ANALYSIS OF PUBLIC ROAD ACCESSIBILITY IN HUNGARY

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Abstract: Hungary's example is taken in this study to analyse the changes of accessibility by public roads in 2005. The paper examines the extent to which changing accessibility is reflected in socio-economic processes. The question is how much an improving accessibility by road contributes to competitiveness, and if it contributes to the latter at all, and at what degree favourable accessibility conditions following public road investments or other local factors can result in favourable or unfavourable socio-economic processes

Keywords: public roads, accessibility, regional development, shift-share analysis, competitiveness

1 Introduction

For a long time, regional scientists have studied how accessibility interacts with economic processes. Over these studies correlation closeness and features were priority research fields. By using different approaches of multiple methods, this Hungary based study analyses how road accessibility correlated with major territorial processes.

2 Defining Accessibility

Because of the globalization processes everything (goods, services, etc.) is being transported in the world, and the main problem that everybody forget about the importance of the reachable potentials (goods, services, etc.) within the settlement, county, region (of course without considerable transportation) where the people live.

That's why we have to think not only about the services of the transportation system, but the sustainable development of the place we live, as well.

So we can say, that land-use and transportation form a consistent system, and we have to examine these two parts together

In this respect the accessibility is: "The extent to which the land-use transport system enables (groups of) individuals or goods to reach activities or destinations by means of a (combination of) transport mode(s)." (Geurs-Ritsema, 2001).

3 Data and Method

Regional science applies many accessibility models. I used in the study gravitation model, because it is proper to take into account all accessible, study

area based destinations and not only the radius zone or magnitude based ones. This model is generally able to integrate the preferences of all travellers, which facilitate to identify general connections.

In this study I used the gravitational analogy based model with linear resistance factor as is in my earlier study (Tóth, 2008) I realised that it is the most proper model to describe spatial patterns in Hungary.

Model taken into account:

Gravitational analogy based model with linear resistance factor

$$a = \frac{W_i}{c_{ii}} + \sum_j \frac{W_j}{c_{ij}}$$

The first part of these equation is the own potential, which reflects to the accessible goods and services within the settlement. The second part is the inner potential, which shows the accessibility of all other settlements.

Where a is the accessibility index of locality i; W is the volume required to reach (population);c ii travel time within the settlement, cij is the interlocality travel time between i and j.

Dimension	Remarks
Source	My analysis computes as well as interprets accessibility from aspects of all people; specific social groups as well as the different destinations of specific travellers are not differentiated.
Destination	The targeted destination is quantified with specific settlement populations.
Resistance	Spatial resistance factor is represented by inter-settlement (settlement centre-settlement centre), road measurable theoretical accessibility times expressed in minutes. Applied resistance factor: linear (average resistance).
Limitations	Road specific speed limits
Coverage	My analysis territory covers Hungary
Traffic mode	My analyses did not differentiate passenger and freight transport aspects
Modality	Unimodal accessibility was calculated for public roads
Territorial level	Fundamentally the settlement level
Equal rights	Fundamental research goals are to model the Hungarian centre-periphery differences.
Dynamics	My research used population and road network data from 2005.

Table 1: Analysis dimensions

On Figure 1 we can see the result of the calculation. Map categorization was implemented by dividing the potential distribution range to 5 equal parts and then in line with this depicted it.

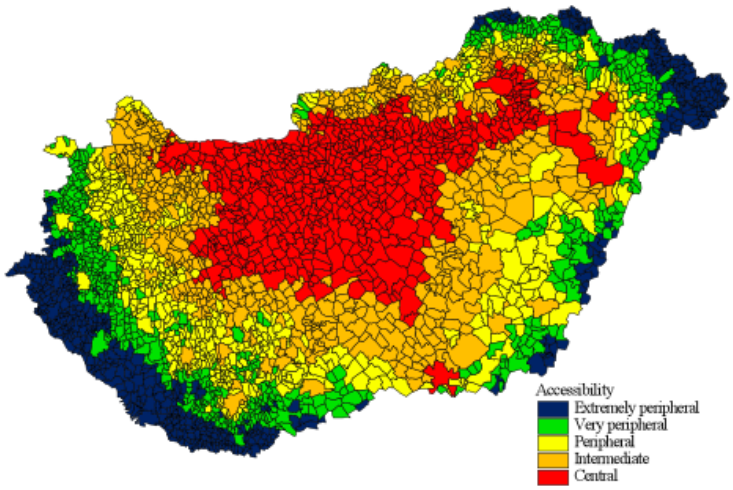

Figure 1: Settlement accessibility by applying a linear resistance factor, 2005

4 How Spatial Structure Interacts with Accessibility

One of the major implications of regional disparities in per capita earnings is that accessibility potentials correlate with per capita earnings (Table 2). Only two counties (Heves and Somogy) differs from this and one relatively well accessible settlement group underperforms more disadvantaged areas.

	Accessibility categories					
Counties	Extremely peripheral	Very peripheral	Peri-pheral	Inter-mediate	Central	In total
Budapest	-	-	-	-	146,7	146,7
Baranya	57,4	73,2	81,3	105,4	-	86,7
Bács-K.	57,1	56,8	59,4	71,2	93,4	78,5
Békés	48,3	60,0	74,8	96,2	-	76,3
B.-A.-Z.	51,4	58,5	60,3	72,6	94,7	79,6
Csongrád	50,0	61,9	73,6	75,5	111,0	88,0
Fejér	-	-	-	68,6	114,5	112,2
Gy.-M.-S.	-	87,1	97,8	96,5	126,1	107,5
H.-B.	42,5	50,9	67,6	66,1	100,6	81,0
Heves	-	-	66,6	63,4	96,3	90,4
K.-E.	-	-	-	86,2	108,6	108,2
Nógrád	-	56,0	63,4	85,3	81,1	82,8
Pest	-	68,7	83,4	82,2	110,3	109,8
Somogy	65,4	49,9	70,7	92,1	95,0	76,8
Sz.-Sz.-B.	51,4	61,8	59,4	61,5	104,2	67,4
J.-N.-Sz.	-	-	54,5	69,9	104,3	82,5
Tolna	-	53,0	64,0	99,8	81,6	88,3
Vas	89,3	98,4	115,9	-	-	106,3
Veszprém	-	58,8	73,1	94,3	116,1	98,4
Zala	79,2	91,9	112,6	-	-	95,5
Country	62,0	70,4	80,0	82,6	118,6	100,0

Table 2: National average based per capita income and accessibility, 2006 (%)

5 How Accessibility Interacts with Competitiveness

Recently, several studies, methodological procedures were published to measure regional competitiveness. We tried to use these procedures. (Nemes Nagy, 2004)

After some mathematical transformations (using log values) the multiplications are transformed into much better manageable amounts, in line with the below formula:

$$\log\left(\frac{\text{Income}}{\text{Population}}\right) = \log\left(\frac{\text{Income}}{\text{Exployees}}\right) + \log\left(\frac{\text{Exployees}}{\text{Activeaged}}\right) + \log\left(\frac{\text{Activeaged}}{\text{Population}}\right)$$

Taxpayer incomes essentially approximate productivity levels in counties, the taxpayers/active aged population ratio provides an applicable employee

estimate, while the active aged population/total population ratio, like a specific age structure ratio, regards as a positive regional asset the younger demographic profile.

Our table indicates above and below national average values with 1 and 0, respectively (the first figure is always for residential incomes, the second is for productivity, the third is for employment, the fourth is for the demographic factor). Areas with above average residential incomes are regarded as competitive, while the below average ones as disadvantaged. Within this, complex competitive advantaged areas show above average values for the all three components of residential incomes, while multi- or monofactor competitive advantaged areas show similar values for only two or one factors. This analogy is applied for classifying competitive disadvantages, too

	Accessibility categories				
Counties	Extremely peripheral	Very peripheral	Peripheral pheral	Inter-mediate	Central
Budapest	-	-	-	-	1110
Baranya	0001	0001	0001	1110	-
Bcs-K.	0001	0000	0000	0001	0011
Bks	0000	0001	0000	0010	-
B.-A.-Z.	0000	0000	0000	0001	0001
Csongrd	0000	0000	0000	0000	1110
Fejr	-	-	-	0001	1111
Gy.-M.-S.	-	0010	0010	0011	1110
H.-B.	0001	0000	0001	0001	1011
Heves	-	-	0000	0000	0010
K.-E.	-	-	-	0010	1011
Ngrd	-	0000	0000	0000	0000
Pest	-	0000	0000	0000	1100
Somogy	0001	0000	0001	0010	0011
Sz.-Sz.-B.	0001	0001	0001	0001	1011
J.-N.-Sz.	-	-	0001	0001	1010
Tolna	-	0001	0001	1011	0000
Vas	0010	0010	1011	-	-
Veszprm	-	0010	0011	0011	1111
Zala	0010	0011	1011	-	-

Table 3: Relative income situation: factors, 2006 (Remarks: figure 1 is for residential incomes, 2 is for productivity, 3 is for employment, 4 is for the age-structure factor)

In sum the centrality is not always for competitive advantage, in multiple counties central settlements are multifactor competitive disadvantaged, nay in Nógrád and Tolna counties, complex competitive disadvantaged (Table 3).

Intermediate (accessible) settlements, only in Baranya and Tolna counties, are multifactor competitive advantaged, but in others, multifactor as well as complex competitive disadvantaged. Among peripheral areas, moderately peripheral, multifactor competitive advantaged Vas and Zala county based settlements may be highlighted. Settlements in other peripheral micro regions may be featured by some number of competitive disadvantages.

6 How Accessibility Impacts Territorial Development: a Shift-Share Analysis

This method is proper to separate regional and non-territorial based factors (i.e. accessibility) of economic development.

I wanted to study that which plays more important part in the economic development, either the accessibility or the other local effects.

For year 2006, this study broke down regional disparities of per resident incomes into specific factors.

In the Total column those counties got the number +100%, which are developed than the national average. The -100% means of course the opposite. In the next two columns we can see the components of the regional development, so that which one is more important in this case: the territorial aspect or the accessibility?

County	Total (%)	Territorial (%)	Accessibility (%)
Budapest	100,0	37,0	63,0
Baranya	-100,0	5,4	-105,4
Bcs-K.	-100,0	-60,8	-39,2
Bks	-100,0	-23,1	-76,9
B.-A.-Z.	-100,0	-13,1	-86,9
Csongrd	-100,0	35,5	-135,5
Fejr	100,0	-56,1	156,1
Gy.-M.-S.	100,0	204,8	-104,8
H.-B.	-100,0	-24,5	-75,5
Heves	-100,0	-117,1	17,1
K.-E.	100,0	-88,9	188,9
Ngrd	-100,0	-48,9	-51,1
Pest	100,0	-258,2	358,2
Somogy	-100,0	-27,6	-72,4
Sz.-Sz.-B.	-100,0	-27,4	-72,6
J.-N.-Sz.	-100,0	-26,2	-73,8
Tolna	-100,0	20,9	-120,9
Vas	100,0	336,2	-236,2
Veszprm	-100,0	1820,1	-1920,1
Zala	-100,0	455,9	-555,9

Table 4: Income surplus/shortage and county components, (%)

Counties	Income surplus	Income shortage	Favourable territorial assets	Unfavourable territorial assets	Positive accessibility impacts	Negative accessibility impacts
Budapest	79,5	-	55,7	-	55,2	-
Baranya	-	5,6	0,6	-	-	6,5
Bcs-K.	-	11,6	-	13,4	-	5,0
Bks	-	9,0	-	4,0	-	7,7
B.-A.-Z.	-	14,6	-	3,6	-	14,0
Csongrd	-	4,7	3,2	-	-	7,0
Fejr	4,8	-	-	5,1	8,2	-
Gy.-M.-S.	3,7	-	14,2	-	-	4,2
H.-B.	-	10,4	-	4,8	-	8,7
Heves	-	2,8	-	6,3	0,5	-
K.-E.	2,6	-	-	4,3	5,3	-
Ngrd	-	3,6	-	3,3	-	2,0
Pest	7,8	-	-	38,0	30,7	-
Somogy	-	7,3	-	3,8	-	5,8
Sz.-Sz.-B.	-	18,8	-	9,8	-	15,1
J.-N.-Sz.	-	7,2	-	3,6	-	5,9
Tolna	-	3,0	1,2	-	-	4,1
Vas	1,7	-	11,0	-	-	4,5
Veszprm	-	0,2	5,3	-	-	3,3
Zala	-	1,0	8,9	-	-	6,3
Total	100,0	100,0	100,0	100,0	100,0	100,0

Table 5: County shares in income surpluses/shortages and related components, (%)

Shift-share findings show that accessibility assets exceed place based ones in most cases (17 counties from the 20). Place based assets exceed accessibility ones only in Bács-Kiskun, Győr-Moson-Sopron and Heves Counties. (Table 4)

Concerning the income surplus (Table 5), the best positioned Budapest has excellent local and accessibility factors; so essentially non-identifiable which is the more important. Pest, Fejér and Komárom-Esztergom Counties are in a clearer position; here the income surplus is mainly due to accessibility factors not the negative territorial ones. Though Győr-Moson-Sopron and Vas Counties, in national comparison, are featured by income surpluses, but it is mainly due to other, location assets not negative accessibility factors. Accessibility naturally impacts these local assets. Our model accounts only Hungarian destinations, therefore many counties show slightly worse results than in reality.

Only Heves County shows, in national comparison, an income shortage despite its favourable accessibility assets. All other counties are characterized, in national comparison, by unfavourable accessibility factors and income shortages.

7 Conclusions

As it could be seen, accessibility plays a very important role in the regional processes in Hungary. That's why regional planners and politicians has to take into account in their decisions every aspect of the road accessibility for the balanced regional development and processes.

References

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