation index (percentage of residents younger than 15 to those over 60)	%	HCSO
x_{24}	Proportion of people >18 with GCE**	%	RDSPIS
x_{25}	Average number of the recipients of regular social assistance from the local government per 1000 inhabitants per year	persons	RDSPIS
x_{26}	Number of recipients of extraordinary child protection support provided by the local government per 1000 inhabitants*	persons	RDSPIS
Employment			
x_{27}	Proportion of registered jobseekers in the working-age population	%	HCSO
x_{28}	Proportion of permanently registered (>180 days) – jobseekers in the working-age population	%	HCSO
x_{29}	Economic activity rate	%	HCSO

* Data for 2003 and 2010

** Data for 2001 and 2011

Source: own compilation based on Annex 3 of National Assembly resolution No. 67/2007 (VI. 28), 2014

These indicators were further classified for the GIS analysis. The values of the complex development index of the municipalities in the micro-region were attached to the vector map database of the administrative territory of the municipalities by ArcMap 10.1 software. Thematic maps of the graduated colours scheme were created by use of the software based on the quantitative values. The number and the range of the classes were determined using the method of equal intervals taking into account the extreme values of the investigated data.

The investigated factors were selected from the 29 variables on the basis of factor loadings. The impact of these factors on the complex development index was examined by regression analysis. The Cobb-Douglas production function was used to describe the relationship as I. Szűcs (2002) suggests. The formula of the function is the following:

$$\underline{Y}_i = a x_1^{\alpha} * x_2^{\beta} * x_3^{\chi} .... \quad , \tag{3}$$

where:

a – constant,

$\underline{Y}_i$ – the complex development index (CDI) in the ith investigated year,

x_1; x_2; $x_{3...}$– the complex development indicators (cdi) involved by the factor loadings,

a; β; γ;… – returns to scale of the factors.

First the indicators were transformed in order to convert the non-linear relationship into a linear one:

$$\ln (\underline{Y}_i) = \ln (a) + \alpha \ln (x_1) + \beta \ln (x_2) + \gamma \ln (x_3)\ldots \tag{4}$$

Next, logarithms of the variables were calculated, and then the fitting of the multivariate linear regression equation was completed. During the calculation of the function it was assumed that the function is homogeneous, the evolution of the dependent variable is 100% determined by the independent variables. Using the formula, the effect of the single variables on the CDI could be determined.

$$1 = \frac{\ln a}{\ln \underline{Y}_i} + \frac{\alpha \ln(x_1)}{\ln \underline{Y}i} + \frac{\beta \ln(x_2)}{\ln \underline{Y}i} + \frac{\gamma \ln(x_3)}{\ln \underline{Y}_i} \ldots \tag{5}$$

2.2. The investigated area

The micro-region is the most important arena of regional self-organisation. It is a very important basic level of complex interpretation of a bottom-up regional development policy (Csatári 1996). According to Nemes Nagy (2003), it is not the statistical accounting function of micro-regions that is determinant, but the fact that they can serve as the basic units of the analysis of regional processes and regional development. There are 168 micro-regions in Hungary from 1 January 2004 (Figure 1).

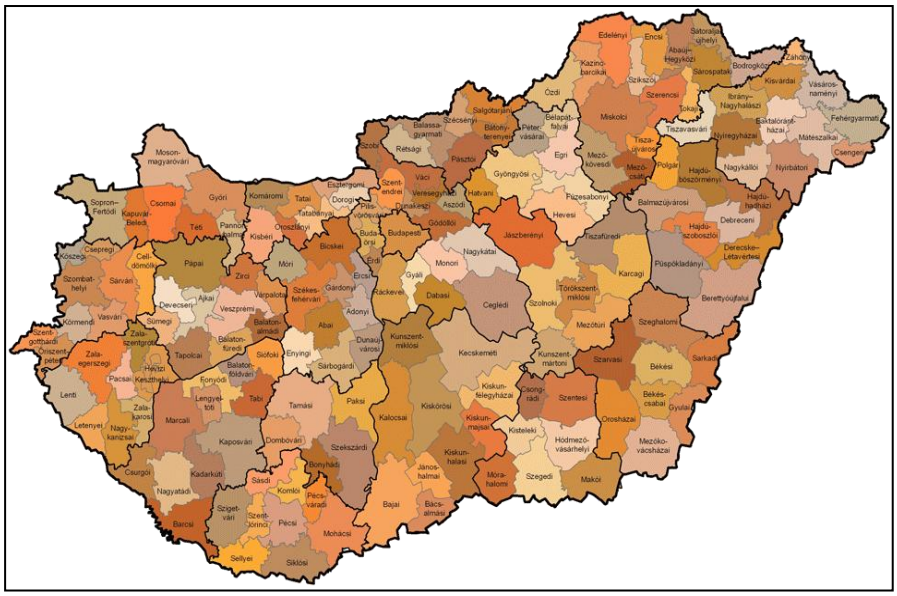

Figure 1. Statistical micro regions in Hungary

Source: http://dev.terport.hu/kistersegek/magyarorszag-kistersegei

The development level of the municipalities in the micro-region of Gyöngyös (LAU 4) was examined by economic, social and infrastructural indicators based on the NUTS classification. The investigated micro-region is located in Heves County (LAU 3) in northern Hungary (LAU 2), as it is illustrated in Figure 2.

The investigated area was created by the merger of Mátraaljai Micro-Regional Development Association of Local Governments and Gyöngyös District Regional Development Association on 1 January 2004. From 2007, Pálosvörösmart became separated from Abasár, so now the investigated micro-region consists of 25 municipalities (Figure 2). Its size is 750.78 km^2 and 74,199 inhabitants in 2012 according to data of the Hungarian Central Statistical Office.

The settlements of the micro-region form a structural and functional physical geographical unit as well as that of the structure of the settlements. They belong to the agglomeration of Gyöngyös.

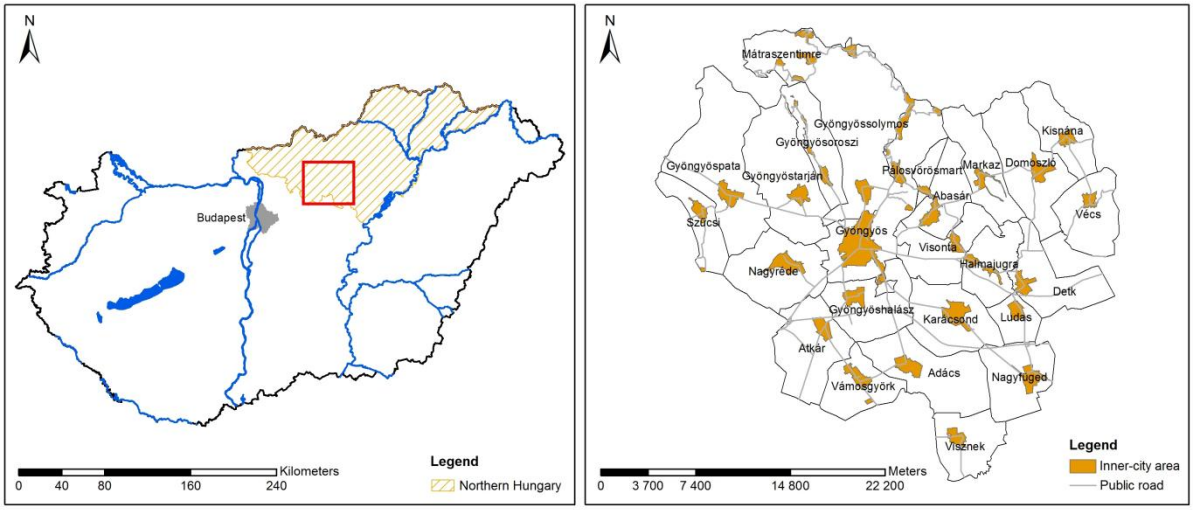

Figure 2. The location of the micro region of Gyöngyös

Source: own composition, 2014

3. Results

The complex development index defined for each of the variables shows the values of the settlements which determine the directions of development. We determined the values for declining (CDI = 0.241379 - 0.335241), lagging (CDI = 0.335242 - 0.429104), stagnating (CDI = 0.429105 - 0.522967), developing (CDI = 0.522968 - 0,616,830) and strongly developing (CDI = 0.616831 - 0.710693) municipalities. The developmental order of the municipalities can be determined on this basis. This test can be performed on the LAU 1, 2 and 3 levels as well.

In case of the municipalities that are classified as declining settlements, there is no source of own revenues that can be used to supplement available support options, so direct support is necessary. The financial resources of lagging municipalities must be extended as well. At stagnating municipalities it is important to decide which are the most important indicators to develop (based on the CDI value). At the other settlements the prioritization of importance of development projects is decisive. In my opinion, this study shows a more objective image for policymakers.

The complex development indicators determined for the single variables show the values on the basis of which development programmes can be formulated. The number of enterprises is closely related to infrastructural coverage in 2001 (Figure 3).

The number of guest nights per 1000 inhabitants was primarily concentrated at Mátraszentimre and at the resort areas of Gyöngyös in 2001. By 2010, the few day events of small municipalities had largely contributed to the spread of rural tourism. Where the number of guest nights was large, the number of commercial stores was also higher, as it is expedient to serve the needs of not only the residents, but also those of the visitors locally.

By 2010, the intention for construction significantly decreased in the micro-region, there were only nine municipalities where new dwellings were built.

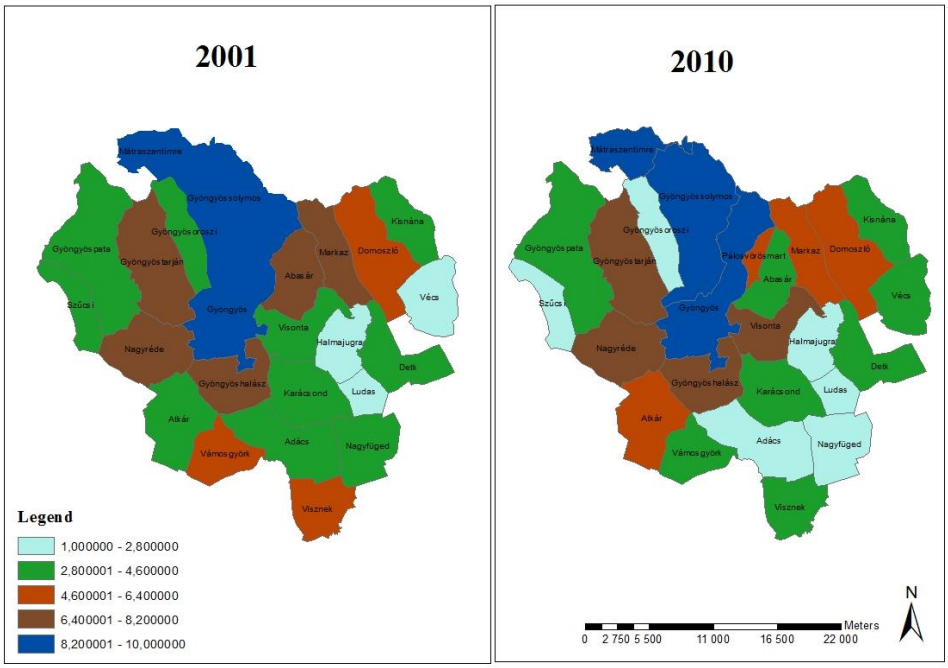

Figure 3. The number of enterprises per 1000 inhabitants (pcs) at the settlements of the micro-region of Gyöngyös in 2001 and 2010

Source: own composition

Net migration also reflects the situation of the settlements. Families prefer to move to the more advanced municipalities with better infrastructure. It is worth mentioning that in 2001 the movement from larger to smaller municipalities was characteristic.

During the investigated period, the net migration was only positive in case of four municipalities. Population density increased at only five settlements, while a decrease was experienced in 19 settlements.

The rank of municipalities based on the rejuvenation index changed between 2001 and 2010 (Figure 4). This also applied to the CDI.

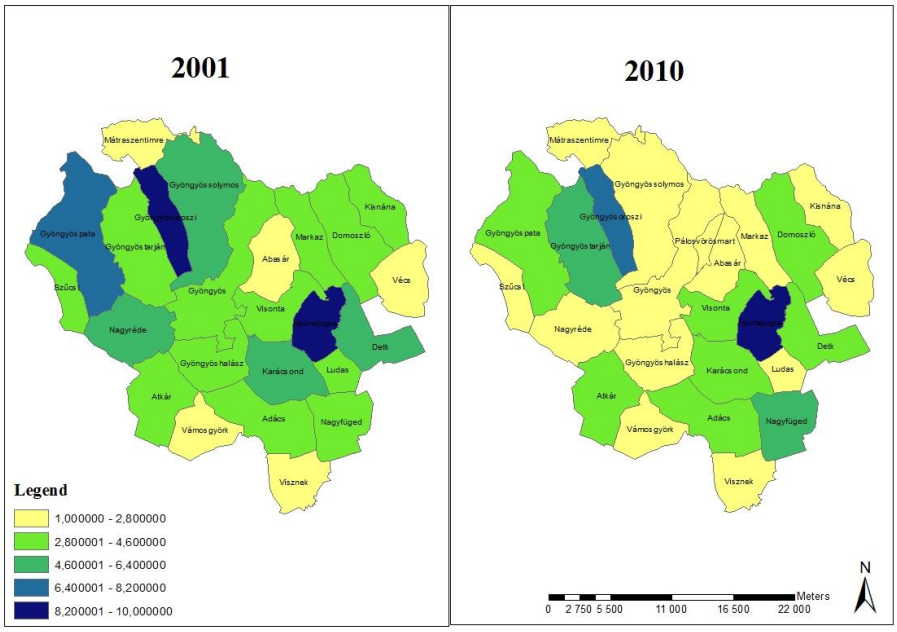

Figure 4: The rejuvenation index of the settlements in the micro region of Gyöngyös (%), 2001 and 2010

Source: own composition

Table 2 shows that at the beginning of the investigation Markaz (0.5490), Mátraszentimre (0.5390) and Nagyréde (0.5290) belonged to the most developed municipalities of the micro-region.

Regarding the relative standard deviation, it can be stated that the indicators exceeded 50% in both investigated years. It means that the complex development indicators of municipalities are highly changeable.

The development level of the municipalities shown on the map became comparable based on the data for 2001 and 2010. The GIS display classifies the municipalities into five groups[2]. In 2001 – as it is shown in Figure 5 – none of the settlements was classified as strongly developing municipality on the basis of the investigated

[2] The ranges of the classes were determined by the software ArcMap 10.1 displaying thematic maps of the Graduated colours scheme based on the average values, using the method of equal intervals taking into account the extreme values of the investigated data: declining: 0.241379 – 0.335241; lagging 0.335242 – 0.429104; stagnating: 0.429105 – 0.522967; developing: 0.522968 – 0.616830; strongly developing: 0.616831 – 0.710693.

complex indicators. In the same period Gyöngyös, and its neighbouring municipalities of Nagyréde, Gyöngyöshalász and Markaz were developing settlements. The

Table 2. The CDI index and ranks of the municipalities, 2001 and 2010

2001			2010		
Position	Municipality	Value	Position	Municipality	Value
1	Gyöngyös	0.5900	1	Gyöngyös	0,7107
2	Markaz	0.5490	2	Gyöngyössolymos	0,5748
3	Mátraszentimre	0.5390	3	Gyöngyöshalász	0,5741
4	Nagyréde	0.5290	4	Pálosvörösmart	0,5721
5	Gyöngyöshalász	0.5234	5	Nagyréde	0,5600
6	Gyöngyössolymos	0.5169	6	Atkár	0,5593
7	Visonta	0.5159	7	Visonta	0,5552
8	Gyöngyöstarján	0.4872	8	Markaz	0,5476
9	Atkár	0.4769	9	Gyöngyöstarján	0,5217
10	Abasár	0.4610	10	Mátraszentimre	0,4786
11	Szűcsi	0.4369	11	Vámosgyörk	0,4631
12	Detk	0.4310	12	Abasár	0,4583
13	Domoszló	0.4093	13	Domoszló	0,4524
14	Gyöngyöspata	0.3972	14	Gyöngyöspata	0,4452
15	Vámosgyörk	0.3903	15	Szűcsi	0,4266
16	Kisnána	0.3776	16	Detk	0,4186
17	Karácsond	0.3762	17	Kisnána	0,4103
18	Halmajugra	0.3607	18	Adács	0,4014
19	Gyöngyösoroszi	0.3438	19	Karácsond	0,3952
20	Adács	0.3386	20	Vécs	0,3821
21	Visznek	0.3048	21	Visznek	0,3772
22	Ludas	0.2993	22	Ludas	0,3762
23	Nagyfüged	0.2938	23	Nagyfüged	0,3759
24	Vécs	0.2414	24	Gyöngyösoroszi	0,3317
			25	Halmajugra	0.3179

Source: own calculation, 2014

northernmost settlement of the micro-region, Mátraszentimre was also developing; moreover, it got the maximum score in case of five variables. At the south-eastern periphery of the micro-region, there were four declining municipalities, all of which belonged to the lagging group in the 2010 investigation. Due to the development projects implemented, at 17 municipalities and at the newly separated Pálosvö-rösmart some progress was achieved, however only the town of Gyöngyös managed to get into the best group. The overall conclusion is that the micro-region moderately de-

veloped over 10 years. On the basis of these results it can be stated that the investigated thresholds can be used for the municipalities of other micro-regions as well. It is important to be aware of a wide range of factors that affect the development level of municipalities. In this case, we can choose the most appropriate variables that are needed to increase the development level of the municipality in a reliable way.

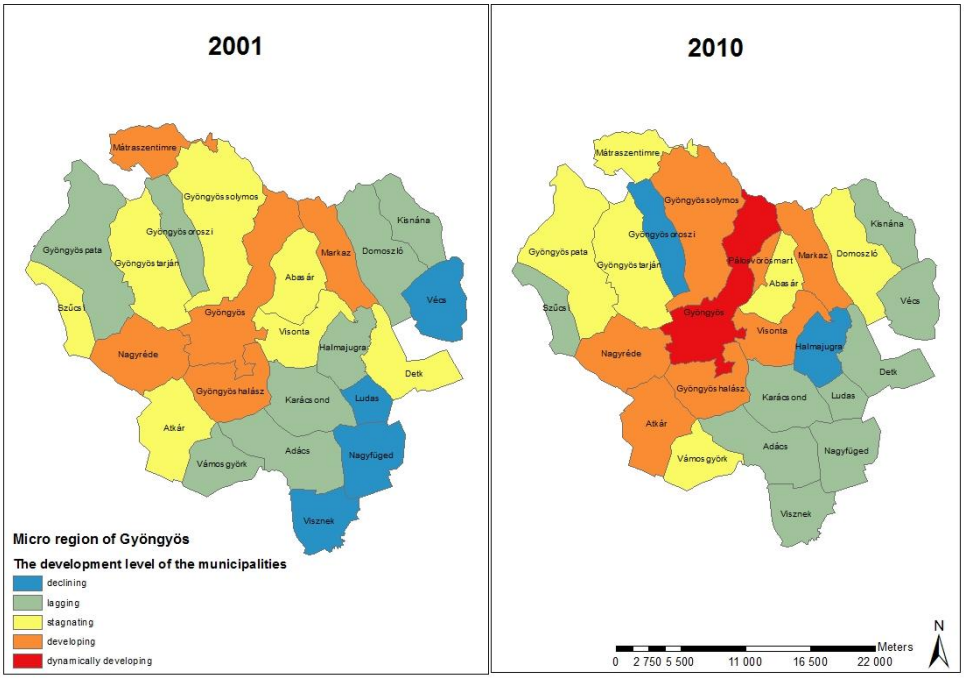

Figure 5. The development level of the municipalities in the micro-region of Gyöngyös based on the complex development index, 2001 and 2010

Source: own composition, 2014

Based on the data of the rotated component matrix, it can be stated that in 2001 indicators No. 1, 4, 5, 16, 19 and 21 was used in the investigation. In 2010 indicator No. 19 was replaced by No. 7 while the others remained unchanged based.

It can be concluded that the motorway accessibility indicator (17.88%) had the most significant impact on the investigated complex development index (CDI) in 2001 (Table 3). The share of employment in the service sector (17.83%) and the number of active enterprises per 1000 inhabitants (17.33%) also had a significant effect. In 2010, the share of employment in agricultural and service sectors and the number of active enterprises still significantly affected the CDI. The role of the motorway acces-

sibility indicator and personal income tax base somewhat reduced. The newly involved indicator, the local governments' revenue from local taxes, had the least significant effect on the development of the CDI. It is important to be aware of the impact a variable has on the value of the CDI, which may show different results for each sub-region.

Table 3. The role of individual factors in the development of the index CDI, %

Indicator	Year 2001	Year 2010
x_1 number of active enterprises per 1,000 inhabitants	17.33	19.08
x_4 share of employment in agriculture	15.97	19.24
x_5 share of employment in the service sector	17.83	19.34
x_7 local governments' revenue from local taxes	-	10.62
x_{16} motorway accessibility indicator	17.88	15.86
x_{19} net migration	14.63	-
x_{21} personal income tax base per resident	16.36	15.86
Total	100	100

Source: own calculation, 2013

4. Conclusions

The complex development indicators specified for the different variables show the weakest points of the municipalities. The variables that can be built into the short-, medium- and long-term strategic development programmes can be chosen from the 29 indicators investigated in this paper. The number of variables can be changed, especially increased. The developmental rank of the municipalities in the micro-region can be determined based on the values of the complex development index. Declining (cdi=0.241379-0.335241), lagging (cdi=0.335242-0.429104), stagnating (cdi=0.429105-0.522967), developing (cdi=0.522968-0.616830) and strongly developing (cdi=0.616831-0.710693) municipalities can be distinguished. The variables that have the largest impact on the complex development index can be determined, and they can be included in the strategic development plan of the micro-region or the district. The number of active enterprises per 1,000 inhabitants, the share of employment in agricultural and service sectors, the motorway accessibility indicator, personal income tax base per resident, net migration and the local governments' revenue from local taxes had the most significant effect on the development of the CDI. With the

use of the complex development index micro-regions become comparable, development resources can be broken down to the level of municipalities, and the impact of development projects can be controlled.

It is proposed to establish a general complex development indicator system to determine the efficiency of the utilisation of public and EU resources. It is necessary to involve state agencies which are able to provide information of adequate depth in the process. Using this system, the international comparison of different spatial units would also be possible.

It is believed that the development of a municipality depends not only on external factors and financial support. It is greatly influenced by the local people's will and attitude. Local communities have a decisive role in the success of settlements. It is essential that there are such people at the municipality who see the improvement of their place of residence and their environment as their mission.

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Wpłynęło/received 13.03.2015; poprawiono/revised 30.11.2015