

The role of GIS in spatial planning

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Abstract— GIS makes it possible to link large amount of spatial data to each other. Data integration results in synergy, also known as combined power. The application of GIS provides such new consequences that we could not have previously thought of. The databases used in spatial development are also suitable for registration, query and analysis. However, perhaps the biggest role of GIS is in decision support. The application of GIS contributes to the planning of the location of different objects, to the determination of the spatial distribution of different activities or to the determination of the areas that need to be developed. This article aims to present the role of GIS in spatial development through the example of the beneficiary settlements.

Keywords — *spatial analyses, spatial planning, settlement development*

I. INTRODUCTION

According to the National Spatial Development Concept, the spatial system is the spatial joint appearance of the systems of various organizations of different natural, social and economic objects (spatial elements), their connection related to a given area, their complex system. The spatial system is formed by a spatially different set of society, economy, geographical location, natural factors and human resources. So within a given territorial unit, these factors form a system, influence each other and interact with each other. The combination of these creates a very diverse territorial capital. Therefore, modern societies intervene into the functioning of the territorial system of specific territorial units for various reasons. Since the 1950s modern states have begun to consciously influence the territorial system development In order to correct large disparities as well as market mechanisms. [1] [2]

Regional development is nothing more than “Monitoring and evaluating the social, economic, infrastructural and environmental territorial processes covering the country and the regions, determining the necessary intervention directions; definition of short- and long-term comprehensive development strategies, concepts and plans, coordination of development goals and programs, implementation of plans”. [3]

Regional development and regional policies form a complex, diversified system at different territorial levels and define several strategic and development concepts. These documents directly and indirectly determine the development of each area. Areas can be delimited at the regional, county, district and municipal levels. The present study examines the delimitation of the beneficiary areas at the municipal level. [4] [5]

II. LEVELS OF SPATIAL PLANNING IN HUNGARY

The tasks of spatial development can be divided into urban and rural areas based on the different functions of the areas, based on which we distinguish between urban development

and rural development. However, it is not practical to separate the two development categories, because many economic and social problems can only be solved through the cooperation of villages and cities. Contrary to the Hungarian approach, small towns, and their surroundings, where industry has already appeared, but even agriculture plays an important role, are considered rural areas in the European Union. The city and its surroundings can be considered as a living unit, and its development can only be imagined by integrating the territorial and settlement approach. The aim of rural development is the continuous self-sustaining and sustainable development of the capacities of rural areas, so it has a very close relationship with the agricultural economy. Rural development policy helps to create sustainable agriculture, diversify farms, expand employment opportunities, and thus the competitiveness of rural areas.

At the same time, spatial planning is a hierarchically structured institutional system, the national, regional, county, micro-regional and settlement levels of which are distinguished. Higher-level territorial units necessarily include lower-level ones, and conversely, higher levels are aggregates of smaller spatial units. According to the target areas at different levels, we can differentiate between settlement development, micro-regional development, regional development, etc. According to some views, settlement development does not belong to the concept of regional development, because the scope of the Regional Development Act does not cover settlement development, but in the spatial science sense, the totality of levels forms regional development. The development strategy and the management plan must be based on a unified situation analysis and concept, both must be considered when planning the various programs.

The spatial plan is a plan document defining the long-term technical-physical structure of the country and certain regions, which ensures the long-term utilization and protection of spatial features and resources, enforcement of ecological principles, coordinated development of technical-infrastructure networks and optimal land use structure. At the national and regional level, the main goal is to create a geographically dispersed, small volume but mutually reinforcing networking, in which the two most important elements are the agricultural economy and the natural environment. The other levels of planning also have specific, unique functions, but the physical, socio-economic environment, social community, values, and interests have a common denominator. Certain territorial-environmental value choices may restrict owners (possibly other citizens) from exercising their rights. These should be enacted and included in the settlement plan. The development plan aims to promote conflicts between national spatial planning interests and national, territorial and local land use intentions.

At the regional level, a regional development concept is being prepared for several counties to be managed together from a social, economic or environmental point of view. The concept identifies the situation of the different territorial units and makes suggestions for the most effective developments, thus helping regional policy decisions. The spatial planning task of the counties is primarily the elaboration of infrastructural and environmental protection developments affecting several settlements, as well as the coordination of national and local zoning plans. The settlements are mostly connected to a well-defined central settlement, which means the micro-regional system, for which a planning document is also prepared. In order to limit their settlement development goals and the enforcement of individual interests, local governments regulate the formation of the natural and artificial environment in a development plan. Whereas previously land use was primarily regulated, today land use is increasingly regulated. Contrary to higher-level plans, the settlement level is not dominated by comprehensive regulation of land use, but by administrative and official elements. Once the settlement plan is adopted, a regulatory plan is drawn up that directly delimits possible improvements.

III. NATIONAL SPATIAL DEVELOPMENT AND SPATIAL PLANNING INFORMATION SYSTEM IN HUNGARY

The National Spatial Development and Spatial Planning Information System (TeIR) aims to provide central, regional and local public administrations, other legal entities, unincorporated companies and natural persons with:

- provide an opportunity to get to know the population, economy, condition of the built, landscape and natural environment of the country, its territorial characteristics, to monitor its changes, to compare them with the European Union,
- service information by displaying data and indicators and analyses obtained during their processing, presenting text and map documents of regional development concepts and programs, spatial planning plans, settlement development concepts, integrated settlement development strategies and settlement planning tools,
- assist governmental, regional, regional, county, district, municipal development and planning, other regional and sectoral planning, development and monitoring organizations in preparing and making spatial development and spatial planning decisions, social, economic and environmental by continuously monitoring the changes in its territorial characteristics, to analyse the effects of decisions and to prepare regional development concepts and programs, settlement development concepts, integrated settlement development strategies, and spatial planning plans and settlement planning tools,
- offer information to local and regional authorities and regional development councils for planning, program management, tender evaluation and monitoring activities.

The data content of TeIR is very extensive. Spatial planning and specialization (Protected natural areas of Hungary, Location of landfills in the country, Hungary's transport network, Operating and abandoned mines in Hungary, The natural environment of Hungary, Hungary's electricity system, Contact information, Changes in the administrative borders of Hungary, The administrative system of Hungary,

CORINE land cover, Drinking water quality in Hungary) also includes the following:

Remediation data
Nature and landscape protection
Public employment
Contact times and distances
Institutional provision
Aggregate data for industrial parks
Hazardous waste generated
Infocommunication data
Unemployment
General Agricultural Census
Regional Statistical Data System
Budapest Statistical Data System
County-Regional Statistical Data System
Census, microcensus data
Employees by occupational groups
Average rate of local taxes
Municipal management data
Sick pay data
Energy data
Local road data
Road accidents
Simplified Business Tax (EVA)
Personal income tax (PIT)
Corporate tax (TAO)
PIT civilian 1% offerings
Patient number, prescription data
Forest areas
Inpatient care
Drinking water quality
Outpatient treatment
Screening data
Data on disadvantaged primary school students
Higher education enrollment data
Students of foreign nationality
Flood and inland water damage
Dangerous plants
Domestic patent applications of Hungarian applicants. [6]

IV. THE METHOD OF CLASSIFYING BENEFICIARY SETTLEMENTS

The criteria for the classification of the beneficiary settlements are set out in Decree 105/2015. (IV. 23.). When classifying settlements on the basis of territorial development, it is necessary to take into account a complex indicator formed from social and demographic, housing and living conditions, local economy and labour market, as well as infrastructure and environmental indicators (four groups of indicators). [7]

A. Indicator group 1: Social and demographic situation

- Mortality rate (number of deaths per 1000 population) is the average of the last five years, ‰
- Migration difference per thousand inhabitants (average of the last five years), main
- Number of beds providing nursery care and day care services per ten thousand permanent residents aged 0-2, pcs
- Proportion of recipients of regular child protection benefits from the permanent population aged 0-24, %

- Number of people receiving active care (regular social assistance and employment replacement support) per thousand permanent residents, persons.

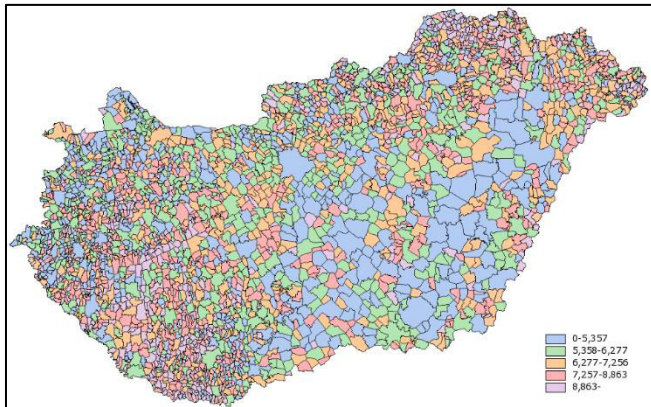


Fig.1. Internal emigration [%] (Edited in TeIR)

B. Indicator group 2: Housing and living conditions

- Average price of used apartments, HUF
- Proportion of dwellings built during the last five years out of the housing stock at the end of the period, %
- Dwellings without comfort (inhabited) as a percentage of inhabited dwellings
- The income forming the PIT base per permanent resident, thousand HUF
- Number of age-weighted passenger cars operated by natural persons per thousand inhabitants, pcs
- Social-economically and infrastructurally beneficiary settlements
- Significant unemployment affected municipalities
- Beneficiary settlement in both aspects

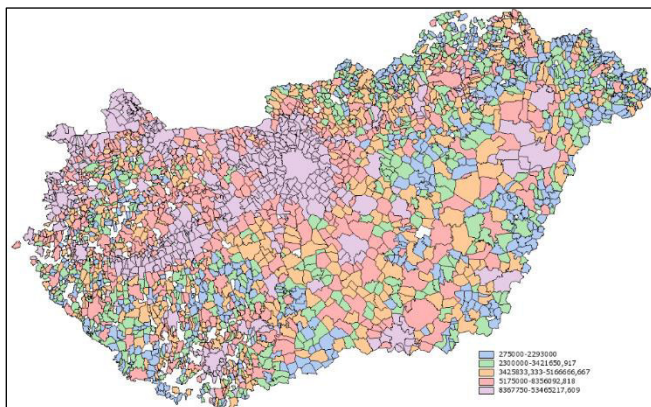


Fig.2. The average price of second-hand flats sold in 2016 [HUF] (Edited in TeIR)

C. Indicator group 3: Local economy and labour market

- Proportion of those aged 18 and over with at least a high school diploma, %
- Proportion of registered jobseekers in the working age permanent population, %
- Proportion of permanently registered jobseekers for at least 12 months out of the permanent working age population, %

- Proportion of registered jobseekers with no more than primary school, %
- Number of operating enterprises per thousand inhabitants, pcs
- Number of retail stores per thousand inhabitants, pcs
- Proportion of local tax revenues of local governments from current year revenues, %

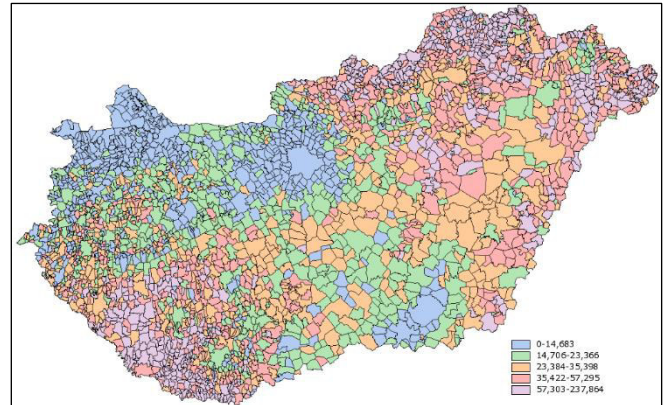


Fig.3. Proportion of registered jobseekers in the working age permanent population [per 1000 people] (Edited in TeIR)

D. Indicator group 4: Infrastructure and environment

- Proportion of dwellings connected to the public sewerage network, %
- Proportion of dwellings involved in regular waste collection, %
- Number of broadband internet subscribers per thousand inhabitants, pcs
- Proportion of roads built out of all municipal roads, %
- Indicator of the achievement of the county seat, minutes
- Indicator of access rate for controlled-access highway, minutes

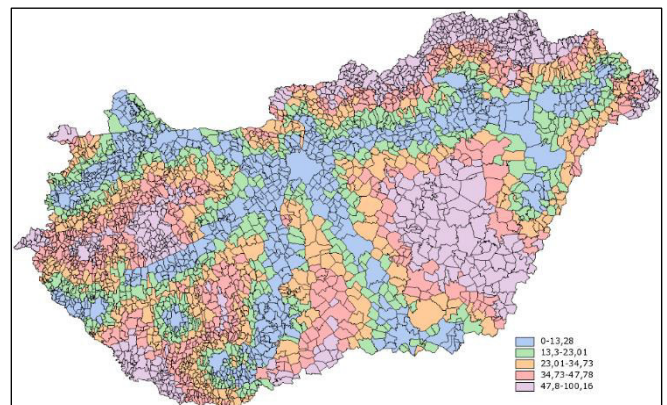


Fig.4. Access rate for expressways [min] (Edited in TeIR)

V. AGGREGATION OF INDICATORS

The method of calculation is laid down in the cited government decree. The transformation of the basic indicators to the same scale is performed by a normalization procedure according to the equation 1.

$$fa_{i,j,norm} = \frac{fa_{i,j} - \min(fa_{i,j})}{\max(fa_{i,j}) - \min(fa_{i,j})} \cdot 100 \quad (1)$$

$fa_{i,j,norm}$: normalized basic indicator

$fa_{i,j}$: basic indicator

$\min(f_{a_{i,j}})$: the smallest value of the basic indicator

$\max(f_{a_{i,j}})$: maximum value of the basic indicator

Calculation of group indicators: the average value of the basic indicators within a group gives the value of the group indicator of the given group according to the equation 2.

$$fa_i = \frac{1}{n} \sum_{j=1}^n fa_{i,j,norm} \quad (2)$$

fa_i : group indicator

$fa_{i,j,norm}$: normalized basic indicator

n : number of indicators in group

Calculation of a complex indicator: the average value of the four group indicators gives the value of the development complex indicator according to the equation 3.

$$f_i = \frac{1}{m} \sum_{i=1}^m fa_i \quad (3)$$

fa_i : group indicator

f_i : complex indicator

m : number of group indicators

As a result of the analysis, 1053 disadvantaged or beneficiary settlements are demarcated. (Fig.5.) The range of beneficiary settlements should be reviewed in accordance with the planning cycles of the European Union. The review may also be initiated by the Government on a separate schedule. [8]

Almost half (45.9%) of the settlements in Hungary have never been included in the socio-economic and infrastructurally disadvantaged settlements, and 16.4% only in one or two ways have been added to the list. At the same time, almost 10% of the Hungarian settlement population are more than six times between the demarcated settlements, so their peripherality was well established when calculating a complex indicator. More than 80% of the settlement population of Pest, Komárom-Esztergom, Győr-Moson-Sopron and Fejér counties was never included in the list of underdeveloped settlements. At the same time, more than 10% of the settlements of Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg, Baranya and Somogy counties were included in the lagging settlements during the larger delimitation. The former is extra large concentrates the backward settlements in proportion, as Borsod-Abaúj-Zemplén more than a third of the county settlements are almost all the demarcations considered peripheral. [9]

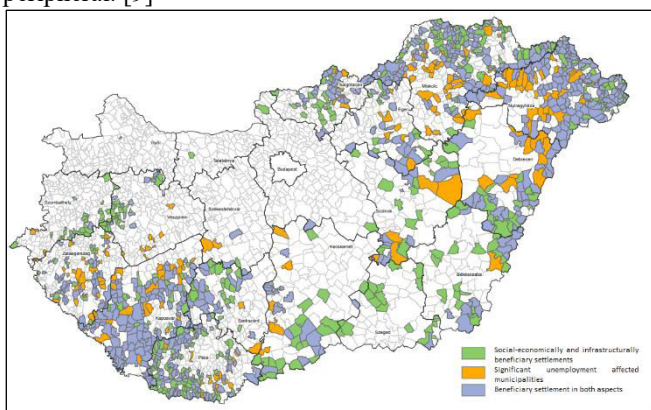


Fig.5. Beneficiary settlements in Hungary (TeIR)

VI. CONCLUSIONS

Overall, it can be stated that many settlements in Hungary have an absolute advantage over the others, while others have an absolute disadvantage they are at a disadvantage. However, the research also shows that this case may change over time, as settlements that have changed their beneficiary status depending on when and which indicators are used, they were delineated. Breaking out of disadvantage is a goal that is everything it floats there in front of a troubled settlement, and which you usually find very difficult alone inability to achieve. Territorial development and territorial policies at different levels are responsible to help these settlements to recover from their disadvantages so that so that they could eliminate large territorial disparities in the country, or at least moderate. This can be aided by a GIS database that aggregates complex data.

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