CENTRE FOR REGIONAL STUDIES
OF HUNGARIAN ACADEMY OF SCIENCES

DISCUSSION PAPERS

No. 8

Role of Accessibility in Development and Functioning of Settlements

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Series editor HRUBI, László
Translated by PÉTER, Sándor and FÖLDESNÉ SZARVAS, Mária

Pécs
1990

ISSN 0238–2008

Kiadja a Magyar Tudományos Akadémia Regionális Kutatások Központja
Felelős kiadó: Enyedi György
Sorozatszerkesztő: Hrubi László
Készült 250 példányban, 3 (B/5) ív terjedelemben
Agora Nyomda Pécs – 91-544
Felelős vezető: Kőrösi Lajos

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INTRODUCTION

The economic structure, development ability, and functioning of settlements in a region are significantly influenced by the measure of connections of settlements of various importance. Transportation network is a growth factor playing important role in the life of settlements. The connection of large settlements to each other and to less important settlements in their gravity zones is closely related to the development and functioning of the settlements.

This paper intends to analyze the connection system of settlements with the concept of transportation accessibility. My research is restricted even more since only mass transportation is included into the analysis.

In the analysis of the connection system the clarification of the concept of accessibility and the demonstration of the methods of its measurement need to be done first.

Inquiring both domestic and international literature has led me to the conclusion that there is no exact definition for accessibility. We all feel what accessibility, transportational accessibility means, but its contents are conceptualized only with limitations. *P. Gould* gives a quite apt description of it: ***"The accessibility is ... a slipary notion ... one of those common terms that everyone uses until faced with the problem of defining and measuring it"***.[1]

Accessibility is usually examined from two aspects: from the ***spatial*** and from the ***social*** ones, or in other words, its ***physical*** and its ***social*** dimensions are investigated.

T. Hägerstrand states that accessibility has at least two sides. One is ***physical***, which means the possibilities of transportation between two geographical points while the other, ***social*** side means that the social position of the individual supplies or enforces the accessible points.[2]

Physical accessibility means the revealed connections between two geographical points. *E. J. Taffee* is concerned with its examination and mathematical analysis when analyzing flows and connections among centres. He defines the roads and railroads among centres as a graph which can be trans-

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formed into a matrix. Depending on the values corresponding with the vertices and edges there are various forms of matrices. For example the so-called ***connection matrix*** is obtained when only the existence or non-existence of direct links between two points is demonstrated. The author emphasizes that in this way we obtain a simple measure with little relevance to the level of the centre. Proceeding from this the ***accessibility matrix*** can be defined if the "existing" (1) and "non-existing" (0) values are replaced with the time or cost values of the distance between the two points.[3]

*W. L. **Garrison*** investigated the ***centre accessibility***. His method is similar to the above mentioned. He used the graph theory, too, and the matrix multiplier based on it to measure the accessibility of centres in the South Atlantic USA. He uses the connection matrix and recognizes the problem of direct versus indirect connections, namely that a more realistic measure could be gained if the importance of indirect connections could be reduced, that is, indirect connections should be weighted in inverse way.[4]

*W. A. **Muraco*** measured the physical accessibility on the basis of graph theory, too. Weighted values dependent on traffic, using the ***Ford-Fulkerson algorithm***, represent the graph of road network (including highways, principal, secondary and local roads).[5]

Many of the Hungarian researchers have examined the spatial aspects of accessibility, too. ***Pálfalvi J. and Schwertner J.*** define accessibility as passanger transportation links among a central settlement and its gravity zone. Examination of accessibility in various periods of the day is claimed to be important in their work but society is considered homogeneous. The authors emphasize the qualitative side of accessibility from the point of view of passanger transportation. Improvement is required in reducing congestion, the quality of passanger services, that is, the servicing functions of accessibility must be improved since the links have already been existing.[6]

Similarly, ***Erdősi F.*** emphasizes the qualitative improvement of physical accessibility having the mere existence of accessibility given. He is the one who investigates the most the concept of accessibility and transportational gravity zones in the Hungarian literature. In a number of his works he analyzes the connection system between the centre and its gravity zone with respect transportation and accessibility.[7]

Many researchers, such as *T. **Hägerstrand***, have dealt with the ***social side*** of accessibility. They define accessibility as an ability that enables people to reach the destination where the individuals to perform a particular activity.[8]

According to *D. R. Ingram* the concept of accessibility has departed from the nature of destination and its essence is ***mobility*** itself.[9]

M. J. Moseley claims that the concept can not be restricted this much since mobility depends not only on external circumstances and transportational possibilities but on the moving capacity, physical and financial conditions of the individual, too. Presuming either objective or subjective improvement of accessibility, ***it leads to improvement in the quality of life. The goal of revealing accessibility is to show the role of destination in the hope for better accessibility. This goal can be reached by the joint examination of the social and the spatial dimensions of accessibility.***

M. J. Moseley illustrated the three components of accessibility in the following way:

$$\text{man} \xrightarrow{\textit{relation}} \text{place of activity}$$

where "man" means the social dimension, that is, the social and demographic composition of the settlement must be taken into consideration. As *M. J. Moseley* puts it, he is interested in the accessibility or non-accessibility of villages. He feels important the examination of mobility possibilities of various strata in villages, particularly, when the decline of rural transportation may induce the decline of mobility.

In his model "relation" means the revealance of the extent and quality of the passanger transportation network and the forces influencing it. The "place of activity" is reaching the final destination where jobs, commerce, education, health and other services are available, the geographical system of which components should be taken into consideration.[10]

S. Őberg examines individual strata and places of activity in a case study focusing on choosing dentist in Southern Sweden. He models the accessibility of supply points.[11] ***B. Lenntorp*** deals with the above model, with respect to accessibility and its geographical and economic effects.[12]

The Polish geographer ***R. Domanski*** gave the following definition for accessibility: "Accessibility means the possibility of utilization of such opportunities that are represented by economic, political, social, and cultural institutions and establishments. Individuals, families, and settlements do not have equal opportunity to reach these objects. Accessibility may be a measure of spatial equality."[13] He examines the relations among ***accessibility, efficiency and spatial organization*** and concludes that under certain circumstances there may be a positive relation between concentration and spatial accessibility, that is, with increasing geographical concentration accessibility increases and accessibility affects spatial structure. Although spatial accessibility (between two geographical points) is increased by increasing spatial concentration, my view is that extreme centralization leads to exclusion of wider strata from the access to certain activities.

The concept of accessibility is well demonstrated by the model represented by *Table 1* in which accessibility has two distinctive sides. The first is ***physical*** or ***spatial*** dimension, which mostly belongs to transportation geography. The other side is ***social*** dimension, which is closest to sociology. At the meeting points of the two dimensions there is the two-sided accessibility that is examined by social geography. This means that the analysis of accessibility between two geographical points from the point of view of certain activities or services is restricted to the affected social stratum.

I examine the accessibility ***among centres***, and that between ***centres and the settlements in their gravity zones*** by measuring the ***physical side***, which belongs to transportational geography. Since population is not homogeneous, I examine only the strata of it which ***are able to use the mobility possibilites*** when investigating the accessibility with respect to a particular activity.

METHODS OF MEASURING ACCESSIBILITY

While the concept of accessibility can only be circumscribed, there are exact methods to measure it in the literature. However, as the concept itself can not be simplified, a single method of measurement can not be used either. The choice and working out of a specific process depends on the side of accessibility to be measured. Overviewing the methods of measurement found in the literature it is apparent that measuring accessibility does not mean a clean, unique method. Simple, two-variable methods are used just like exact mathematical ones.

The most meaningful value for accessibility is ***running time***, the representation of which in cartography is the ***isochrone*** and the number of daily or part-of-day ***line-pairs***. The ratio of the two can be treated as a primary index, since the former one relates inversely and the latter one directly to the quality of accessibility. Further on I call the line-pair over running time quotient ***accessibility index*** after *H. Zimpel*[14], and each examined settlement will correspond with a value of this index. In the analysis I use the following two

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mathematical methods.

1. Measuring accessibility among centres

The method is used to measure the ***spatial dimension***, that is, physical accessibility, and is applied to examine the links among district centres.[15]

The transport network (public roads and railroads) is represented by a connected undirected graph, $G = (V, E)$, where V is a set of vertices and E is a set of edges (route sections). A so-called *cost function* can be chosen to the graph which corresponds a real number to each elements of set E. I call this real number direct accessibility and I calculate it the following way:

$$d(v_i, v_k) = \frac{n(v_i, v_k)}{t(v_i, v_k)}$$

where $n(v_i, v_k)$ is the number of public line-pairs, and $t(v_i, v_k)$ is the average running time.

In the next step the $a(v_i, v_k)$ accessibility between non-adjacent vertices (settlements) should be defined. Here the following characteristics must be considered.

1. $a(v_i, v_k) = a(v_k, v_i)$, commutativity;

2. Accessibility on joint route sections is smaller than any accessibility corresponding with any part of the route, that is

$$a(v_i, v_k) < a(v_i, v_j), \quad \text{and} \quad a(v_i, v_k) < a(v_j, v_k)$$

3. If vertex v_j, adjacent to both v_i and v_k, is only a stop between v_i and v_k, that is $n(v_i, v_j) = n(v_j, v_k)$, that is the number of line-pairs does not change, then

$$a(v_i, v_k) = \frac{n(v_i, v_k)}{t(v_i, v_k)} = \frac{n(v_i, v_j)}{t(v_i, v_j) + t(v_j, v_k)}$$

value should be the outcome according to characteristic in 1.

4. There may exist more than one routes between two vertices and accessibility can correspond to each. In order to keep the validity of characteristics 1–3. I have chosen the simplest possibility, the maximum of all attainable accessibilities on all roads. On this basis accessibility is

$$a(v_i,\ v_k) = \overset{Max}{G}\left(max\ \frac{1}{\sum_{j=1}^{n-1} \frac{1}{a(v_{l_j},\ v_{l_{j+1}})}},\ d(v_i,\ v_k)\right)$$

where

$$v_i = v_{l_1}\ v_{l_2}\ v_{l_3} \ldots v_{l_n} = v_k$$

are vertices of a non-circle route between v_i and v_k.

5. If between v_i and v_k the optimal path is $v_i\ \ldots\ v_j,\ v_k$ and $(v_j,\ v_k)$ edge is optimal, too, then

$$a(v_i,\ v_k) = \frac{1}{\frac{1}{a(v_i,\ v_j)} + \frac{1}{d(v_j,\ v_k)}}$$

This last characteristics gives the real possibility to calculate accessibility for which I have used the ***Dijkstra-algorithm*** of the shortest possible route starting from a designated source, for the similarity of the problems.

This algorithm also supplies to each settlement, as to each root element, ***hierarchic spanned tree of the graph*** representing the transportation network.

Another problem emerges when simultaneously examining public road and railroad accessibility. For this joint accessibility calculation the above method is to be modified only in the sense that when computing the ***joint direct accessibility*** the total number of line-pairs should be divided by average of the running times weighted by the number of line-pairs, that is

$$d = \frac{n_A + n_B}{\frac{n_A}{n_A+n_B}\, t_A \ + \ \frac{n_B}{n_A+n_B}\, t_B}$$

where n_A, n_B are two kinds of number of line-pairs, and t_A, t_B the average running times, respectively. For the trivial case of $n_A = n_B = 0,\ t_A = t_B$ this definition gives the right results separately.

Finally, the ***total accessibility*** of a settlement is measured by

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$$a_k = \sum a(v_i,\ v_k)$$

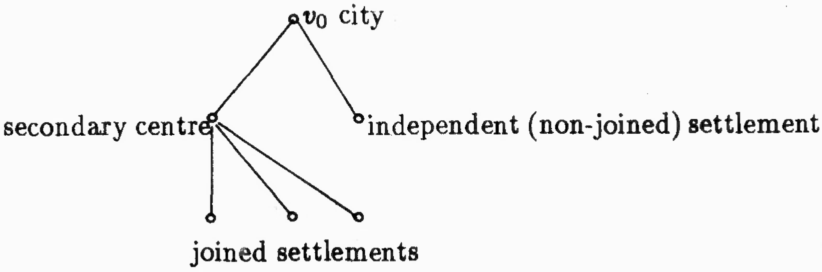
that is summing up all the accessibilities from other settlements.

2. Measuring the social dimension of accessibility

Different activities and services are needed by different groups of the population, thus the accessibility of these does not affect the whole population only various parts of it. The literature is abundant in processes to calculate this side of accessibility but using them one should not forget about the background supplying empirical facts, because an automatic application of these methods without change can give false results.

The method used here serves the measurement of the ***accessibility of the workplace***. In this process accessibility from each point (settlement) to each point (settlement) is considered. Each point has some specific feature which is called "attraction", and the model is called ***attraction-accessibility method.***

The settlement network under examination mathematically is represented by the connected undirected graph $G = (V,\ E)$, where V is the set of vertices (settlements) and E is the set of edges (transport routes). The administrative hierarchy is represented by the $S = (V,\ T)$ spanned tree of G (see the figure below), where T is set of the edges of the tree ($T \subset E$), and $v_0 \in V$ is the source.



On the edges defined are

- (a) the $d_{k,j} = d(v_k,\ v_j)$ ***cost function*** (e.g. travelling time),

- (b) the $l_{k,j} = l(v_k,\ v_j)$ ***flow function*** (e.g. the number of commuters from settlement v_j to settlement v_k).

On the vertices defined are

- (c) the $w_j = w(v_j)$ ***supply function*** (e.g. the number of workplaces)
- (d) the $h_j = h(v_j)$ ***demand function*** (e.g. the active labour force there).

Knowing these four functions the accessibility of certain characteristics can be examined and defined for the vertices within graph G.

1. The ***demand potential*** – that corresponds values to vertices – expresses the measure of demand that can be "felt" in an particular settlement toward the given activity. The demand potential corresponding with vertex v_j is

$$z_j = \sum_{k=1}^{n} p_s(d_{k_j})h_k, \quad j = 1, \dots n$$

where

n is the number of settlements under examination,

$h_k = h(v_k)$ is the demand at vertex k,

$d_{k,j} = d(v_k,\ v_j)$ is the travelling time along edge $(v_k,\ v_j)$, and

$p_s(d)$ is a monotonous non-increasing function reduced to spanned tree S, called ***power function.***

The power function has the characteristics

$$p_s(0) = 1$$

and

$$\lim_{d \to \infty} p_s(d) = 0$$

Such function can be created in various ways, but in the literature it is often used in the form of

$$p_s(d) = e^{kd}, \quad \text{where} \quad k < 0.$$

The question remains that from what data can ***parameter k*** be estimated. I have chosen the following process. Within a district of a city the $l(v_i,\ v_j)$, the number of people commuting from settlement v_j (always including those commuting to the central settlement) is known as well as $h(v_j)$ the active local labour force in v_j settlement. I plotted the ratio of these as a function of the distance from the central settlement, and then fitted a regression function to this set of points. The value of parameter k can be obtained from this.

Obviously, $h(v_0) = \sum l(v_i,\ v_0)$, that is, the number of people working in the central settlement is equal with the sum of those staying home ("locally migrating") and migrating to other settlements.

2. I correspond a so called "ability to attract" or ***attractivity*** to each vertex of graph G. This is, after *J.W.* ***Weibull*** [16], computed the following way:

$$c_j = \frac{w_j}{z_j}$$

3. The ***accessibility function*** can be calculated with the ***weighted sum of attractivities*** of surrounding settlements.

$$f_j = f(v_j) = \sum q_s(d_{k,j})z_k$$

where the $q(d)$ weight function is monotonous non-increasing, and satisfies the

$$q(0) = 1 \quad \text{and} \quad \lim_{d\to\infty} q(d) = 0$$

conditions.

I used the *Ingram-type* weight function. The most suitable way of choosing the parameter seemed to be the case when the value of the weight function decreases to $\frac{1}{4}$ at the 1 hour limit.

As a last step the ***the distribution function of accessibility*** was defined. $F(p)$ distribution function shows that for what p ratio of the active labour force of the examined group of settlements falls no more than $F(p)$ value of accessibility. I computed the distribution function as follows:

$$F(p) = \begin{cases} 0, & \text{if} \quad p = 0 \\ f_j, & \text{if} \quad \frac{\sum h_i | f_{j-1} \leq F}{\sum h_i} < p \leq \frac{\sum h_i | f_j \leq F}{\sum h_i} \end{cases}$$

where $f_1 \leq f_2 \leq f_3 \ldots$.

In the next chapters I measure accessibility with the above methods. The examined region covers ***Győr-Sopron, Vas and Veszprém*** counties. The region includes 21 smaller administrative units, so-called ***city districts*** according to the January 1, 1984 status, with 590 settlements. At this time the three counties contained 21 districts. The investigations concerning centres are related to the centres of these 21 districts. There are no more cities besides them in the region.

There has been research concerning the so-called ***small secondary centres***, too. This concept means those villages which have one or more of the following three functions: administrative, health and educational services. Depending on the number of functions, I call these settlements ***three- two- or one-function small centres***. In this region there are 104, 44 and 57 such small centres, respectively. In other words, there are 205 settlements in the region to which joined villages belong and there are 364 ones that are not involved in joint village relationship.

ACCESSIBILITY AMONG CENTRES

When analyzing the transportation system in a region the first thing to study is accessibility among (district) centres. This would explore the possible transportation links among settlements having approximately the same functions. At the same time it would enlighten the role of the different centres in the region as a whole and outline their connection possibilities.

The aim of the present chapter – as introduced above – is to study the physical aspect of accessibility among centres. The method used will be the one introduced in the previous chapter and called ***measuring accessibility among nodes***. Here ***node*** means a (district) centre.

In order to carry out the calculations the following data had to be collected: average running time among the 21 centres and number of line-pairs per day among them, respectively. As this study does not intend to investigate either the transit possibilities for foreign tourism or weekend traffic, the number of line-pairs would concern an average not-summer weekday. Each node is matched with 20 number-pairs including the running time and the number of line-pairs per day. In case there is no direct access between two settlements, running time was taken for infinite and the number of line-pairs for 0.

The resultant graph starting from the different centres is a spanned tree of graph. It is of minimum pass-lenght and on it any vertex is accessible from any other vertex but only on one route. The graph defined by the algorithm applied shows the routes with optimum accessibility. The routes excluded from optimum accessibility and not being taken into account by the graph may all the same carry some traffic. Their exclusion will only mean that these routes do not provide a better accessibility than the passes defined. It is the optimum route from every single node to any other nodes that figures independently of the accessibility values of the two towns. So it is not the number of lines that defines the quality of the district centres links, it refers only to route use frequency.

The investigations were carried out independently for rail transport and public road traffic but only their joint accessibility values figure here as the means of transportation seems to be indifferent from the target's point of accessibility. The basic factors are the numbers of trip opportunities and the running time. In order to measure joint accessibility the services provided by rail and buses were added according to the method mentioned before. The joint accessibility values were calculated using the data base obtained by the above method and without changing the algorithm. The values are shown by ***Table 2***. Taking into account measurement results the 21 centres were classified into 5 categories. The elements of each category can be seen in ***Table 3***.

The settlements graded as ***excellent*** or ***good*** have a frequent bus lines among each others. High number of line-pairs is in close connection with their high industrialization rates and – consequently – heavy daily commuting. Its other factor is the earlier suspension of some rail lines and their replacement by public road traffic.

Towns figuring in the ***average*** category owe their position either to their outstanding rail links ***(Szombathely, Sárvár, Celldömölk)*** or to a balanced but not too high accessibility in both fields of transportation.

The 5 towns figuring in the ***weak*** category – except for ***Mosonmagyaróvár*** – are all small towns. Three of them ***(Vasvár, Sümeg, Körmend)*** obtained town status in 1970- 80, so their communication infrastructure is not developed yet, they have less economic importance and peripheral position in the region. ***Szentgotthárd*** represents a category in itself as its accessibility value (1.77) is far behind the values of any other centres. Its location in the basic graph is also exceptional as it can be linked to any other centres only through ***Körmend*** while ***Körmend*** itself can be connected with the other graphic elements through *Szombathely* only. In this way *Szentgotthárd* has the most peripheral position in the graph. Moreover it has little industrial importance so less commuter traffic as well.

The present paper does not intend to analyze all the spanned trees of graphs of the centres. Its aim is to present the joint spanned trees of graph only of three county seats *(Győr, Szombathely, Veszprém)* together with two smaller towns *Csorna* and *Pápa (Figure 1, 2, 3, 4, 5).*

The graphs include characteristics of both transport branches and the main paths are defined according to the dominant one of them.

While analyzing the spanned tree of graphs some routes with unexpectedly optimal accessibility value were found since the passes with direct access between two centres in the basic graph can be left out of the optimum passes by the algorithm. The passes with direct access not figuring in the optimum route in case of the spanned tree of graphs analyzed above were examined. (A pass with direct access will provide connection between two centres without intervening node for public transport.) The spanned tree of graph of *Győr* contains all the passes with direct access that was expectable by its position in the basic graph. There is a single pass with direct access missing from the spanned tree of the graph of *Veszprém* between *Szombathely-Veszprém*. Instead one can find the optimum pass through *Veszprém-Ajka-Celldömölk-Sárvár-Szombathely.* Partly this is why *Vasvár, Szentgotthárd, Körmend* centres are handicapped compared to the others in the region and are in loose connection with them. There is a single line-pair on the pass with direct access between *Veszprém-Szombathely* at present. Increasing this number of line-pairs the pass with direct access could serve as the present optimum pass, thus establishing a better integration of the three centres *(Körmend, Vasvár, Szentgotthárd)* into the region.

The lack of the pass with direct access mentioned above also jumps to the eye from the joint spanned tree of the graph of *Szombathely*. Apart from this there is also the direct pass of *Szombathely-Csorna* missing. That's why the optimum accessibility is provided on the *Győr-Pápa-Celldömölk-Sárvár-Szombathely* route.

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From among the spanned trees of graphs shown it is the joint spanned tree of the graph of *Pápa* centre where the majority of lacking direct routes can be found. The passes between *Pápa-Csorna, Pápa-Kapuvár, Pápa-Sopron, Pápa-Zirc, Pápa-Sümeg* and *Pápa-Tapolca* do not figure in the graph. It can be explained by the small number of line-pairs there as *Pápa* has a smaller gravity zone linking mainly the settlements in its limited suburban area only.

Using this method in different variations by changing number of line-pairs on the lacking direct passes optimum accessibility and its path could be changeable as well. Thus a method useful for both transportation managers and planners could be obtained.

ANALYZING ACCESS BETWEEN THE CENTRES AND THE SETTLEMENTS OF THEIR DISTRICTS

The aim of this chapter is to study physical accessibility among centres and their districts settlements. Physical accessibility is the basic factor of relationship between centre and its gravity zone and at the same time enlightens the problem of acessibility of so-called urban functions since the centres seem to be the unique medium of urban functions in this region.

The study is two-sided. On one hand it examines accessibility among the centres and the settlements of their gravity zones (i.e. 21 so-called districts) by using accessibility value, while, on the other hand, it tries to define the actual gravity zone of the centres from the view-point of transportation geography. With this two-sided approach it is possible to outline the settlements and zones in transportation shade.

1. Accessibility between the centres and the settlements of their districts

For the examination the number of daily line-pairs/running time as the accessibility value was determined for each settlement. This value refers to service link between the settlements and their centre. This datafile of the settlements in sequence was averaged for each district. This value referring to the access between a centre and settlements of its district is called ***average accessibility value***. In case of the 21 centres average values get into the

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interval of 1.01-0.29. Being multi-variable, this index number is capable of characterizing closeness of relation between a centre and other settlements and it can be used to classify gravity zones (districts). The categories are shown in *Table 4*. Average accessibility value can be affected by the area of zones, the number of settlements, the existence of connection between the centre and the other settlements and the socio-economic division of labour.

The gravity zone (district) of *Várpalota* town with its high accessibility value seems to be unique but could hardly be regarded as an independent category since this zone consists only of six settlements including the centre. It could hardly be compared with an administrative units consisting of 40-50 settlements.

The ***centres*** with an accessibility value ***in the interval of 0.6-1*** form a real group. It includes towns situated almost in the centre of their gravity zones. In this group there is an intensive relation between a centre and other settlements which means not only a short running time to the centre and back but also a high number of line-pairs.

On the basis of the average accessibility value the ***third category*** includes 4 centres. Their transportation link with the other settlements of their districts is still acceptable though not excellent. It can be described as good. This category includes 3 small towns – ***Kapuvár***, ***Celldömölk*** and ***Sümeg*** – and the biggest city of the region, that is ***Győr***. The number of settlements in the zones of the 3 small towns is low. ***Celldömölk*** has a favourable position from the view-point of transportation geography since it is a rail junction. It has an especially good communication with the settlements having rail connection as well.

Relationship between ***Győr*** and the settlements of its zone is of a quite different character. On the one hand the number of settlements of its zone is higher, on the other hand, relations are extended in space and quality because of the city functions of ***Győr***. As a region centre and an important industrial centre ***Győr*** has relations of different types. For example the 15-minute isochrone belt can not surround the city because of its great area. (Namely, ***Győr*** has incorporated the agglomeration settlements.) Thus it takes more running time to get from some neighbouring settlements to ***Győr*** which results in a decrease of accessibility value.

The lower accessibility value characterizing the centres of ***fourth category*** refers to loose relation between the centre and the other settlements. The 4 centres belonging here have a peripheral position. The zones (districts) of *Sopron, Kőszeg, Mosonmagyaróvár* and *Szentgotthárd* are situated in the neighborhood of the Austrian-Hungarian border thus several settlements are in "dead-end" position. They can not have any transit traffic, the number of direct line-pairs is apparently low. Although as far as *Sopron*'s zone is concerned it is not the settlements neighboring the border that have unsatisfying connection with the centre *Sopron*. Namely, in the northern part of this zone a main traffic road joining the settlements from *Kapuvár* to *Sopron* provides them a good access to both *Sopron* and the other towns of the county. Unsatisfying connection characterizes settlements in the southern area having no towns and thus being in transportation shade.

The zone (district) of *Sárvár* including the centre consists of 44 settlements, its north-south expansion is significant. However, it cannot be taken for the reason of loose relation between the centre and the other settlements. It may be caused by the neighborhood of *Szombathely* city attracting commuters from *Sárvár*'s zone as well. That's why traffic management turns lines to the county seat *(Szombathely)* instead of the district centre *Sárvár*.

The average accessibility values characterizing *fifth category* are only the outcome of relationship between centres and other settlements. An extremity in connection could characterize all the centres of this category. There are settlements with an accessibility value over 1 and at the same time there are several settlements having no direct access to the centre.

Measuring accessibility provides further information about relation system of a centre and the other settlements. The question is how accessibility value can be improved. The investigation results could easily show the way to do it, however, they would represent a simple analysis of the mathematical relation for measuring accessibility. It is apparent that accessibility rate could be improved by a higher number of line-pairs and a lower running time, as far as the basic factors are concerned. The real question is that weather the complex problem of accessibility could be solved by such a simplifyed way, not taking into account the socio-economic factors, respectively. The answer should be no.

According to the study it is obvious that running time from remote settlements is long and the isochrone is often over an hour. In order to shorten the distance and the time to take changing the administrative border seems to be an appropriate solution. However, in case of settlements located in the neighborhood of an another town (or district centre) their administrative whereabouts should be considered.

An increase in accessibility is in direct proportion with the number of line-pairs. The latter, however, reflects the number of commuters to the centre. According to this statement this study supports the following concept: public transport makes possible manpower mobilization, in other words profit acquisition. That's why it would be a double mistake to draw the simple conclusion of a better access in case of higher number of line-pairs. (A higher number of line-pairs would mean more commuters.)

Social interest demands a lower number of commuters and at the same time a switch to independent company management and an increase in transport fee may also result in lower commuter traffic.

Accessibility is always in close connection with certain activities, including making use of different services or provisions that's why its value may be improved by a dispersed location of them.

The present study shows that accessibility of new towns and centres with one- sided urban function should be increased. This trend could be supported by strengthening urban functions.

2. Determining areas in transportation shade

The aim is not only to determine the location of areas in transportation shade but also to decrease the number of settlements with a low accessibility value and at the same time to increase average accessibility of the centres (or districts).

As a first step transportation geography gravity zones should be delimited then compared them with the administrative units, i.e. districts.

Transportation geography gravity zone means the spatial interpretation of intensive transport connection between a centre (town) and its agglomeration. For the determination an 1 hour isochrone of public transport is studied but further aspects of investigation are needed. Since an 1 hour isochrone of a central settlement or a town generally overlaps the same isochrone of a town nearby.

How to determine a gravity zone? The 1 hour isochrone of centres was taken in 15- minute sections that is in four categories, taking into account the two means of public transport that is bus and train.

Settlements, included in smaller isochrone categories of their administrative (district) centre than that of an other centre (town) can definitely be

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enlisted in the gravity zone of their "own" centre. If a settlement figures in the same isochrone belt of two or more towns the so-called accessibility value was taken into account. (This value is the ratio of the number of daily line-pairs between the settlement and the centre and running time.) If this value is definitely higher in case of a town different from its administrative (district) centre the settlement will belong to the transportation geography gravity zone of this town. However, if a settlement gets into one of the isochrone belts of its district centre but an another town is in shorter access the settlement will belong to a better isochrone belt of this other town as well. In this case it is the accessibility value – running time *and* the number of line-pairs – that is decisive. If the accessibility value is lower in the relation of the settlement and its district centre than in case of the other town, the settlement will belong to this other town's gravity zone. If the above accessibility values are almost the same, the numbers of commuters to the centres will be the decisive factor.

Special attention was paid to the settlements needing more than an hour running time to their centres or having no direct access or the combination of the two. I find both factors rather disadvantageous and what's more they do not exclude each other.

In each zone the settlements located within an 1 hour's reach from the centre were classified into four time categories broken down to 15 minutes, respectively. The fifth category includes all the settlements needing more than 1 hour running time or a change. *Table 5* shows distribution of population in the different isochrone belts. On this base the centres having worse accessibility can be spotted. Accessibility of settlements figuring in category 5 (where runing time to its centre is more than 1 hour) was calculated not only in relation to their "own" centre but to the neighbouring centre as well.

Settlements situated in transportation shade – and concentrated mainly in certain areas – are the following *(Figure 6)*:

- south-west part of *Sopron*'s zone,
- northern part of *Sárvár*'s zone,
- villages of *Őrség* belonging to *Körmend*'s zone,
- settlement in the north west part of *Ajka*'s zone,
- small villages in the western part of *Balatonfüred*'s zone,
- three neighbouring settlements of *Zirc*'s zone.

When determining transportation gravity zones, the aim was to get handicapped settlement into a better position. It is illustrated by *Table 6* showing average accessibility of districts and the actual gravity zones outlined above. If the district centres are taken for gravity zone centres the previously lowest average accessibility values will come out to be higher. Some decrease might occur as well, though the deviation will be of a hundredth.

In order to find further proofs to these results *Table 5* and *7* were compared where the numerical values show a more favourable distribution of residents' number in the actual gravity zones and a lessening importance of category 5 and at the same time a definite decrease in the number of settlements in transportation shade.

ACCESSIBILITY OF SMALL (SECONDARY) CENTRES

This chapter studies accessibility of small (secondary) centres by public transport as defined in the first chapter. This provides opportunity to describe communication between a small centre and its so-called joined settlements.

On one hand this chapter studies accessibility of three-, two- or one-function small centres from settlements of their micro-zones. On the other hand, it examines accessibility between small centres and district centres.

At the same time relationship of a small centre with different functions and settlements of its micro-zone is to be studied.

To define accessibility a method similar to the one used in the previous chapter is applied: running time and number of line-pairs between small centres and settlements of their micro-zones are measured.

Since in this case the distance to cover – to get to a neighbouring settlement – is shorter, these isochrones are of 5-10-15-20 minutes and number of line-pairs between the settlements and their small centre was divided by their isochrone value. Thus an ***accessibility value*** characterizing each so-called joined settlement is obtained in the interval of $0 \leq a \leq 6.04$.

Five accessibility categories of these values were defined

- excellent $a \geq 1.5$
- good $1.0 \leq a < 1.5$
- average $0.5 \leq a < 1.0$
- still acceptable $0.2 \leq a < 0.5$
- not good $0 \leq a < 0.2$.

As far as settlements (communities) are concerned, the classification took place according to an accessibility regarding all the three functions of small centres.

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Before analyzing connection between small centres and the settlements of their zones the accessibility between small centres and district centres is to be examined, taking also into account the number of functions. What kind of relation can be there between a small centre having one, two or three functions and the district centre? Is there any significant difference in connections between the small centres with certain functions and the district centres, between the other settlements (communities) of micro-zones of these small centres and the district centres and between the so-called independent settlements and the district centres?

The average accessibility values of small centres having three, two or one function and of settlements without any small central function were calculated for each district *(Table 8)*.

Considering the region average, there seem to be no significant difference in the accessibility value of small centres with different numbers of functions. However, examining accessibility values of the different districts shows a much bigger scattering.

Thus the region average is suitable to show the deviation, however, no significant conclusions can be drawn. It means that the number of small central functions does not affect closeness of relations.

Accessibility values characterizing relations between settlements without any small central function and their district centres are much lower than the same value in the previous categories and no significant deviation concerning the districts could be detected. This category includes mainly joined settlements (communities), often situated in "dead-end" position.

It can be stated that there is not close relation between the accessibility value and the functions of a settlement. Though accessibility values of settlements without any small central functions are lower than that of the small centres having three, two or one function, the values are scattered so much that it questions the connection, the values are scattered so much that it questions the relation between functions and accessibility values. It is not the number of the administrative functions of the small centres that are decisive concerning accessibility between district centres and them. It much more depends on the distance from a city or an attractive centre providing many jobs and the location in the communication network. Some special functions may also affect the accessibility value of a settlement, e.g. tourism, convalescence holidays.

Small centres must have a good access to their district centres but it is more important to have a good connection with settlements of their micro-zones. If there is no good accessibility between a small centre and communities of its micro-zone their relation becomes formal and will not work.

The access to small centres from the other communities of zones was studied *(Table 9)*. The centres were classified according to the number of their functions. Here the five-minute time intervals (isochrones) were used, thus the accessibility value can not be directly compared with the previous values. However, they carry valuable information. Regional averages of accessibility of small centres with three, two or one function are almost the same.

In order to determine the importance of each function from the viewpoint of accessibility from the settlements of micro-zone, further investigation was needed. Accessibilities to administration centres, settlements with health centre and primary school centres were analyzed in case of each district. The settlements were classified into accessibility categories introduced at the beginning of this chapter.

1. Accessibility of administration (council) centres from their joined communities

Centralization of council network initiated partnership among settlements. Thus the residents of the so-called joined settlements (communities) have to travel to the centre of the joint local council in order to arrange any administrative problem even of first instance. It needs communication. ***Table 10*** shows the distribution of population in percentage in every accessibility category that is it shows the accessibility and travel conditions of the people of joined settlements to the administration (council) centre. As the distribution is indicated in percentage, the districts having more or fewer inhabitants are of the same importance, though a high percentage might stand for only one or two settlements. 30% of the population of joined settlements in the region gets into the "excellent" accessibility category and 75% live in settlements figuring in the first three categories. The "not good" category includes 12% of the population that is altogether 21,980 persons. It's a high number as it represents a loose connection between joined settlements and the administration centres of first instance. In certain zones categories 4 and 5 are the dominating ones compared with the average. In the region a not acceptable accessibility characterizes the zones (districts) of *Tapolca, Szentgotthárd, Körmend* and ***Mosonmagyaróvár***. In these areas more than 30% of population gets into the "still acceptable" and "not good" accessibility categories.

2. Accessibility of local health centres

System of local health centres and the network of their (joined) settlements were set up earlier than administrative centralization occurred. That's why it is possible to find quite a different territorial division in the two types of centres. In many cases it could be explained by traditions, former system of local health officers or economic point of views. Communication was of second importance.

Because of a lower rate of centralization the majority of population gets into the more favourable accessibility categories *(Table 11)*. It is heartening that 33% of the population of the joined settlements gets into the "excellent" accessibility category while only about 7% figures in the fifth category. Though the above ratio is favorable low, however, it refers to 11,331 people. There are altogether 4 joined settlements in the region which have no public transport connection with their health centres. This lack of connection makes formal not only the relation between a centre and its joined settlements but also the function itself. Though it must be remarked that joined settlements also have health service locally in some definite surgery hours, however, in case of emergency direct access would be very important.

3. Accessibility of primary school centres

According to the primary school centralization programme of the 70's primary school centres were established. Together with the centralization new transport demands for children of 6-14 occurred.

Apart from health centre system, primary school centres and administration centres are almost the same. It may explain an almost similar accessibility of the two types of centres. In both cases 74 – 75% of the population gets into the first three accessibility categories. The settlements getting into the "not good" category, however, must have a different evaluation when analyzing educational function (see *Table 12*). There are some joined settlements with bad connection or without it, but they have branch for first four classes of primary school locally. Thus no daily transport service is needed for the pupils.

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The primary school centre system can be regarded as favourable not only because 74% of the population gets into the first three accessibility categories but also both school bus departure and running time are good. The average running time is 10 minutes, and time of departure is mainly after 7 o'clock. These values refer partly to road density, partly to a low number of settlements in "dead-end" position. The average 1.5-3 km and the 5-10 minute running time to school centres is not more than the average running time spent on means of public transport in bigger towns.

In spite of a favourable accessibility, communication between small centres and the other settlement should be improved since there are still thousands of people living in settlements classified into "still acceptable" or "not good" accessibility categories. However, the transport line system can not be enlarged in the former way as the profit-oriented transport companies can not increase but on the contrary, decrease the number of line-pairs recently.

In my opinion it is not an improvement but a basic change that public transport service of small centres demands. Buses with great seating capacity should be changed for microbuses capable to carry fewer passengers but to run at a higher frequency between the small centres and their joined settlements, taking into account local demand. The route could touch certain service points thus eliminating the present practice of main road transport. These vehicles could be run either by the council or the co-operative or any production or service company or even a private entrepreneurship.

AN ATTEMPT TO MEASURE SOCIAL DIMENSION OF ACCESSIBILITY

According to the accessibility model, social dimension measurements always concern the communication of a population stratum carried out in order to perform an activity. In this chapter the place of activity is the ***working place*** and the population stratum is the active wage-earners. I think that the present changes in economic structure of Hungary make this investigation even more up-to-date since suspension and creation of new jobs affecting their accessibility is present everywhere. The importance of this analysis is underlined by the fact that 30% of the employees in this region are commuters.

For the analysis the ***attraction-accessibility measuring procedure*** introduced in the first chapter was used. The complexity of the method guarantees the complexity of the result since not only the settlements' location in the region (e.g. their distance from the centre) and their mass (that is usnally the population) but also the attraction force characterizing the settlements was taken into account. The attraction force of different settlements may enlighten their importance from the view-point of working place accessibility thus determining not only the centre's attraction force but also the effect of each settlement in the network. So the model provides a variation of the multivariable demand and supply methods in order to make the processes taking place in the region understandable and at the same time to be used to solve regional planning problems.

Returning to the definite task undertaken, the ***distance function*** $d_{k,j}$ for the settlement network represented by partial graph S (this function includes running time to and from different settlements) and the ***flow function*** $l_{k,j}$ representing the number of commuters from the settlements to the towns were defined. With the help of the above two functions the so-called power function $p(d)$ could be set up having characteristics introduced in the theoretical chapter. The power function was defined for two periods (1970 and 1980) concerning daily manpower flow between the centres and their zones. The function gives a picture of commuting rate between a centre and its zone and of commuting rules. From the function of type $p = e^{kd}$ the value of k was estimated as described in the first chapter. This value is different for the two periods thus showing the changes of commuting rules in the gravity zones.

The smaller the value of k the more straight the connected exponential curve is but if the value of k is increasing, the exponential curve gets closer to the horizontal time axis. What does it mean?

If the value of k is small enough that is the curve does not leap to the horizontal axis than the centre has a significant effect on other settlements, commuting is rather important and territorially wide-spread. It can be explained by the considerable extension of the zone (district) and – as a rule – the loose connection between a centre and its joined settlements. The other reason is the great number of commuters of active wage-earners in the settlements.

On the contrary, in case of a high k value the curve has a quick leap to the axis which means that the centre draws manpower from a smaller zone. Its reasons can be the following:

– there is a very good transport connection between a centre and other settlements either because of the short distance between them or the short running time;

– there are some distant settlements in the zone having a weak communication with their centre but their age structure of population is grown old which supposes a low number of active employees that is commuters.

There can an even more rare case occur when though communication from the settlement to a centre is weak but all the same it is an attractive place with employment possibilities. In this case the number of commuters is low.

For the measurements, the p functions for each centres (zones) were calculated but from among them only the power function of *Szentgotthárd* town is going to be introduced concerning two periods *(Figure 7)*.

In 1970 there is a $k = -0.02$ exponential function when a low number of commuters characterized the region which indicated a moderate commuting to the centre. This was basically changed by 1980 by industrialization of *Szentgotthárd*. In the settlements of its zone the number of commuters increased and so did the ratio of active wage-earners and commuters. The changes in the 10-year interval were significant. The p function of *Szentgotthárd* for 1980 already shows a strong attraction of the centre concerning the settlements of its gravity zone.

The next step was to define attractivities of the settlements:

$$c_j = w_j / z_j$$

where w_j is the number of jobs in the j settlement. The function

$$z_j = \sum_{k=1}^{n} p_s(d_{k,j}) h_k$$

is the demand potential of the j settlement that is the summary of the distance function and the number of active wage-earners.

Here the a_j values indicate the attractivity of settlements from the view-points of jobs and transportation service that is the importance of the settlements in working place supply and their position in transport system.

Only one more step is needed to define *accessibility functions* of the different settlements. For this the *weight function* introduced in the first chapter was applied.

The function value calculated for each settlement can be used to measure accessibility. In its complexity it is suitable to characterize the settlements' position in public transport service, their attractivity concerning working place demand and supply and – as a most important factor – it refers to the

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settlements' position in their zones that is the kind of attractions present in the centres. Thus the accessibility function value does not characterize a settlement in isolation but takes into account its position in the zone together with its advantages and disadvantages of this position.

On the basis of the function values the settlements were classified into 7 categories as follows:

Type 1	$0 \leq f_i < 0.3$
Type 2	$0.3 \leq f_i < 0.6$
Type 3	$0.6 \leq f_i < 0.8$
Type 4	$0.8 \leq f_i < 1.0$
Type 5	$1.0 \leq f_i < 1.2$
Type 6	$1.2 \leq f_i < 2.0$
Type 7	$2 \leq fi$

In *Type 1* the settlements are remote from their centre and the transport connection is very loose. Mostly tiny villages belong here where the number of active wage-earners is very low and almost no jobs are available.

In *Type 2* there is a more frequent transport service between the settlements and their centre or the distance between them is not so big. Although these are small settlements but the number of active wage-earners is higher and a partial employment is provided locally.

Type 3 is an average type where accessibility between the centres and their joined settlements is also average. The effect of the centre is smaller than that of an agglomeration zone though the presence of employment possibilities is observable.

In *Type 4* the settlements may be divided into two groups. The ones in group 1 belong to the agglomeration ring of a centre – in case the centre is a big town settlements of this group are located in the external ring of agglomeration while in case of a smaller attraction force of the centre this group includes the settlements in the direct neighbourhood of the centre.

Group 2 includes the settlements remote from their centre but all the same having an attraction force of their own or located in easy reach of a settlement provided with attractive forces and thus affecting their agglomeration and making use of the manpower supply present.

Type 5 – similarly to Type 3 – it is also an average type. It contains two groups as well. The first concerns settlements located in the inner agglomeration of a big town having a good position because of a good service and attraction force. In the second group we can find settlements having their own attractive force including high employment possibilities not only for themselves but also for the settlements ot their gravity zones.

Towns exercising a significant influence on their zone belong to ***Type 6***.

Type 7 is a special type though not an extension of Type I. Though the function value is the highest, it is characteristic of small towns located in the neighbourhood of big towns and existing under their influence. Their high function value can be explained by the neighbourhood of a big town with several attractive functions.

Figure 8 shows the regional distribution of the seven categories. The figure indicates the advantageous and disadvantageous areas from the view-point of employment place accessibility. According to the figure it seems trivial that this accessibility is good in the zones of centres with higher attraction, in other words labour force demand and supply meet each other, supported by a good transport connection.

However, there are centres, towns without significant attraction force for their neighbouring settlements. In this case it is not the transport connection to be blamed but the shortage in employment possibilities.

As a final step of the procedure the ***accessibility distribution function*** was defined for the different zones in the periods of 1970 and 1980. Taking the active wage-earners of the districts for 100%, the functions show the accessibility function value belonging to the active wage-earners proportion of the zones. All the 21 distribution functions could be characterized by a decreasing accessibility in 1980. How could it be explained? As transport line system between 1970 and 1980 could not significantly change the main reason can be found in change of regional distribution of working places.

The basic data show that the number of places of work in each town studied in 1970 and 1980 increased while in villages it decreased resulting in a longer travelling time necessary to reach working place. Consequently, accessibility rate for the individual became worse. This is characteristic of each zone though the distribution functions of the settlements are different with some similarities.

In the zones where most of the working places can be found in the centre and the other settlements are not really attractive with a low accessibility the curves have a steep growth after a stagnation. In this kind of zones accessibility is very low for 50 – 60%, maybe 75% of the active wage-earners.

Another type of distribution functions characterizes zones having a somewhat better accessibility for a small part of active wage-earners living in the rural areas. Accessibility here is continuously improving. These zones can be described as having a more balanced working place distribution between the centre and the other settlements.

After completing the analysis two questions arise. How could the access to working place be improved? How does a changing location of places of work affect accessibility?

The two questions can be answered together. If the number of working places increases in the rural areas accessibility will improve in the zone as a whole.

The method used in the present study could be applied to solve the problem of accessibility in case of studying different strata of active wage-earners e.g. taking into account qualification structure or sectoral structure of population.

As the method is suitable to measure the social side of accessibility in general it could be adapted to measure accessibility concerning other activities such as health service, trade service or education as well. Both the adaptation of the method and the study of the activities enlisted above need further investigation.

SUMMARY AND CONCLUSIONS

On the basis of the results of the methods it seems to be suitable to study the communication system among settlements. Investigating accessibility from different aspects supports a many-sided approach to accessibility on different levels. The accessibility studies were carried out according to settlement network hierarchy.

Thus the first step was to define accessibility of centres (towns) among each others. In the second step the service conditions between district centres and the other settlements were studied. The third step was to introduce accessibility characterizing small centres and their joined communities, in correspondence with the hierarchy level.

In this region – but probably in the whole country – accessibility could hardly affect directly the functioning of the centres since these functions are artificially controlled and defined in advance. A good accessibility does not strengthen the functions, however, its insufficiency does weaken them.

Transport management of the present gives priority to accessibility of places of work in the towns while the other functions are restricted to basic provision. The decreasing number of places of employment in industry (that is less commuting) lessens the number of line-pairs between a centre and the other settlements thus undermining physical access to a settlement. This tendency can be observed from the beginning of the 80's. With a declining public transport the connection between centres and the other settlements is getting worse. In order to stop the present decline and at the same time have a profitable fleet of vehicles a new type of transport management is needed. A big town, a small town and a small centre need different types of transport thus the uniform system existing nowadays should be transformed.

The probable decrease in the number of places of work in the centres, the increased part-time employment in small centres and settlements require a more up-to-date transport connections. Buses capable of carrying many passengers at a time could provide an uneconomic service only. Instead it seems profitable to run buses with small seating capacity between the small centres and their joined settlements. This service could be operated either by the local council or the co-operative or any other enterprise, including private entrepreneurship as well. Thus a higher number of lines that is better communication could be obtained. This would support the development of real functional areas in the rural regions. Local management, local initiatives could meet real local demands which could establish good functioning conditions for the small centres in an advantageous way.

NOTES

[1] GOULD,P (1969). p. 64.

[2] HÄGERSTRAND,T. 1974.

[3] TAFFEE, E.J. – GOUTHIER, H.L. 1973.

[4] GARRISON, W.L. 1960.

[5] MURACO, W.A. 1972

[6] PÁLFALVI, J. – SCHWERTNER, J. 1980.

[7] ERDŐSI, F. 1980, 1983.

[8] HÄGERSTRAND, T. 1974.

[9] INGRAM, D.R. 1971.

[10] MOSELEY, M.J. 1979.

[11] ŐBERG, S. 1976.

[12] LENNTORP, B. 1976.

[13] DOMANSKI, R. (1980). p. 13.

[14] ZIMPEL, H. 1958.

[15] The so-called district of town was an administrative unit between the local and county level in the last period (up to the end of 1990) of the former three-level system of regional administration in Hungary. It consisted of a district centre (town) and some dozens other settlements (communities) around the centre (see HAJDÚ, Z. 1987.).

[16] WEIBULL, J.W. 1976.

REFERENCES

ABLER, R. (1971): Distance, Communications and Geography. *Proceedings of the Association of American Geographers*. no.3,pp.1-4.

ABONYINÉ PALOTÁS, J. (1980): Közlekedési infrastruktúránk és a területi gazdasági fejlettség néhány jellemzője (Infrastructure of Transport and Some Characteristics of Regional Economic Development Level). *Közlekedéstudományi Szemle*. no.7,pp.306-309.

ALLEN, P.M. – SANGLIER, M. (1979): A Dynamic Model of Growth in a Central Place System. *Geographical Analysis*. no.3,pp.256-272.

BALOGH, B. (1980): Az országos, a regionális és a megyei településhálózat-fejlesztési tervek megvalósulása, különös tekintettel a városhálózat fejlődésére (Realization of Settlement Network Development Plans of the Country, the Regions and the Counties with Special Regard to Town Network Development). *Területrendezés*. no.4,pp.11-19.

BARTA, GY. – ENYEDI GY. (1981): *Iparosodás és a falu átalakulása* (Industrialization and Changing Villages). Budapest: Közgazdasági és Jogi Könyvkiadó

BELUSZKY, P. (1967): A magyar városok központi szerepköre (Central Functions of Hungarian Towns). *Statisztikai Szemle*. no.6,pp.543-563.

BELUSZKY, P. (1970): A falu-város kapcsolatok vizsgálati módszerei, e kapcsolatok jellege és mennyiségi jellemzője Szabolcs-Szatmár megyei központok példáján (Methods to Study Town-Village Relations, Characteristics of These Relations on an Example of Centres in Szabolcs-Szatmár County). *Területi Statisztika*. no.4,pp.368-380.

BERRY, B.J.L. (1959): Recent Studies Concerning the Role of Transportation in the Space Economy. *Annals of the Association of American Geographers*. no.3,pp.328-342.

CSATÁRI, B. – GÖDÖR, ZS. (1987): A falusi települések térkapcsolatainak néhány jellemző összefüggése Szolnok megyei példákon (Spatial Relationship of Rural Settlements on Examples of Szolnok County). *Alföldi Tanulmányok*. vol.11,pp.263-280.

CULLINGFORD, D. – OPENSHAW, S. (1982): Identifying Areas of Rural Deprivation Using Social Area Analysis. *Regional Studies*. no.6,pp.409-418.

DOMANSKI, R. (1980): Dostepnosc, przestrzenna organizacija. *Przglad Geograficzny*. no.1,pp.3-39.

ENYEDI, GY. (1984): *Az urbanizációs ciklus és a magyar településhálózat átalakulása* (Urbanization Cycle and Change of the Hungarian Settlement Network). Budapest: Akadémiai Kiadó

ERDŐSI, F. (1980): A közlekedésföldrajz kartografikus vizsgálati módszereinek alkalmazási problémái a regionális kutatásban (Problems of Applying Carthographical Methods of the Transportation Geography in Regional Studies). *Közlemények*. vol.27, pp.87-109. Pécs: MTA Dunántúli Tudományos Intézete

ERDŐSI, F. (1983): A közlekedési feltártság és ellátottság, valamint az elérhetőség vizsgálatának helye és néhány problémája a területi vonzáskörzeti kutatásokban (Role and Some Problems of the Study of Transportation Supply and Accessibility in the Regional Research of Gravity Zones). *Közlemények*. vol.30,pp.149-176. Pécs: MTA Dunántúli Tudományos Intézete

ERDŐSI, F. – KOVÁTS, K. – HORVÁTH, CS. (1986): A községekben élők közlekedési lehetőségei Baranya megyében (Transport Possibilities for People of Villages in Baranya County). *Területi Statisztika*. no.3,pp.220-240.

GARRISON, W.L. (1960): Connectivity of the Interstate Highway System. *Papers of the Regional Science Association*. vol.6,pp.121-138.

GOULD, P. (1969): *Spatial Diffusion, Comission of College Geography*. Washington D.C.: Association of American Geographers

HÄGERSTRAND, T. (1957): Migration and Area. Migration in Sweden. *Lund Studies in Geography. Series B. Human Geography*. vol.13,pp.27-158.

HÄGERSTRAND, T. (1974): *Transport in the 1980-1990 Decade - the Impact of Transport on the Quality of Life*. Paper presented at the 5th International Symposium on the Theory and Practice of Transport Economics. Athens, October 1973.

HAGETT, P. – CHORLEY, R.J. (1969): *Network Analysis in Geography*. Great Britain: Edward Arnold Ltd.

HAJDÚ, Z. (1987): *Administrative Division and Administrative Geography in Hungary*. Discussion Papers.no.5. Pécs: Centre for Regional Studies

HORVÁTH, Á. (1984): *A személyszállítás alapellátottsági és minőségi követelmény- és feltételrendszere* (Demands and Conditions in the Basic Service and Quality of the Passenger Transport). Research Report. Budapest: Közlekedéstudományi Intézet

HURST, E.M.E. (1970): An Approach to the Study of Non-Residental Land Use Traffic Generation. *Annals of the Association of American Geographers*., no.1,pp.153-173.

INGRAM, D.L. (1971): The Concept of Accessibility: a Search for an Operational Form. *Regional Studies*. no.5(2), pp.101-107.

KOENIG, J.G. (1980): Indicators of Urban Accessibility: Theory and Application. *Transportation*. no.2,pp.145-172.

LACKÓ, L. (1978): Települések vonzásterületének meghatározása egymásrahatási modell segítségével (Defining Gravity Zones of Settlements with Interaction Model). *Földrajzi Értesítő*. no.1,pp.31-43.

LACKÓ, L. (1988): *Területi fejlődés, politika, tervezés* (Regional Development, Policy and Planning). Területi és települési kutatások. vol.2. Budapest: Akadémiai Kiadó

LENNTORP, B. (1976): *Path in Space-Time Environments. A Time-Geographic Study of Movement Possiblities of Individuals*. Lund Studies in Geography. Series B. Human Geography. vol.44. Lund: Royal University

MATHEIKA, M. (1975): A települések közötti és a településeken belüli kapcsolatok jellegéről, különböző hálózati dimenziókban (About Characteristics of Inter- and Intra-Settlement Relationship in Different Network Dimensions). *Földrajzi Értesítő*. no.3,pp.417-421.

MÉSZÁROS, R. (1988): A falusi település térbelisége a lakósság térpályái alapján (Rural Settlement in Space on the Basis of People's Spatial Movement). *Tér és Társadalom*. no.1,pp.43-57.

MOSELEY, M.J. (1979): *Accessibility: the Rural Challenge*. London: Methuen Co. Ltd.

MURACO, W.A. (1972): Intra-Urban Accessibility. *Economic Geography*. no.4,pp.388-405.

ŐBERG, S. (1976): *Methods of Describing Physical Access to Supply Points*. Lund Studies in Geography. Series B. Human Geography. vol.43. Lund: Royal University

PÁLFALVI, J. – SCHWERTNER, J. (1980): *Központi szerepkörű települések megközelítési feltételeinek javítása* (Improvement of Accessibility Conditions of Central Settlements). Tervgazdasági Közlemények. Budapest: OT Tervgazdasági Intézete

SZÖRÉNYINÉ KUKORELLI, I. (1985): Közlekedésföldrajzi vonzáskörzetek meghatározása és elemzése Észak-Dunántúlon (Delimitation and Analysis of Transportation Gravity Zones in Northern Transdanubia) *Földrajzi Értesítő*. no.3,pp.235-258.

TAFFEE, E.J. – GOUTHIER, H.L. (1973): *Geography of Transportation*. Englewood: Foundations of Economic Geography Series, Prentice-Hall Inc.

TINER, T. (1981): Az észak-magyarországi körzet főútvonal-hálózatának mátrixalgebrai elemzése (Matrix-Algebraic Analysis of the Main Road Network of the Region in Northern Hungary). *Földrajzi Értesítő*. no.4,pp.445-463.

WEIBULL, J.W. (1976): An Axiomatic Approach to the Measurement of Accessibility. *Regional Science and Urban Economics*. no.6,pp.357-359.

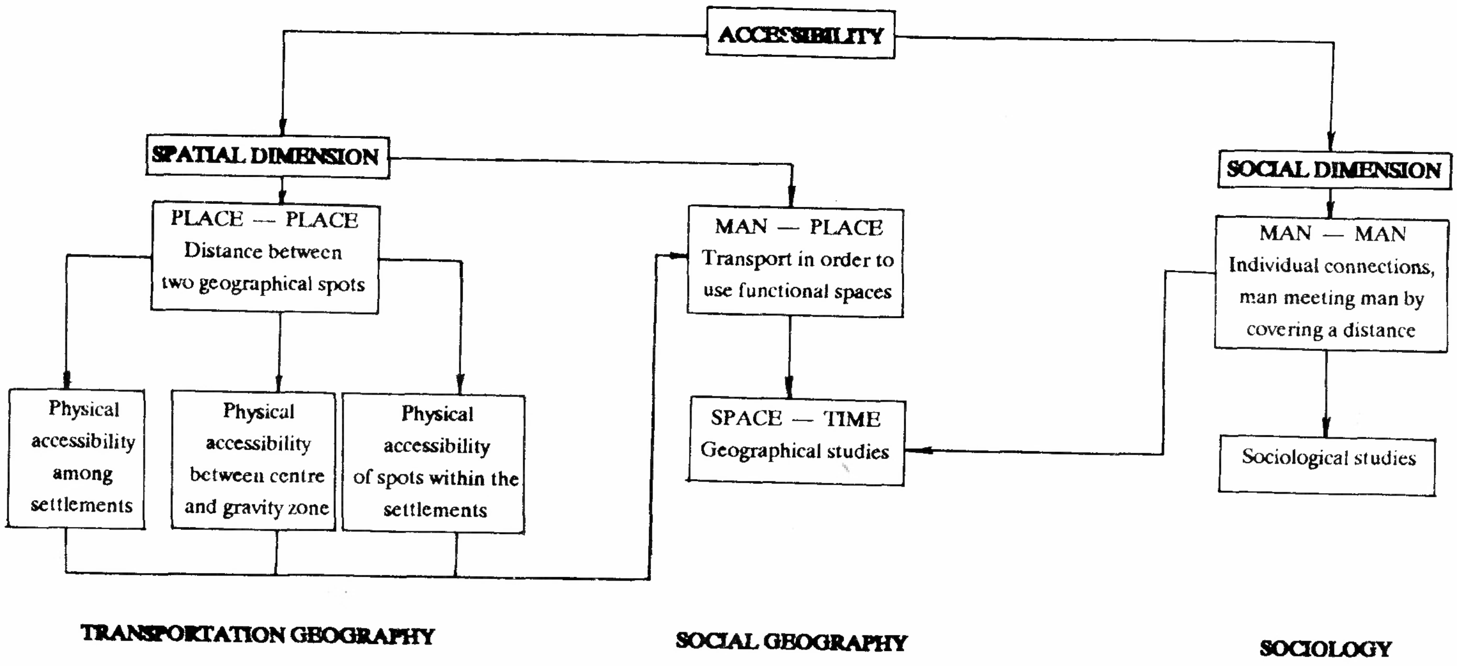
ZIMPEL, H. (1958): Verkehrsbestimmte Systeme der Kulturraum bzw. Kulturlandschaftsgliederung. *Berichte zur deutschen Lundeskunde*. no.2,pp.267-287.

Szörényiné Kukorelli, Irén: Role of Accessibility in Development and Functioning of Settlemets.
Pécs: Centre for Regional Studies, 1990. 34 p.
Discussion Papers, No. 8.

TABLES AND FIGURES

Table 1

Model for the concept of accessibility



Szörényiné Kukorelli, Irén: Role of Accessibility in Development and Functioning of Settlemets.
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Table 2

Joint accessibility values of the centres

Centres	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Győr	.	0.47	0.79	0.53	0.28	0.18	0.16	0.20	0.35	0.14	0.08	0.10	0.16	0.16	0.14	0.16	0.19	0.12	0.07	0.10	0.11
2. Mosonmagyaróvár		.	0.29	0.25	0.17	0.13	0.12	0.14	0.20	0.11	0.07	0.08	0.12	0.12	0.11	0.12	0.14	0.09	0.06	0.08	0.09
3. Csorna			.	1.58	0.43	0.15	0.13	0.16	0.24	0.12	0.08	0.09	0.13	0.14	0.12	0.14	0.16	0.10	0.06	0.09	0.09
4. Kapuvár				.	0.59	0.13	0.12	0.14	0.21	0.11	0.07	0.08	0.12	0.12	0.11	0.13	0.14	0.10	0.06	0.08	0.09
5. Sopron					.	0.11	0.10	0.12	0.16	0.09	0.06	0.07	0.10	0.10	0.12	0.11	0.11	0.11	0.07	0.09	0.10
6. Veszprém						.	1.40	1.97	0.17	0.64	0.16	0.21	1.20	1.81	0.12	0.14	0.16	0.10	0.07	0.09	0.10
7. Várpalota							.	0.82	0.15	0.44	0.14	0.18	0.65	0.79	0.11	0.13	0.14	0.10	0.06	0.08	0.09
8. Zirc								.	0.15	0.48	0.15	0.19	0.75	0.94	0.11	0.13	0.15	0.10	0.06	0.08	0.09
9. Pápa									.	0.15	0.09	0.09	0.15	0.15	0.23	0.31	0.44	0.17	0.09	0.13	0.15
10. Ajka										.	0.19	0.16	0.42	0.47	0.15	0.18	0.22	0.12	0.07	0.10	0.11
11. Sümeg											.	0.67	0.18	0.15	0.09	0.10	0.11	0.08	0.05	0.07	0.07
12. Tapolca												.	0.25	0.19	0.08	0.09	0.09	0.07	0.05	0.06	0.07
13. Balatonfüred													.	0.72	0.11	0.13	0.14	0.10	0.06	0.08	0.09
14. Balatonalmádi														.	0.11	0.13	0.15	0.10	0.06	0.08	0.09
15. Szombathely															.	0.85	0.47	0.73	0.14	0.32	0.48
16. Sárvár																.	1.07	0.39	0.12	0.23	0.31
17. Celldömölk																	.	0.29	0.11	0.19	0.24
18. Kőszeg																		.	0.12	0.22	0.29
19. Szentgotthárd																			.	0.26	0.11
20. Körmend																				.	0.19
21. Vasvár																					.
Total	4.49	2.96	5.09	4.76	3.09	9.04	5.91	6.93	3.78	4.47	2.66	2.87	5.66	6.58	4.70	4.97	4.71	3.50	1.75	2.62	2.96
Order	11	16	6	8	15	1	4	2	13	12	19	18	5	3	10	7	9	14	21	20	16

Table 3

Accessibility categories of centres by the algorithm

Centres with accessibility				
excellent a > 8	good 8 > a > 5.5	average 5.5 > a > 3	weak 3 > a > 2	not good 2 > a
Veszprém	Zirc	Csorna	Vasvár	Szentgotthárd
	Balatonalmádi	Sárvár	Mosonmagyaróvár	
	Várpalota	Kapuvár	Tapolca	
	Balatonfüred	Celldömölk	Sümeg	
		Szombathely	Körmend	
		Győr		
		Ajka		
		Pápa		
		Kőszeg		
		Sopron		

Table 4

Categories of the gravity zones (districts) of the centres by average accessibility value

Gravity zones (districts) of the centres in category				
1 a > 1	2 1 > a > 0.6	3 0.6 > 1 > 0.47	4 0.46 > a > 0.37	5 0.37 ≥ a
Várpalota(1.01)	Szombathely (0.82)	Győr (0.59)	Sopron (0.45)	Ajka (0.37)
	B.almádi (0.73)	Kapuvár (0.54)	Sárvár (0.43)	Csorna (0.34)
	B.füred (0.68)	Sümeg (0.53)	Kőszeg (0.42)	Zirc (0.32)
	Veszprém (0.66)	Celldömölk (0.49)	M.óvár (0.41)	Körmend (0.29)
	Tapolca (0.65)		Vasvár (0.39)	
	Pápa (0.62)		Sz.gotthárd (0.38)	

Table 5

Distribution of population by the time-categories in the districts in 1985

(%)

Centres	Category 1	2	3	4	5	Total
	t < 15'	16' < t < 30'	31' < t < 45'	46' < t < 60'	60' < t	
Győr	4.8	59.5	25.2	10.5	-	100.0
Sopron	9.7	24.3	32.8	20.3	12.9	100.0
Mosonmagyaróvár	15.4	67.4	13.7	3.5	-	100.0
Kapuvár	39.9	24.1	29.5	6.5	-	100.0
Csorna	17.9	41.4	15.2	17.5	8.0	100.0
Kőszeg	19.4	55.8	24.8	-	-	100.0
Szombathely	44.9	36.0	9.9	7.8	1.4	100.0
Sárvár	31.0	32.9	13.2	20.6	2.3	100.0
Celldömölk	37.7	38.8	22.2	-	1.3	100.0
Vasvár	65.1	19.8	11.2	3.9	-	100.0
Körmend	21.7	37.0	9.5	16.2	15.6	100.0
Szentgotthárd	38.4	50.6	10.8	-	0.2	100.0
Pápa	24.7	47.8	24.3	3.2	-	100.0
Zirc	14.9	33.0	30.5	10.7	10.9	100.0
Ajka	27.0	36.1	15.9	4.9	16.1	100.0
Sümeg	62.8	23.5	9.6	4.1	-	100.0
Tapolca	38.0	33.4	23.4	5.2	-	100.0
Veszprém	-	38.3	45.3	16.4	-	100.0
Balatonfüred	51.1	29.1	2.4	5.8	11.6	100.0
Balatonalmádi	65.3	24.1	-	-	10.6	100.0
Várpalota	87.6	9.7	2.7	-	-	100.0
Region total	27.6	40.5	19.1	8.6	4.2	100.0

Table 6

Average accessibility value of the centres

Centres	Accessibility of the	
	districts	actual gravity zones
Győr	0.59	0.62
Sopron	0.45	0.48
Mosonmagyaróvár	0.41	0.41
Kapuvár	0.54	0.56
Csorna	0.34	0.37
Kőszeg	0.42	0.40
Szombathely	0.82	0.81
Sárvár	0.43	0.44
Celldömölk	0.49	0.46
Vasvár	0.39	0.39
Körmend	0.29	0.31
Szentgotthárd	0.38	0.34
Pápa	0.62	0.59
Zirc	0.32	0.35
Ajka	0.37	0.44
Sümeg	0.53	0.53
Tapolca	0.65	0.65
Veszprém	0.66	0.64
Balatonfüred	0.68	0.99
Balatonalmádi	0.73	0.73
Várpalota	1.01	1.20

Table 7

Distribution of population by the time-categories in the actual gravity zones in 1985

(%)

Centres	Category 1 t<15'	2 16'<t<30'	3 31'<t<45'	4 46'<t<60'	5 60'<t	Total
Győr	4.6	56.7	24.1	14.6	-	100.0
Sopron	10.4	26.1	35.2	18.4	9.9	100.0
Mosonmagyaróvár	15.5	67.4	13.7	3.4	-	100.0
Kapuvár	39.9	24.1	29.5	6.5	-	100.0
Csorna	20.3	46.9	17.2	15.6	-	100.0
Kőszeg	25.0	72.3	-	2.7	-	100.0
Szombathely	37.8	42.2	12.3	6.6	1.1	100.0
Sárvár	34.6	25.9	15.0	22.8	1.7	100.0
Celldömölk	34.3	35.2	29.3	-	1.2	100.0
Vasvár	65.0	19.9	11.2	3.9	-	100.0
Körmend	23.2	39.3	10.0	17.2	10.3	100.0
Szentgotthárd	33.0	53.5	9.2	4.3	-	100.0
Pápa	22.8	46.8	25.8	3.0	1.6	100.0
Zirc	16.1	35.7	32.9	11.5	3.8	100.0
Ajka	28.5	45.1	15.5	1.5	9.4	100.0
Sümeg	62.8	23.5	9.6	4.1	-	100.0
Tapolca	40.1	26.7	27.8	5.4	-	100.0
Veszprém	9.2	33.3	39.2	13.5	4.8	100.0
Balatonfüred	58.6	38.7	2.7	-	-	100.0
Balatonalmádi	71.9	16.4	-	-	11.7	100.0
Várpalota	90.1	9.9	-	-	-	100.0
Region total	28.2	40.9	19.4	8.9	2.6	100.0

Table 8

Average accessibility values of small centres to their district centre

District centres	Small centres with 3 functions	Small centres with 2 functions	Small centres with 1 function	Settlements without functions
Győr	0.85	0.73	0.86	0.46
Mosonmagyaróvár	0.36	0.20	-	0.45
Csorna	0.37	1.06	0.28	0.23
Kapuvár	0.27	-	0.56	0.59
Sopron	0.55	0.68	0.25	0.44
Kőszeg	0.79	0.66	0.63	0.30
Szombathely	1.31	0.93	1.24	0.55
Sárvár	0.77	0.44	0.44	0.30
Vasvár	0.56	0.61	0.21	0.31
Körmend	0.56	0.52	0.32	0.22
Celldömölk	0.54	1.53	0.66	0.38
Szentgotthárd	1.00	0.47	0.22	0.31
Ajka	0.56	-	0.40	0.28
Pápa	0.70	1.33	0.30	0.53
Sümeg	0.56	1.20	0.14	0.37
Tapolca	1.13	0.49	0.93	0.58
Várpalota	-	1.33	1.40	1.11
Zirc	0.52	0.53	0.05	0.20
Veszprém	0.42	2.30	1.24	0.46
Balatonfüred	1.32	1.06	1.26	0.47
Balatonalmádi	0.83	-	1.76	0.67
Region total	0.7	0.89	0.66	0.44

Table 9

Average accessibility values of small centres from the settlements of their micro-zones

Districts	Small centres with 3 functions	Small centres with 2 functions	Small centres with 1 function
Győr	1.54	1.30	0.91
Mosonmagyaróvár	1.08	0.60	-
Csorna	1.28	0.60	0.78
Kapuvár	1.16	-	1.67
Sopron	1.82	2.07	0.79
Kőszeg	1.52	0.50	1.49
Szombathely	2.24	1.67	2.06
Sárvár	1.44	1.87	1.01
Vasvár	1.56	1.07	0.97
Körmend	0.68	0.84	0.80
Celldömölk	0.75	4.20	1.80
Szentgotthárd	0.64	0.63	0.54
Ajka	1.07	-	0.26
Pápa	1.09	0.87	1.49
Sümeg	3.97	0.68	0.34
Tapolca	0.57	1.01	0.80
Várpalota	-	0.66	0.20
Zirc	0.94	0.95	0.20
Veszprém	1.70	6.04	1.61
Balatonfüred	1.25	0.10	3.56
Balatonalmádi	2.70	-	2.46
Region total	1.20	1.43	1.18

Table 10

Distribution of population of the joined communities by the accessibility categories to their administrative centre (%)

Districts	Category 1 a>1.5	2 1.5>a>1	3 1>a>0.5	4 0.5>a>0.2	5 0.2>a	Total
Győr	16.0	50.3	19.4	9.1	5.2	100.0
Mosonmagyaróvár	16.1	8.9	41.0	15.3	18.7	100.0
Csorna	22.4	22.6	35.1	19.9	-	100.0
Kapuvár	12.3	4.4	51.9	11.1	20.3	100.0
Sopron	41.2	16.9	22.4	18.1	1.4	100.0
Kőszeg	46.8	35.0	-	-	18.2	100.0
Szombathely	48.3	22.8	18.2	3.8	6.9	100.0
Sárvár	34.2	29.9	13.8	16.1	6.0	100.0
Vasvár	25.2	21.5	47.3	6.0	-	100.0
Körmend	19.5	7.2	16.8	24.8	31.7	100.0
Celldömölk	26.1	10.9	35.6	8.2	19.2	100.0
Szentgotthárd	-	17.7	45.9	34.2	2.2	100.0
Ajka	46.8	10.0	16.5	13.8	12.9	100.0
Pápa	33.9	14.2	22.3	8.5	21.1	100.0
Várpalota	-	100.0	-	-	-	100.0
Tapolca	14.2	8.9	39.2	21.7	16.0	100.0
Zirc	8.9	42.8	24.6	6.2	17.5	100.0
Veszprém	29.7	-	19.9	-	50.4	100.0
Balatonfüred	49.0	12.8	20.9	15.4	1.9	100.0
Balatonalmádi	87.0	-	13.0	-	-	100.0
Sümeg	29.5	23.5	18.9	21.9	6.2	100.0
Region total	29.8	20.2	24.8	13.1	12.1	100.0

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Table 11

Distribution of population of the joined communities by the accessibility categories to their health centre (%)

Districts	Category 1 a > 1.5	2 1.5 > a > 1	3 1 > a > 0.5	4 0.5 > a > 0.2	5 0.2 > a	Total
Győr	21.0	34.0	28.2	16.8	-	100.0
Mosonmagyaróvár	40.8	6.3	42.1	10.8	-	100.0
Csorna	20.8	24.1	47.4	7.7	-	100.0
Kapuvár	39.3	5.7	21.1	-	33.9	100.0
Sopron	42.5	20.1	9.4	28.0	-	100.0
Kőszeg	46.8	35.0	-	-	18.2	100.0
Szombathely	51.5	15.7	17.1	5.2	10.5	100.0
Sárvár	39.2	29.2	18.1	8.6	4.9	100.0
Vasvár	23.9	26.2	43.1	6.8	-	100.0
Körmend	28.0	2.9	13.4	41.7	14.0	100.0
Celldömölk	12.5	35.3	44.8	5.7	1.7	100.0
Szentgotthárd	-	24.6	33.8	26.5	15.1	100.0
Ajka	48.5	10.8	15.2	22.2	3.3	100.0
Pápa	41.5	-	33.5	11.3	13.7	100.0
Sümeg	26.0	27.1	29.1	17.8	-	100.0
Tapolca	19.5	28.3	28.3	18.9	5.0	100.0
Várpalota	-	-	100.0	-	-	100.0
Zirc	9.0	28.5	52.0	10.5	-	100.0
Veszprém	36.6	-	34.6	17.9	10.9	100.0
Balatonfüred	24.6	13.7	22.2	26.0	13.5	100.0
Balatonalmádi	86.5	-	13.5	-	-	100.0
Region total	32.8	18.7	27.5	14.4	6.6	100.0

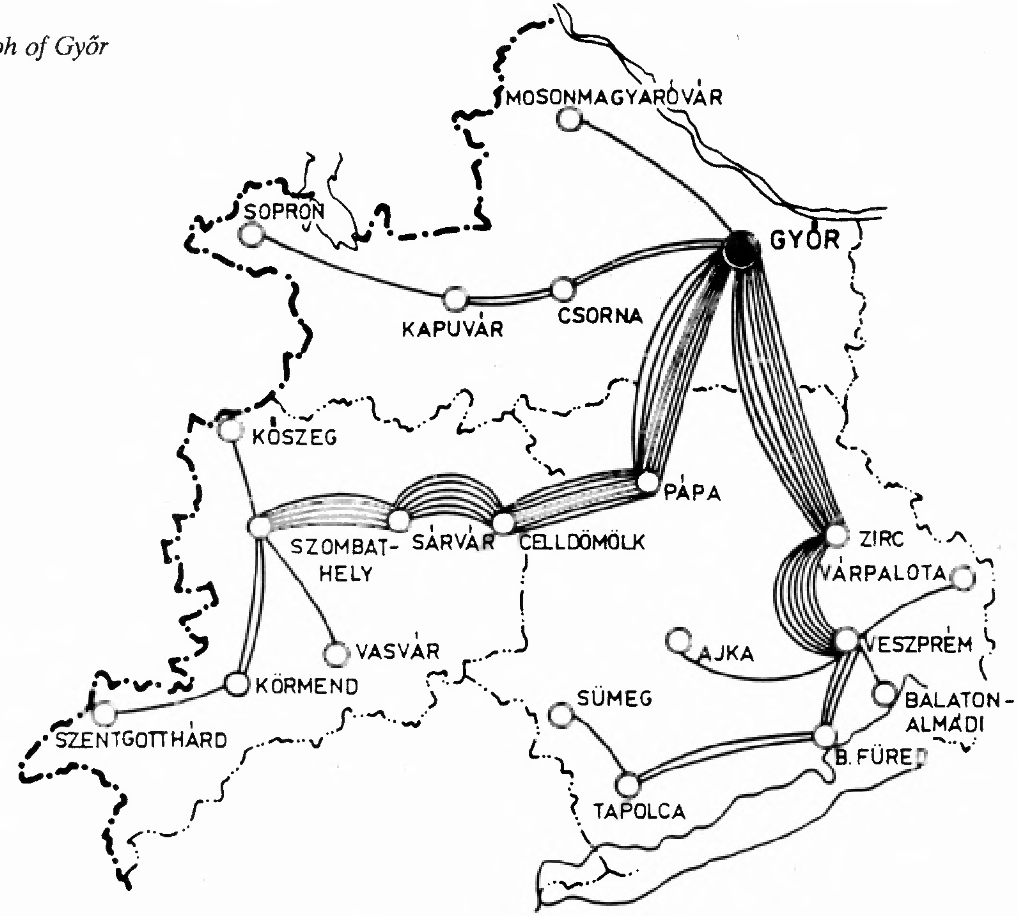
Table 12

Distribution of population of the joined communities by the accessibility categories to their health centre (%)

Districts	Category 1 a>1.5	Category 2 1.5>a>1	Category 3 1>a>0.5	Category 4 0.5>a>0.2	Category 5 0.2>a	Total
Győr	33.2	45.9	4.8	16.1	-	100.0
Mosonmagyaróvár	20.0	11.0	26.6	19.2	23.2	100.0
Csorna	24.2	23.7	32.9	19.2	-	100.0
Kapuvár	39.4	10.0	41.7	-	8.9	100.0
Sopron	23.5	17.8	40.0	18.7	-	100.0
Kőszeg	47.3	34.7	8.5	4.1	5.4	100.0
Szombathely	61.7	26.1	2.9	2.1	7.2	100.0
Sárvár	35.4	15.2	13.1	23.8	12.5	100.0
Vasvár	21.4	25.3	49.5	3.8	-	100.0
Körmend	16.0	8.3	19.3	30.6	25.8	100.0
Celldömölk	23.3	16.6	35.0	14.3	10.8	100.0
Szentgotthárd	-	9.7	29.3	58.5	2.5	100.0
Ajka	46.7	10.1	16.5	13.8	12.9	100.0
Pápa	42.0	14.2	18.3	11.9	13.6	100.0
Sümeg	43.1	14.5	17.7	16.2	8.5	100.0
Tapolca	24.3	-	34.3	32.5	8.9	100.0
Várpalota	-	-	-	-	100.0	100.0
Zirc	9.7	36.8	40.2	8.5	4.8	100.0
Veszprém	38.2	-	25.6	-	36.2	100.0
Balatonfüred	21.3	11.8	19.2	22.5	25.2	100.0
Balatonalmádi	67.8	-	32.2	-	-	100.0
Region total	32.3	18.4	23.3	16.4	9.6	100.0

Figure 1

Joint spanned tree of graph of Győr



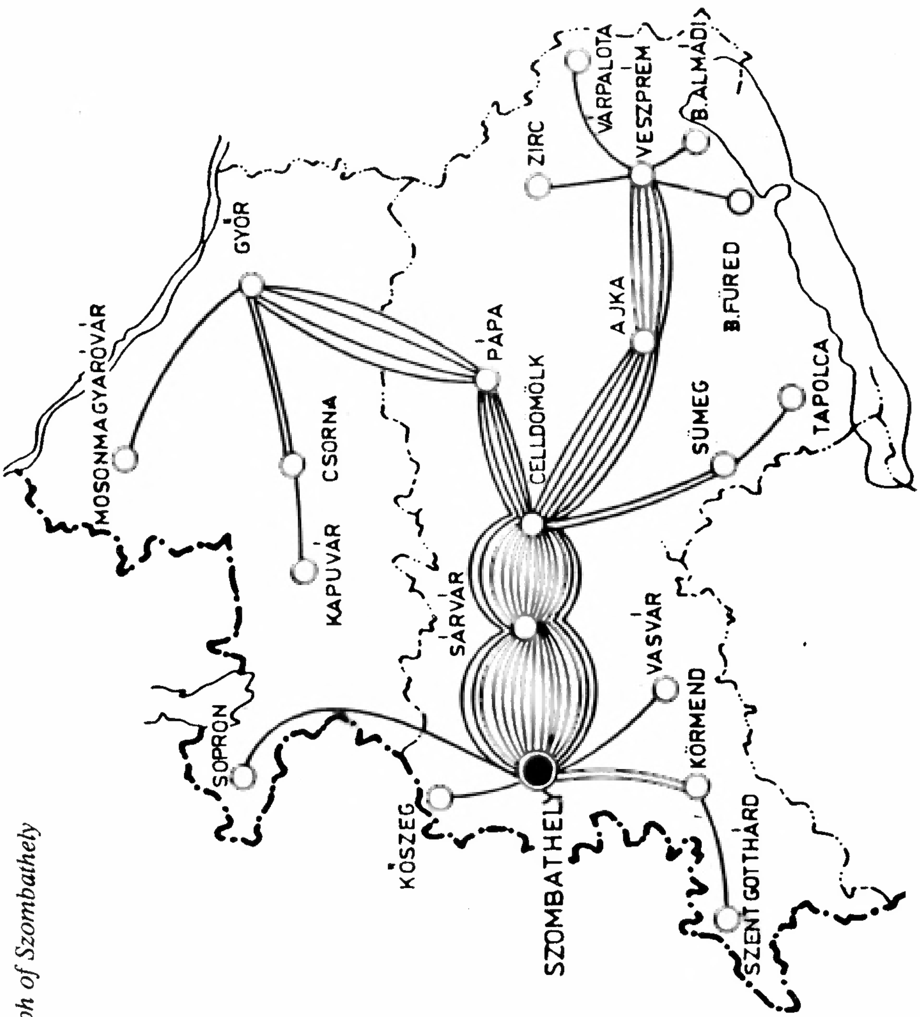


Figure 2
Joint spanned tree of graph of Szombathely

Figure 3
Joint spanned tree of graph of Veszprém

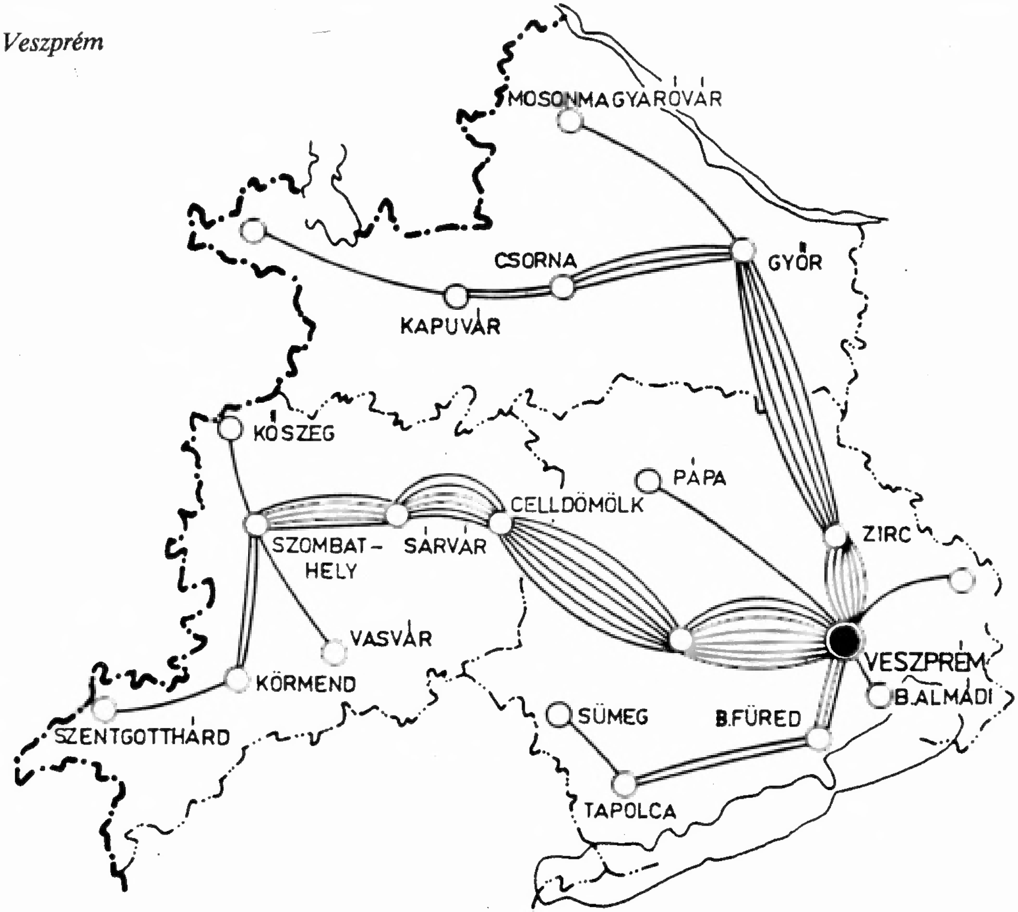
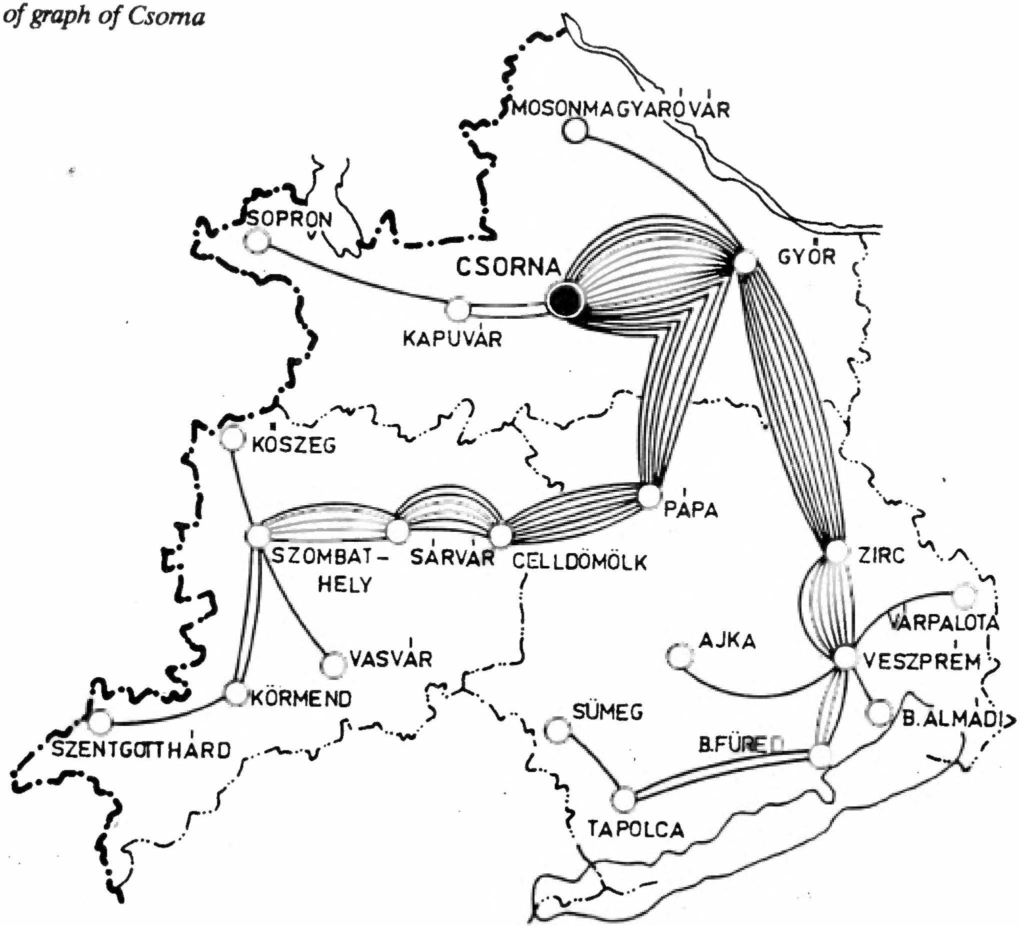


Figure 4

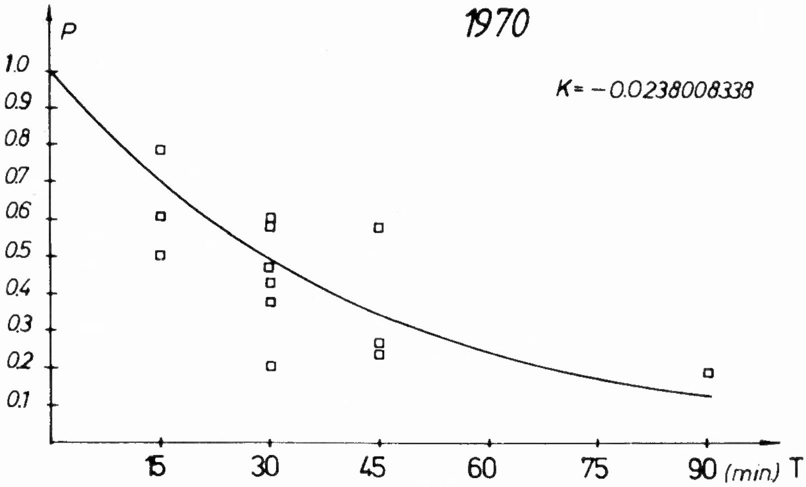
Joint spanned tree of graph of Csorna



Szörényiné Kukorelli, Irén: Role of Accessibility in Development and Functioning of Settlemets.
Pécs: Centre for Regional Studies, 1990. 34 p.
Discussion Papers, No. 8.

Figure 7

Power functions of Szentgotthárd in 1970 and 1980



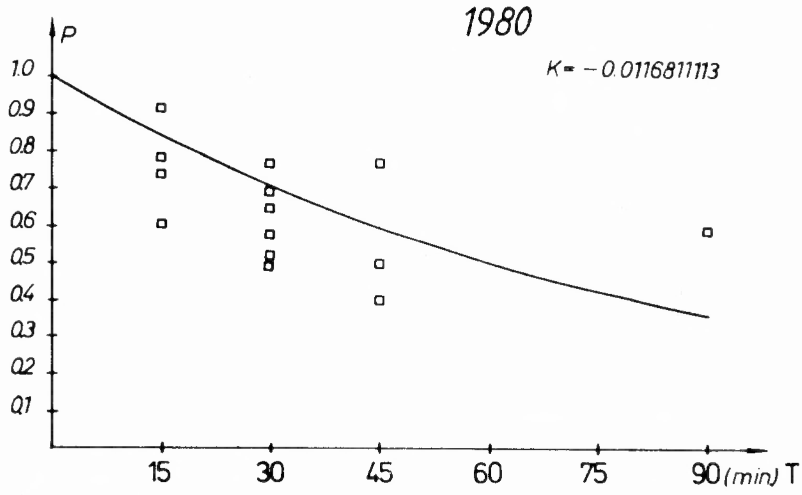


Figure 8
Employment place accessibility of settlements

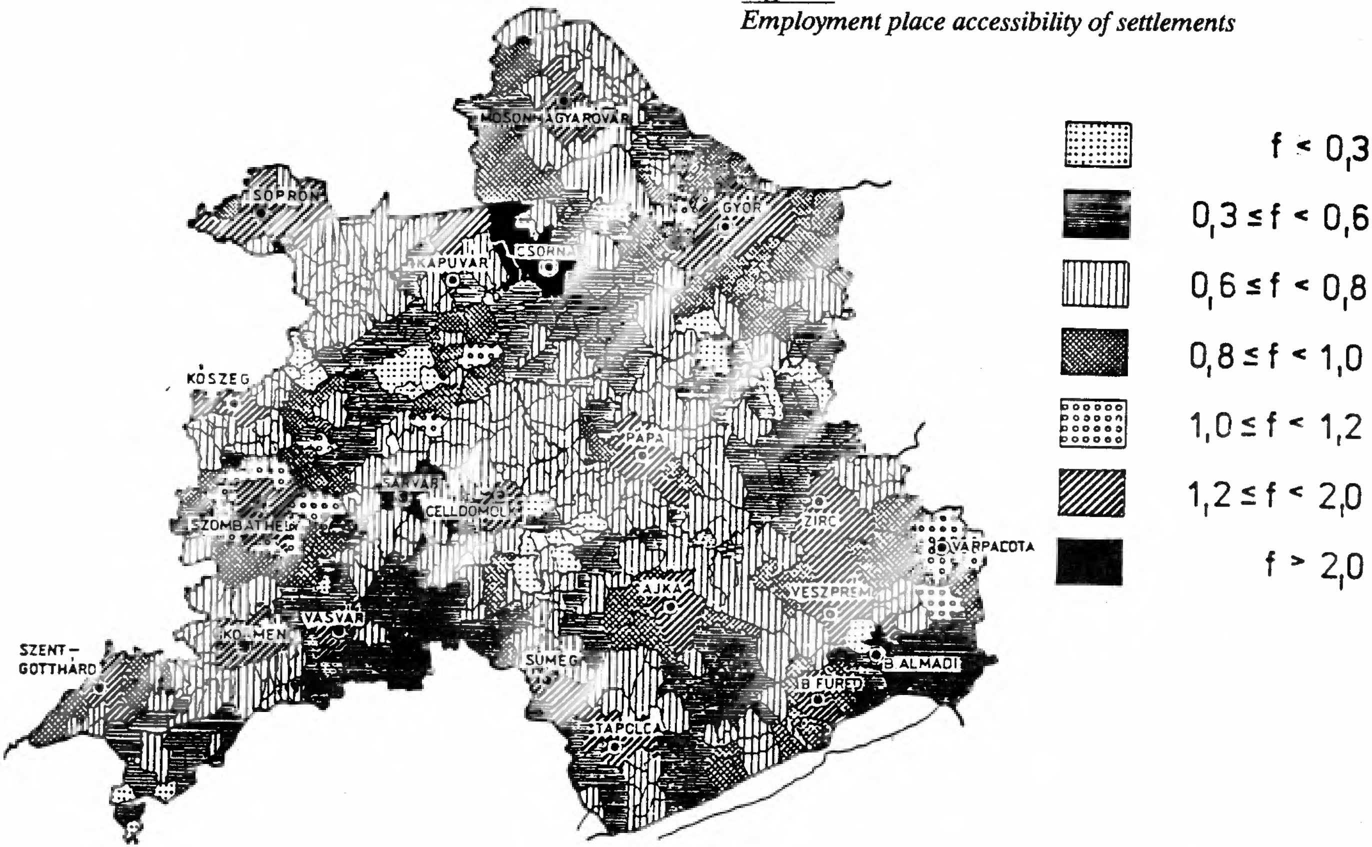


Figure 5

Joint spanned tree of graph of Pápa

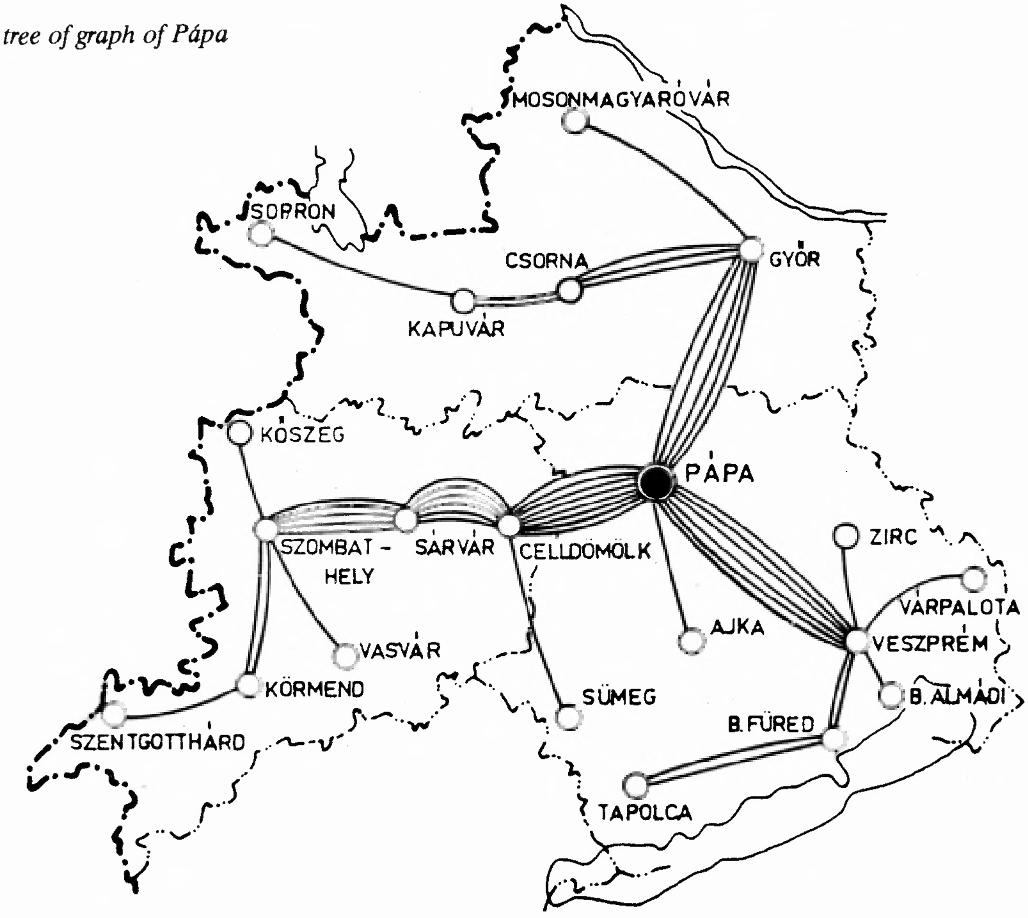
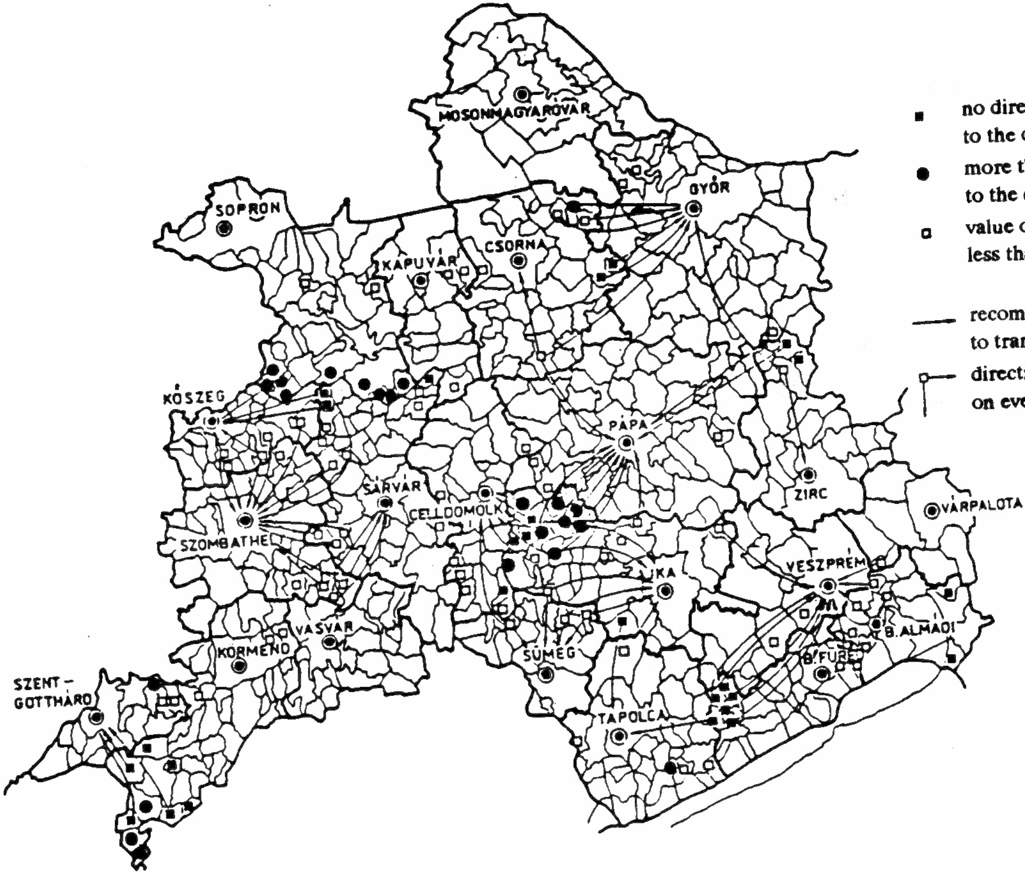


Figure 6

Settlements in transportation shade and in special gravity zone position



- ▪ no direct access to the centre
- ● more than 1 hour running time to the centre
- ▫ value of accessibility to own centre less than that of an other centre
- — recommendable direction to transportation gravity zone centre
- ⊏ directions to more centres on even terms

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