Depending on motorways – transport connections of Hungarian industrial parks and their enterprises

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Abstract

After regime change industrial parks (IPs) with different transport conditions played a prominent role in the renewal and the spatial transformation of Hungarian industry. One of the main goals of this study was to reveal a relationship between the main features and the transport connections of IPs and to demonstrate the impacts of transport infrastructures on the site selection of IPs. A further goal was to study the correspondence between the transport connections of IPs and their enterprises. The research was part of OTKA (Hungarian Scientific Research Fund) project (ref no. K 75906) and was based on two surveys (carried out by questionnaires). The first survey was made among IPs in 2010, the second one (based on the previous research) was carried out among enterprises selected considering several aspects in 2011. During the empirical research the strong dependence of IPs on motorways and the significance of transport infrastructure (especially road transport) in site selection of industrial investments became obvious. All those phenomena determine the new spatial pattern of Hungarian industry and may effect its possible transformation in the future.

Keywords: industrial parks, transport, motorways, Hungary

Introduction

After regime change, radical alterations took place in the Hungarian industry which came to pass in a differentiated way both in space and time and led to the dramatic spatial restructuring of the industry (Kiss, É. 2010). The industrial parks (IPs) being new places for the industrial production contributed to that realignment considerably giving sites for dozens of industrial enterprises (Kiss, É. 2001, 2003). The pace of the industrial renewal and the development of the industry and the IPs depended on many factors (e.g. geographical posi-

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tion, the quantity and the quality of labour force, the conditions of living, the development of infrastructure).

Among them, the character and the technical level of transport infrastructure were emphasized in several studies (Tiner, T. 1996, 2003; Abonyi-Palotás, J. 2006; Bodor, É. 2006; Koltai, Z. 2006). There is no doubt about the close context with the geographical location of the new industrial facilities, the spatial structure of the foreign capital investments, the technical level of the transport infrastructure and the directions of the main axes of the transport network. (Eyerly, R.W., Twark, R. and Downing, R.H. 1987; Molnár, L.J. and Skultéty, L. 2000) All the factors mentioned above had positive impacts on the economic development having been investigated by several experts from different aspects (Hardi, T. 2000; Tóth, G. 2002; Lakshmanan, T.R. 2011).

IPs appeared in Hungary in the 1990s and started to grow in number at the end of the decade. 210 industrial parks were registered in 2010 and their area reached nearly 12,000 ha-s. The number of enterprises settled in them reached nearly 4,000 and about 60 percent of their total income (HUF 10,000 billion) derived from export. The estimated number of their employees was about 200,000 persons. On the whole, they play a very important role both in regional and local economy. But there are considerable differences among them looking at their geographical position, spatial concentration, economic structure and their role in economic and regional development. Additional important factors are their positions in transportation network and the regional differences existing in the technical level of transport infrastructure. Both factors have direct influences on profitability.

Goals and method of the research

It was a remarkable goal of the study to reveal a presumptive relationship between the selection of IPs with different features (e.g. the year of their foundation, their area, the character and the number of their investments) and the quality of their transport connections. We also made an attemption to answer the question how the process of site selection of IPs is determined by the level of transport infrastructure of the chosen region and the direction of the main axes of transport network.

We study whether the transport facilities of IPs correspond with the transport connections needed for the settled companies and we also examine the main reasons of the possible discrepancies are. We try to answer to those questions in the frame of Hungarian Scientific Research Fund (OTKA) project titled "Spatial structural impacts of industrial investments and their transport connections". Connecting to that project, several papers have been published revealing partly the theoretical and the methodological premises and partly

the evaluated regional structure and the transport connections of the firms among the top 500 Hungarian companies settled in the IPs (Tiner, T. 2010a, b). However, the comprehensive study of the IPs is still missing.

This study is based basically on the experiences of two empirical surveys carried out in 2010 and 2011. At first we attempted to reveal the main features and the transport connections of IPs then after the typology of IPs, we made a survey among the 23 selected IPs with different transport facilities. In 2010 questionnaires containing 19 questions were sent to all IPs. One half of the questions referred to the main characteristics of IPs (e.g. the year of the foundation, their area, the type of investments, the number of enterprises and employees). The other half of the questions referred to the transport geographical positions and the transport connections of IPs. Only one third of all IPs (72 altogether) answered the questions, which can be considered a fair rate considering the fact that about 10–20 percent of the IPs have been out of operation for several years (Regős, Zs. 2007). (Among the 72 IPs, few ones haven't answered each question.)

In the course of the empirical research carried out in 2011, questionnaires containing 21 questions were filled out by only 70 transport intensive enterprises (12.6 percent) of the selected 23 IPs. The most important questions referred to the number of employees, the transport connections, the input-output freight traffic and the role of transport conditions in site selection. Though the number of polls filled out seemed to be relatively few (very few questionnaires were sent from the South Hungarian Plain region), we consider the polls sent to us suitable for revealing tensions and contradictions hidden in the transport conditions of the IPs and their enterprises investigated. Furthermore, the given answers may contribute to evaluating the role of transportation in site selection and may disclose the differences of development of IPs.

Relationships between industry and transportation

There is no doubt about the statement that there is a strong coherence between the economic (especially industrial) development and transportation (communication). It is also obvious that investing in transport infrastructure have benefits on the economic (industrial) development of a given region. But there is an argument about the rate of that influence and the way of its measurement (Banister, D. and Berechman, Y. 2001). Though attempts have been made to measure it by applying different methods inland and abroad (e.g. shift and share analysis, potential models) (Hardi T. 2000; Tóth, G. 2006, 2008; Lakshmanan, T.R. 2011), there are no sure evidences demonstrating a clear correlation between the development of economy (industry) and transportation. The reason for that is the difficulty to make differences among influences with high variety (e.g.

distributive and generative effects in case of motorways; multiplicative and accelerative influences in case of railways (Erdősi, F. 1991; Tóth, G. 2006).

Distinct interactions existing between the varied branches of transport and the different sectors of economy make it more difficult to evaluate the interdependency between communication and economic growth. For example, the traditional sectors of industry (because of their transport intensive character) depend on the level of transport to a greater extent than the high-tech and knowledge intensive branches of industry. Of them, the technical level of telecommunication may be the more relevant factor.

The interaction existing between transportation and economy (industry) can be considered as a self-strengthening, dynamic process. Consequently, changes taken place in the transport system have an influence on the accessibility of a given region in accordance with their weights and they also determine the direction of development (Erdősi, F. 1991; Femald, J.G. 1999). Nevertheless, several authors emphasize that the development of transport infrastructure as well as the high standard of transport infrastructure are not enough to develop the economy (industry) or a region. An adequate presence of other factors (e.g. highly developed physical and human infrastructure, political or institutional conditions etc.) is also indispensable (Banister, D. and Berechman, Y. 2001; Tóth, G. 2002, 2006).

Of course, it is difficult to figure out which factors and when will play a decisive role in the process mentioned above. It depends on several conditions and it can change from time to time. For example, in the early 2000s besides the level of skills of labour force, local motivations such as local taxes and different types of allowances played an important role (Kiss, É. 2001, 2003). However, during the last years, those facilities have become less relevant mainly because of the deepening economic crisis and due to the fact that self-governments are suffering from the high rate of deficit of the local budget. Hence, in case of establishing IPs, the settlement can not afford to provide any types of allowances or free areas to the investors to attract them to the settlement.

Throughout history, transportation and its branches have taken part in economic (industrial) development, the site selection of industrial constructions and the shaping of the economic space in different ways. It was clearly demonstrated in a historical review made by Knowles, R.D. (2006). For long centuries, water transport was the most favourable and effective form of transportation. Accordingly, the Hungarian settlements which were located near the bigger rivers (e.g. Danube, Tisza) showed a spectacle economic prosperity. Industrial plants with high transport needs were located also along the big rivers. Until the appearance of railways, there had been no considerable or sharp differences in the conditions of road transport of landlocked countries.

The construction, the spatial structure and the nodes of railway network had a positive impetus on economic development and the selection of

industrial sites which resulted in the shaping of industrialized belts developing dynamically along the main railway lines. Consequently, railway transport played a leading role in the process of industrialization, the establishment of new industrial sites and their location close to the railway lines. That process determined and differentiated the economic (industrial) development of the different areas considerably. It means that the impact of transportation on the economic and regional development is of the same age as the development of railway transport (Erdősi, F. 1991).

In the second half of the 19th century large-scale railway constructions began in Hungary resulting in the build-up of more than 6,000 km long national railway network. At the beginning of the 20th century that length of railway lines represented a very good position in the ranking of the European countries. Railways connected not just Hungary having a periphery position at that time but also its certain fringe areas to the European economic circulation (Berend, T.I. and Ránki, Gy. 1978). Railway construction fostered the development of heavy industries (coal and iron ore mining, metallurgy) with great needs of raw materials. Mostly the main railway lines attracted the new industrial sites and became the main axes of economic prosperity creating important economic (industrial) centres (Erdősi, F. 2005).

In the 20th century the technical development of transportation had a revolutionary impact on overland transport. The process of turning from the railway era into the motorway age was more slowly in the Eastern part of Europe than in the Western one and that process accelerated only in the early 1990s after the political regime change. Consequently, at the beginning of the 21st century structural inequalities in the branches of transport between the Western and the post-socialist countries diminished considerably. In 2005 the rate of vans and lorries in full freight transport was higher in Eastern Europe than that in the EU-15 countries (Erdősi, F. 2009). Moreover, in 2010 more than 70 percent of goods were carried by road in Hungary as well.

The evolvement of motorisation age and the sweeping advance of road transport were connected with the extension of public road network and its technical improvement coming from the high activity in main road construction. Between 1990 and 2010 the total length of motorways and motor roads extended from 349 km to 1,272 km. It is of great importance because more and more counties managed to get main roads for rapid transit. While in 1990 eight Hungarian counties (Bács-Kiskun, Fejér, Győr-Moson-Sopron, Heves, Komárom-Esztergom, Pest and Veszprém) had a modest rapid transit network (with a few dozens of km), 20 years later only 4 counties (Békés, Jász-Nagykun-Szolnok, Nógrád, Vas) missed that type of arterial roads. In the middle of 1990s when the volume of foreign direct investments (FDIs) increased, more than 75 percent of motorways and motor roads were still concentrated in 4 counties (Győr-Moson-Sopron, Fejér, Komárom-Esztergom and Pest). Those counties

also enriched in several industrial investments at that time and deriving from that fact they determine the regional structure of the Hungarian industry of today as well (Kiss, É. 2002, 2010).

As opposed to the developed countries, the intensity of research activities focusing on the economy stimulating effects of transport investments (highway constructions) increased in Hungary only in the last decades. It has two objective reasons. Firstly, the rate of expressways represented only a modest rate within the Hungarian main road network before 1989. Secondly, during the socialist era the transport costs had only a marginal influence on site selection criteria of the large industrial investments (Barta, Gy. and Enyedi, Gy. 1981). After regime change, the importance of transport and transport geographical position determining the accessibility increased spectacularly.

Recent investigations have underlined the positive effects of highways constructions on economic and regional development. Motorway M1 is a good example for that statement because it contributed to the establishment of several industrial plants and the shaping of a new spatial structure of industry by attracting foreign capital investments. However, it was confirmed that probably other favourable local endowments also contributed to it (Móricz, S. and Szegedi, Zs. 2008). It seems to be proven by the fact that different sections of the same highway have an effect of a different degree on the economic development. E.g. motorway M7 did not promote the development of the city of Nagykanizsa, but an area of 100 hectares of the new industrial park located at the village of Sormás was occupied by companies within a few months.

The geographical closeness and the running direction of motorways were important factors in decision making, mainly for German and Austrian investors. The American investors preferred establishing large scale industrial plants in deconcentrated form all over the country. In contrast, the investors arriving from German speaking countries focused their activities mainly in the Northern part of Transdanubia (Kiss, É. 2002). It was also manifested that motorways had positive effects on tax revenues, export incomes, the employment, the living conditions and the competitiveness of settlements (Erdősi, F. 2002; Hardi, T. 2000; Kálnoki Kis, S. and Molnár, A. 2003). Different investigations also revealed that 1–2 years after the construction, the positive economic effects of motorways were limited only to a relatively narrow (10–20 km) zone, but later those impacts expanded to a far greater belt (Tóth, G. 2006).

Parallel to the extension of globalisation the transportation as an important branch of the Hungarian economy is being gradually transformed because of the alteration of the processes of production, storage activity and the distribution of goods. On one hand, those processes are creating new demands and requirements for transportation (Berényi, J. 2006), on the other hand the needs for rapid transmission of information are growing spectacularly revaluing the importance of telecommunication. Furthermore, deriving from the

extension of our rapid transit network, its differentiating role in the economic (industrial) and regional development, the site selection and the shaping of industrial areas will be presumably diminished in the following years.

Features of industrial parks and their transport endowments

It is not a simple task to define the concept of 'industrial park'. Several definitions were born to describe it. Generally, it means an area which is prepared for industrial use (Buzás, N. and Lengyel, I. eds. 2002). However, it can also be considered as a property management project with an area suitable for location of concentrated industrial activity (Benko, G. 1992; Kiss, É. 2001). The areas which have won that title can be considered to be "industrial parks" in Hungary. (Our research focuses on those IPs.) The criteria of getting that title has changed compared to previous conditions. Originally, an area selected to economic and/or industrial development and with industrial profile may manage to win the title of IP if it possessed 10 hectare area, 10 firms and minimum 500 employees.

Nowadays the basic area of large-scale constructions operating as IP must be 10 hectares. However, when applying for a project, only 5 firms are needed to be settled in an IP with only 100 employees. Later applicants must be obliged to increase the number of firms settled in the IPs from 5 to 10 and the number of employees from 100 to 500 within five years. Probably those less strict conditions of getting an IP title contributed to the IP's modest occupation during the last years. Additionally, the long-lasting global economic crisis has unfavourable influences on the rate of occupation and the employment of IPs.

Nearly two third of the IPs taking part in a survey made in 2010 were established before the turn of the millennium. A long time has passed since their establishment and thus there has been an opportunity to build up the infrastructure of their communication and strengthen their connections of transportation. The rate of the IPs established between 2001 and 2005 and after 2005 are nearly the same. The answers given by 72 IP-respondents reflect clearly their distribution by the years of their establishment. Nearly half of them were established in 1997 and 1998 so they belong to the group of older IPs.

Among the respondents, we can discover Győr Industrial Park, the oldest one in Hungary (and in East Central Europe too), which was established in 1991. But officially it has been operating only since 1997 when the Industrial Park Programme was introduced at a governmental level. There is a constant increase in the number of IPs in Hungary (in 2012 their number was 217) and their regional distribution became more even. But here has to remark that even in the early 2000s, there was not a single Hungarian settlement without an IP within its 30 km radius (Nikodémus, A. 2002) *(Figure 1*).

According to the character of investments, IPs can be categorized into three main types: greenfield, brownfield and mixed ones.

a) Initially, the IPs were established as *greenfield* investments, because that type of construction was faster, cheaper and easier to locate than the brownfield ones (Kıss, É. 2001). Those IPs were popular among enterprises settled mainly because their areas and the types of their uses could be changed flexibly and they could be enlarged later. Greenfield IPs show greater regional density in Northern Transdanubia, in the agglomeration zone of Budapest and in the middle part of the Hungarian Great Plain (Alföld) Region.

b) Brownfield IPs were located mainly in previous traditional industrial areas and in the sites of previous factories as the most frequent form of their recycling. A few of them were established in the territory of a former military base. In a broad sense, every non-greenfield IP must be considered as a type of IP which has brownfield character. Most brownfield IPs are connected to former traditional industrial belts developed in the mountainous regions rich in mineral and energy resources.

c) In recent years more and more *mixed* IPs have been established because brownfield ones have expanded their territories with greenfield areas where their local capabilities made those enlargements possible *(Figure 1).*

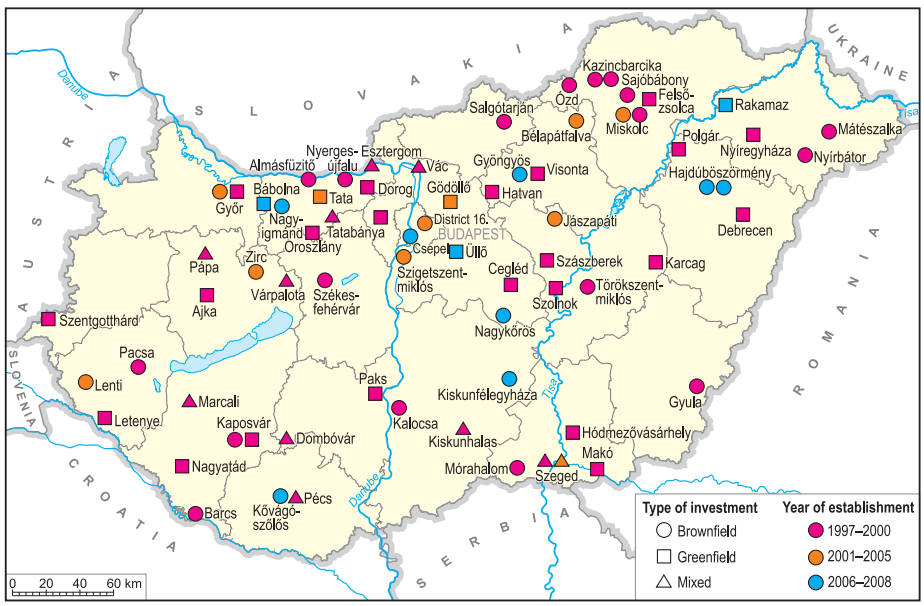

Fig. 1. Regional pattern of IPs by the time period of establishment and the character of investment, 2010. *Source:* Survey carried out in 2010.

28 of 72 investigated IPs were the result of greenfield investments, further 32 IPs were brownfield ones, the rest of them belonged to mixed type. It is very important to deal with the types of investments, because they have different impacts on the transport connections of the firms settled in (the area of IPs). Greenfield investments offer optimal logistics and financial conditions for building up transport and other service infrastructure (e.g. places for parking) in the IPs even in the first phase of their constructions. In contrast, brownfield IPs have to face with more limited possibilities and they have less freedom to form their already existing transport infrastructure. The firms settled in the IPs must take into consideration the previously constructed transport infrastructure, the quality of which is generally far from the modern and high-tech ones built up in the greenfield IPs. Presumably, transport possibilities and facilities available in brownfield IPs determine the type of enterprises settled in (*Photos 1* and *2*).

The areas of IPs differ in size considerably and with their development they often change in time. Of course, those changes have an effect on the transport capabilities of the IPs. The majority (69 percent) of the investigated IPs have territories under 50 hectares. Probably, that value derives from their estimated optimal size which is between 30 and 50 hectares (Rakusz, L. 2000).

Photo 1. Part of the Csepel brownfield industrial park (Photo by Kiss, É.)

Photo 2. Part of the greenfield Győr idustrial park
(Photo by Kıss, É.)

In 2010 the size of 17 IPs exceeded 100 hectares, while in the early 2000s that number was 23. Consequently, during the last decade the number of larger IPs decreased considerably. Though a few of them are greenfield investments (e.g. Győr IP, Szentgotthárd IP and Nyíregyháza IP), but their majority belong to brownfield and mixed type ones.

There may be considerable differences in the number of entrepreneurs settled in and also their employees both within an IP and among the IPs. Generally, IPs with few entrepreneurs have less employees as well. In 2010 78,315 persons were employed at more than 1,800 firms in the 72 IPs altogether. It equals to 25 enterprises and 1,088 employees per IP as an average. Actually, the values of the latter indicator are under the average in case of two third of IPs, so the real number of their employees is much smaller than the average.

Several IPs with less than 10 enterprises operated in the Hungarian Great Plain (e.g. in Jászapáti, Törökszentmiklós, Makó and Kiskunfélegyháza IPs) and in Transdanubia (e.g. in Nagyatád, Barcs and Zirc IPs). However, more than 100 firms belonged to only two brownfield IPs (Ózd IP and Budapest District 16 IP). Most workers are employed not only in those two IPs but in five additional ones (Esztergom IP – 7,750 persons; Tatabánya IP – 5,600 persons;

Győr IP – 4,554 persons; Hatvan IP – 4,247 persons and Nyíregyháza IP – 4,000 persons). The smallest number of employees worked in Almásfüzitő IP (30 persons), Barcs IP and Polgár IP (40–40 persons).

In 61 percent of IPs the occupation of available areas was more than 50 percent which seems to be a very favourable value. IPs with occupation rate of 25–50 percent operate mainly in the Great Plain region. It means that the major part of their area is in permanent use. Less than 25 percent ratio occurs only in case of a few newly (a few years ago) established IPs in North Transdanubia and to the North Hungary. The largest differences between IPs with high and low occupation rates are demonstrated along the Miskolc–Kaposvár line with NE–SW direction. The majority of IPs with high occupation rates is located North of that hypothetical line. The main part of IPs with low occupation rates is concentrated on the South of that line (especially in the Great Plain region).

It must also be emphasized that the occupancy itself doesn't reflect neither the profile and the profitability of located firms nor the utilization rate of IPs. Starting from this statement, there should be remarkable differences between the IPs settled in the Northern parts of the Transdanubian region and the ones settled in the Southern parts in spite of the fact that the occupancy rates are high in both regions. Different transport capabilities have undoubtedly had an influence on it.

The majority of IPs are settled along the motorways. Nearly half of them are located closer than 10 km to those arteries. So the closeness of motorways is a basic condition of the existence for the operation of IPs. Several investigations have confirmed that areas having good motorway connections were put „on the map" of foreign investors and this way they were doomed to development (Bartha, A. and Klauber, M. 2000). The need for accessibility via motorway is various in the different branches of economy. Transport capability is very important especially for the processing industry and mainly for machinery (automotive industry, electronics), because many of their inland factories being subsidiaries of transnational companies are in close contact with the global networks of production.

A close correlation can be detected between the routes of motorways and the spatial distribution of IPs, mainly in the agglomeration zone of Budapest and along the motorways. E.g. along the M1 on Northern Transdanubia, M3 in Northern Hungary and Northern Hungarian Plain, M5 in Southern Hungarian Plain, M6 in Southern Transdanubia and finally along M7 in Central Transdanubia NUTS2 regions. Closeness of motorway is the dominant element of typisation in case of IPs by their position in transportation network (*Figure 2.* A, B, C).

The existence of IPs close to M1 motorway (e.g. Nagyigmánd, Almásfüzitő, Nyergesújfalu IP) with low rate of occupation confirms the hypothesis that additional factors (e.g. favourable demographic structure, skilled

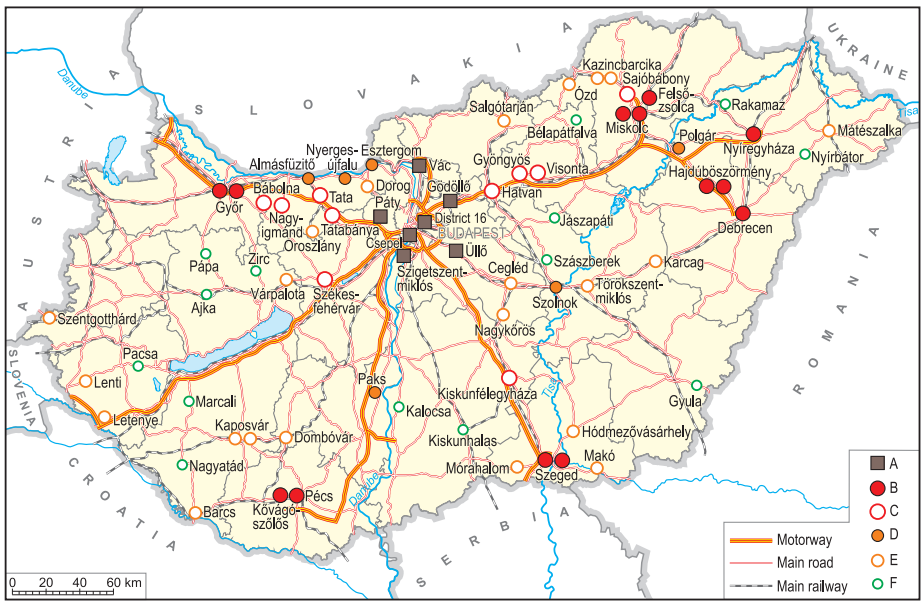

Fig 2. Types of IPs by their position in transportation network, 2010. A = IP in multimodal transport location connecting to superhub (Budapest); B = IP situated along main arteries near important river port and/or airport; C = IP situated along main arteries far from important river port and/or airport; D = IP situated along secondary arteries near important river port and/or airport; E = IP situated along secondary arteries far from important river port and/or airport; F = IP situated along tertiary arterial position. *Source:* Survey carried out in 2010.

labour power) are also necessary to enhance the positive effects of a motorway. Probably, those additional factors contributed to a relatively high occupation rate even in IPs (e.g. Videoton IP in Kaposvár, Gyula IP, Barcs IP) being more than 50 km away from the nearest motorway. Since the majority of the IPs mentioned above are brownfield investments, their connection to motorways is not a decisive factor for their activities, as probably only few enterprises settled in the IPs have close connections to global economy.

Only Gyula IP (Békés county) out of the surveyed 72 IPs informed us about the fact that its distance from the nearest motorway was more than 100 km. Obviously, it is not a coincidence, because transport geographical position of Békés county is very unfavourable. Even these days there are no motorways in Békés county.

Their closeness to primary and secondary roads contributes to the relatively good road accessibility of IPs (*Figure 2.* D, E, F). 19 IPs revealed that their distance from the nearest primary or secondary roads is more than 10 km.

Their regional distribution generally follows the structure of periphery areas of the country, namely they can be found on the outer peripheries along the border regions (e.g. the Barcs IP, Letenye IP) and on inner peripheries along the county borders (Bélapátfalva IP, Makó IP, Szászberek IP). In other words, IPs with poor road accessibility are situated out of the North Transdanubia region which has the most developed industry. North Transdanubia is a pioneer in the industrial innovation and its integration into the global economy is the most advanced).

The connection of IPs to *railway lines* – except Letenye IP, Várpalota IP and Visonta IP – seems to be favourable, because the majority of them can reach railway lines in(side) their settlement/location and within a few km distance. Mainly double- and single-track electrified main railway lines are available for IPs. However, the utilization of that advantageous condition is far from the optimal, because of the lower attraction of freight and passenger rail transport. Consequently, railway connections do not play an essential role neither in site selection of IPs and their enterprises nor in their further development. Generally, Hungarian experiences are in accord with the international trends and they follow them permanently *(Figure 2).*

Looking at the *water transport,* we can state that most of the IPs are in unfavourable position, because the majority of their sites are far from the ports of our navigable rivers. IPs situating in hilly regions with traditional industries are in the worst position. One sixth of the surveyed IPs announced that the nearest river ports are less than 20 km away from them and they are situated along the Danube and the Tisza River.

The water transport connections are also determined by the routes of the navigable rivers. Consequently, only the IPs situated close to water routes can enjoy the benefits of that situation. It often occurs that water transport is not utilized by IPs despite the availability of water transportation. On the other hand, being without direct water transport accessibility doesn't necessarily mean a handicapped situation, because among others, water transport connections might not be important for the companies of the IPs. Survey made among the firms of IPs served to confirm or deny of that preconception (*Figure* 2 B, D.)

Based on the accessibility of their *air transport* connections, IPs can be divided into two groups. The first one involves the IPs situated relatively close (within 20 km) to the nearest airport, the second one consists of IPs situated farther than 50 km. Latter ones can be found mainly in Northern Hungary region, which can be explained with the low airport density of the region owing to its hilly relief. IPs with the best airborne traffic connections are settled in towns, especially in county seats (e.g. in Debrecen, Győr, Pécs, Szeged). The towns mentioned above have old traditions of air transport and they have had their own airports for decades.

From the closeness of IPs to the various elements of transportation networks, we can conclude which elements could play a role in their site selection and in what measure. Answers given to the questions focusing on that problem have also confirmed that high quality elements (highways, primary and secondary main roads) of public road network available in different measure are key transport factors for IPs in site selections. More than 40 out of 72 IPs have revealed that elements of public road and railway connections mentioned above have had the greatest influence on their site selection *(Table 1).*

Table 1. The importance of different transport elements in the site selection of industrial parks, 2010

Denomination of different transport elements	Indicated by industrial parks*	
	Number	%
Motorways	43	59.7
Main roads	41	56.9
Railway lines with different quality	42	58.3
Railway terminals for freight traffic	16	22.2
Water transport connections (river ports)	9	12.5
Air transport connections (airports)	11	15.3
Other elements of transport	4	5.6
Transport connections were not important	7	9.7

*An industrial park might indicate more transport elements. *Source*: Survey carried out in 2010

Mostly road transport and rarely railway transport were in dominant position in case of IPs where waterborne and airborne traffic connections were also relevant factors in site selection. Only four IPs (Szigetszentmiklós IP, Rába IP in Győr, Kalocsa IP and Üllő IP) announced that each form of transport connections had influenced their site selections. All those IPs are settled along the Danube. Ten percent of the IPs answered to the question of the inquiry/survey that not a single transport factor had influenced their site selections *(Table 2).*

IPs classified into various types according to the role of different elements of transportation network in site selection do not form special territorial groups. Essentially, the categories have not spatial specific appearances, they don't favour certain regions.

On the whole, the investigation among IPs revealed partly the importance of road transport and partly the fact that the IPs generally have a favourable transport geographical position. Motorways have played prominent role in site selection for IPs from the middle of 1990s and nowadays their differentiating function still has a great impact on the structure of the Hungarian industry.

Table 2. Groups of industrial parks by different transport connections in their site selection, 2010

Denomination of transport connections	Names of industrial parks with settlements
A) Overland transport network connections (51 IPs)	
Exclusively motorway (5 IPs)	Bábolna, Kazincbarcika (Borsodchem IP), Miskolc, Nagykőrös, Páty
Motorway and main road (6 IPs)	Debrecen, Felsőzsolca, Gödöllő, Makó, Mórahalom, Oroszlány
Exclusively main road (10 IPs)	Ajka, Cegléd, Kaposvár (Videoton IP), Nagyatád, Paks, Pápa, Rakamaz, Salgótarján, Szeged (Délép IP), Törökszentmiklós (Videoton IP)
Motorway, main road and railway (9 IPs)	Győr, Hajdúböszörmény (Eastern IP, Western IP), Hatvan, Mátészalka, Nyergesújfalu, Nyírbátor, Sajóbábony , Várpalota
Motorway and railway (9 IPs)	Budapest (district 16 IP), Gyöngyös, Kiskunfélegyháza, Nagyigmánd, Nyíregyháza, Pécs-Kővágószőlős, Polgár, Székesfehérvár, Visonta
Main road and railway (10 IPs)	Barcs, Dorog, Esztergom, Gyula, Jászapáti, Karcag, Pacsa, Ózd, Vác, Zirc
Exclusively railway (2 IPs))	Kiskunhalas, Lenti
B) Overland and water transport network connections (4 IPs)	
Public road and waterway (1 IP)	Szászberek
Public road, waterway and railway (3 IPs)	Almásfüzitő, Budapest (Csepel IP), Szolnok
C) Overland and air transport network connections (5 IPs)	
Public road and air transport (2 IPs)	Kazincbarcika, Tata
Public road, railway and air (3 IPs)	Kaposvár (Eastern IP), Szentgotthárd, Tatabánya (Western IP)
D) Overland, water and air transport network connections (4 IPs)	Győr (Rába IP), Kalocsa, Szigetszentmiklós, Üllő
E) Transport connections were not important in site selection (7 IPs)	Bélapátfalva, Dombóvár, Hódmezővásárhely, Marcali, Miskolc (DIGÉP IP), Pécs, Szeged (Kálvária IP)

Source: Based on the survey carried out in 2010.

Few previous results of research on transport connections of companies in selected IPs

In 2011 23 IPs with balanced regional structure were chosen for further investigations from among IPs classified into different groups in 2010. 83 so-called "transport intensive" companies situated in those 23 IPs were selected in a way that each NUTS 2 region of the country was represented by 3–4 IPs. The suitable level of transport connections is of great importance for the firms aiming rapid access both to domestic and international markets.

The investigation of transport intensive firms was made by questionnaires. The most important questions referred to the year of foundation, the profile of the firm, the ownership structure, the number of employees, the transport position of IPs inside the transportation network, the network links and the accessibility of network nodes for IPs within the transportation system, the level and the condition of transport infrastructure inside the IPs, the reasons for settling in the IPs, the volume and the seasonal waves of input-output flow of production of the firms, the place of origin of the input and the destination of the output. Though the data of investigation are still under processing, the first achievements of the research are displayed below.

1. Referring to their transport position, the majority (64.2 percent) of the surveyed companies revealed that they had favourable connection possibilities to motorways. 38.4 percent of them responded that they had accessibilities to main railway lines, but only few of them mentioned a neighbouring airport or a river port as important transport factors for their activities. The distribution of responses above seems to verify the hypothesis that transport intensive firms locate their activities in IPs with favourable highway and good railway accessibilities along the East-West international transport axes of northern third of Hungary (Nyíregyháza–Miskolc–Budapest–Győr line) *(Figure 3).*

2. The favourable position in transportation network seemed extremely important or very important for 68.4 percent of the investigated enterprises as a factor of location. In case of enterprises with foreign interest that rate reached 77.8 percent. From among the pathways of branches of transport, 61.4 percent of the companies chose the motorways, additional 25.1 percent mentioned the main roads as essential elements of transport infrastructure needed for their operation. The closeness of railway lines as a factor of location was important only for 13.2 percent of the companies and the accessibility for a neighbouring airport was mentioned merely by 3.6 percent of the investigated firms while the closeness of river ports proved to be a neutral factor of location for the interviewed companies. The survey underlined that transport intensive firms settled in IPs refuse to use railway transport mainly because of its organizational inflexibility, the low level of its transport logistic services, furthermore, for its relatively high freight rates and missing rebates.

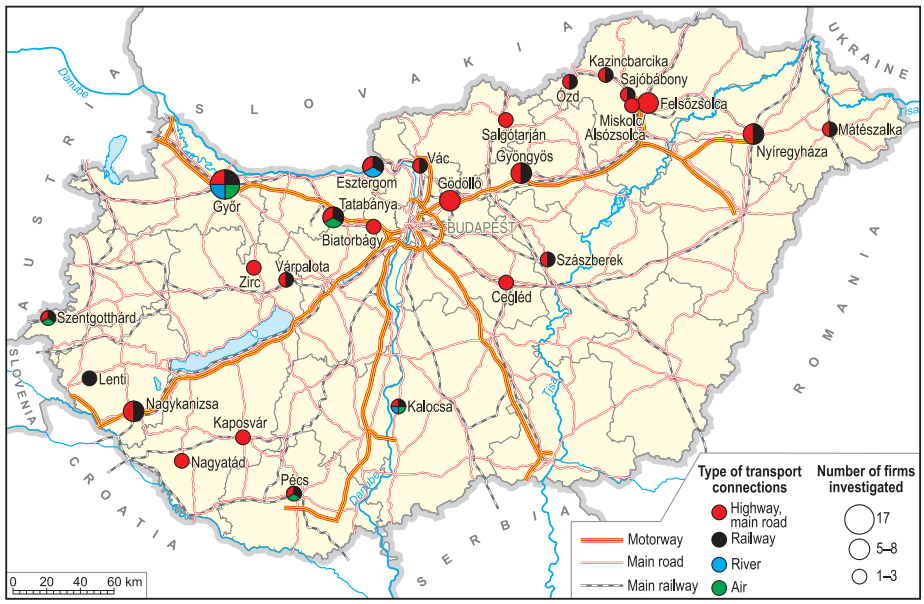

Fig 3. Types of transport intensive enterprises in IPs by their connection opportunities to different branches of transport, 2011. *Source:* Survey carried out in 2010.

3. The regional distribution of mainly transport intensive companies demonstrates a considerable rate of concentration in Western Transdanubia (27 firms) and Northern Hungary (17 firms). Only a dozen of them can be found in Central Transdanubia and 11 of them were settled in Central Hungary. Merely 7 firms represent the Northern Great Plain region and only a few of them moved into some of the IPs of Southern Transdanubia and Southern Great Plain region. This phenomenon demonstrates the industrial character of the investigated companies, their traditions in making all kinds of industrial products mainly for export and the relatively high technical level of the built-up infrastructure of IPs.

4. Considering the years of their foundation, the companies show a relatively balanced temporal distribution between 1985 and 2008. Slightly more than half of the firms (52 percent) were founded in the 1990s, 43 percent of them were established between 2000 and 2008 and merely 5 percent of the them started their activities before the regime change. Nearly 40 percent of the surveyed transport intensive enterprises (35 companies) are owned by international corporations or joint ventures with foreign majority. Being the largest employers, their proportion in the total volume of employees reached 78 percent out of the 83 surveyed companies. It is a general experience that

foreign companies gave the majority of industrial productions, the incomes and profits of more branches of economies in Eastern European countries (Kıss, É. 2010).

5. Based on the collected data for the number of employees, it can be stated that the 83 investigated firms had increased the number of their employees from 4,249 to 13,693 (3.2-fold increase) since their foundation. Among them foreign (transnational) companies and joint ventures with foreign majorities increased their staff number from 3,353 to 9,813 (by nearly 6,500 persons) and purely domestic companies increased the number of their employees from 896 to 3,880 (by only 3,000 persons). Generally, the size of foreign companies are much larger than the Hungarian ones, because they have enough financial resources to wide their productivity in abroad. From their establishment the top 6 companies with the highest increase in staff number (above 500) were the Hungarian Suzuki Co, Esztergom IP (+2,100 employees), Coloplast Hungary Ltd, Tatabánya IP (+1,253), Videoton Elektro-Plast Co, Kaposvár IP (+920), Horvath Transport Ltd, Gyöngyös IP (+670) and ACC Glass Hungary Ltd, Tatabánya IP (+501).

It's an important remark that the long-term prosperity of transport-intensive enterprises essentially depends on the volumes of regular FDIs accumulating in different branches of the Hungarian economy. The volume and the rate of the accumulation of the national capital are far behind the desired level and serve only a few branches of the Hungarian economy (e.g. energy sector, special branches of agriculture).

6. Wholly or partly foreign owned enterprises represented in the sample appeared in Hungary after 1989 and started their economic activities in different periods of the last decades. Austrian companies were among the first ones which launched their subsidiaries in Hungary. More than 75 percent of them were established in Hungary before the year of 2000. Two third of the German owned companies and the German-Hungarian joint ventures were founded during the period of 1998–2002. American (USA) firms appeared in the early 1990s, but additional non-European companies (eg. from Japan, Israel, New-Zealand) started their activities in IPs only after 2001. During the early 2000s Hungary's *preparation* for *accession* to the *European Union was accelerated which* contributed to an increase in the number of companies in the Hungarian IPs (*Figure 4*).

7. Spatial "density" of companies with foreign interests surveyed above demonstrates the dominancy of larger Hungarian towns easily accessible by motorways M1 (Győr, Tatabánya) and M3 (Gyöngyös, Nyíregyháza). Still in the first years of new economic regime they have a considerable advantage in the economic competition for home and foreign markets. The huge economic attraction of Budapest and its agglomeration zone also inspired foreign companies (e.g. the Israeli TEVA in Gödöllő) to choose their sites in Central Hungary offering transport infrastructure of highest quality. Hungary as a landlocked

Fig 4. Establishment of transport intensive enterprises with foreign interest between 1989 and 2008 (according to the nationality of majority owners). *Source:* Survey carried out in 2010.

country with its relatively sparse river ports, underdeveloped river transport and airport infrastructure is rather unable to meet the high technical and logistical requirements of international companies. Only Budapest and larger towns situated along the main transportation axes of road and railway transport are favoured by multinational companies (e.g. Audi in Győr, Coloplast in Tatabánya, Suzuki in Esztergom, Lego and Electrolux in Nyíregyháza etc.). The spatial concentration of foreign enterprises mentioned above also confirms that (*Figure 5).*

8. The investigation outlined that in case of 26.3 percent of transport intensive enterprises both the place of origin of inputs and the destination of outputs were situated in Hungary. More than one fourth of the firms above have not entered the international market yet, moreover, 90 percent of them are wholly domestic owned.

Two third of them are located in Northern Hungary, in the Southern part of Transdanubia and in the Hungarian Great Plain. 63.1 percent of the firms importing goods and services both from Hungary and from other member states of the European Union are foreign-owned companies or joint ventures with mainly foreign interest. Nearly 72 percent of them operate in IPs situated along the primary transport axis of Gyöngyös–Budapest–Győr line.

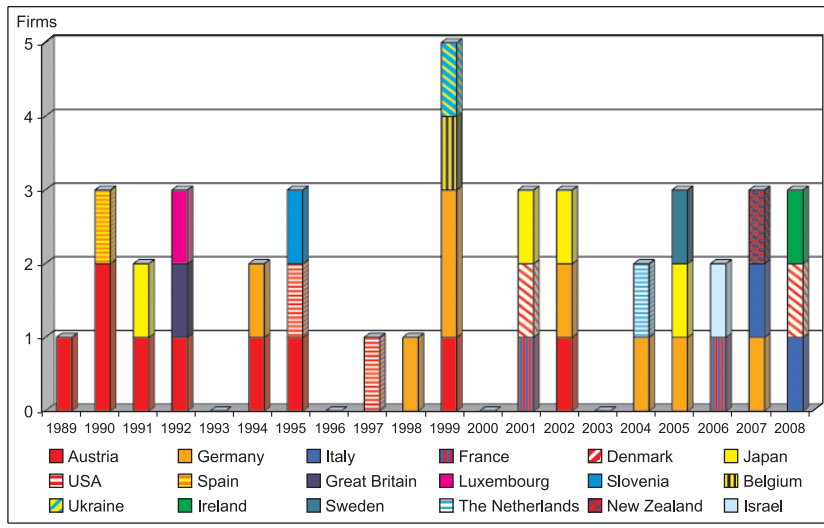

Fig 5. Regional pattern of transport intensive companies with foreign interest, 2011 (according to the nationality of majority owners and the numbers of employees). *Source:* Survey carried out in 2010.

Finally, it is also important to mention that several transport intensive companies are unsatisfied with the transport infrastructure near the IPs. Their problems have both quantitative and qualitative characters:

– Exit lanes of motorways are relatively far from the entrances of many IPs which shows that the transport interests of firms were not taken into consideration when deciding where to build exit lanes.

– Public roads connecting arterial roads with IPs are often narrow and deteriorated because of huge lorry traffic. The bad physical condition of roads causes strong vibration, e.g. fragile commodities often get damaged.

– Transversal roads crossing settlements of Budapest agglomeration zone are permanently congested which leads to bad road accessibility conditions of the IPs of the agglomeration belt.

– The quality of inner road network of several industrial parks is insufficient because those roads were built with low expenses. There are neither pavements nor bicycle roads in several industrial parks which has led to an increased risk of traffic accident.

– It's also a crucial problem that a lot of IPs have bad public transport accessibilities. From among the surveyed employees only the car owners and the daily commuters carried by company buses to their workplaces were satisfied with the conditions of daily travel.

Summary

Empirical studies demonstrated clearly that transport infrastructure had played an important role in site selection of IPs and their enterprises. It was also confirmed that their main attraction factors were the good conditions for road transport, especially the routes of motorways. However, it is an unfavourable fact that IPs don't utilise other available modes of transport for different reasons. Preliminary studies showed that the transport needs for IPs and their companies corresponded with each other, however, some problems had also emerged which predict the main directions of developments.

A close correlation was found between the main indicators of IPs (the years of establishment, the areas of IPs, the characters of investments, the rates of occupation etc.) and the quality of their transport connections. In general, it can be stated that the highest occupation rate can be found in Greenfield IPs established before the turn of the millennium thanks to their favourable transport geographical positions. The majority of those IPs and their enterprises are concentrated in Northern Transdanubia.

Consequently, the sites of enterprises and their IPs depend on the motorways to a great extent. That fact has a decisive impact on the regional pattern of the Hungarian industry and its shaping effect on the regional structure of industry must be taken into consideration as well.

REFERENCES

Abonyi-Palotás, J. 2006. Az *infrastruktúra elemeinek változó szerepe a területi fejlődésben* (Changing role of the elements of infrastructure in regional development). Szeged, SZTE GGT, 174 p.

Banister, D. and Berechman, Y. 2001. Transport investment and the promotion of economic growth. *Journal of Transport Geography* 9. 209–218.

Barta, Gy. and Enyedi, Gy. 1981. *Iparosodás és a falu átalakulása* (Industrialisation and rural transformation). Budapest, Közgazdasági és Jogi Könyvkiadó, 207 p.

Bartha, A. and Klauber, M. 2000. Infrastruktúra és egyes régiók gazdasági fejlődése (Infrastructure and economic development of each region). *Ipari Szemle* 20. (1): 10–13.

Benko, G. 1992. *Technológiai parkok és technopoliszok földrajza* (Geography of technological parks and technopoles). Budapest, MTA RKK, 186 p.

Berend, T.I. and Ránki, Gy. eds. 1978. *Gazdasági elmaradottság a XIX. századi Európában* (Economic backwardness in Europe in the 19th century). Budapest, Közgazdasági és Jogi Könyvkiadó, 504 p.

Berényi, J. 2006. Az áruszállítás regionális vonatkozásai (Regional consequences of freight transport). *Közlekedéstudományi Szemle* 56. (7): 256–263.

Bodor, É. 2001. Az elérhetőség, mint telepítési tényező jelentősége Magyarországon (The importance of accessibility as location factor in Hungary). In *Évkönyv 2001*. Ed. Mezei, C. Pécs, PTE KTK Doctoral School, 244–254.

Buzás, N. and Lengyel, I. eds. 2002. *Ipari parkok fejlődési lehetőségei* (Development possibilities of industrial parks). Szeged, JATE Press, 210 p.
Erdősi, F. 1991. *Kommunikáció és térszerkezet* (Communication and spatial pattern). Budapest, Akadémiai Kiadó, 218 p.
Erdősi, F. 2002. Gondolatok a közlekedés szerepéről a régiók/városok versenyképességének alakulásában (Thoughts on the role of transportation in the formation of the competitiveness of regions/cities). *Tér és Társadalom* 16. (1): 135–159.
Erdősi, F. 2005. Magyarország közlekedési és távközlési földrajza (Transport and telecommunication geography of Hungary). Budapest–Pécs, Dialóg Campus Kiadó, 504 p.
Erdősi, F. 2009. A modal split alakulása Kelet-Európában (Change of modal split in Eastern Europe). *Közlekedéstudományi Szemle* 59. (4): 4–11.
Eyerly, R.W., Twark, R. and Downing, R.H. 1987. Interstate Highways System: Reshaping the non-urban areas of Pennsylvania. *Transportation Research Record*. No. 1125.
Femald, J.G. 1999. Roads to prosperity? Assessing the link between public capital and productivity. *The American Economic Review* 89. (3): 619–638.
Hardi, T. 2000. A gyorsforgalmi úthálózat fejlesztésének hatása, 1998 és 2008 (Effect of clearway network development, 1998 and 2008). *Comitatus* 10. 14–22.
Kálnoki Kis, S. and Molnár, A. 2003. A gyorsforgalmi úthálózat fejlesztésének gazdaságélénkítő hatása (Effect of clearway network development on economic prosperity). *Közúti és Mélyépítési Szemle* 53. (4): 113–119.
Kiss, É. 2001. A hazai ipari parkok néhány jellemző vonása (Some characteristic features of Hungarian industrial parks). *Fal–Város–Régió* 9. 17–23.
Kiss, É. 2002. A magyar ipar térszerkezeti változásai (Spatial structural changes of Hungarian industry). *Hungarian Geographical Bulletin/Földrajzi Értesítő* 51. (3–4): 347–365.
Kiss, É. 2003. Industrial parks in Hungary: their furthering and role in regional economic development. *Regional Symbiosis* 11. 47–65.
Kiss, É. 2010. Területi szerkezetváltás a magyar iparban 1989 után (Spatial restructuring in the Hungarian industry after 1989). Budapest–Pécs, Dialóg Campus Kiadó, 224 p.
Knowles, R.D. 2006. Transport shaping space: differential collapse in time-space. *Journal of Transport Geography* 14. (6): 407–425.
Koltai, Z. 2006. A magyar lakosság és vállalati szféra lakóhely-, illetve telephely-választásának szempontjai (Criteria of residence choose of inhabitants and site selection of companies in Hungary). *Területi Statisztika* 9. (3): 240–254.
Lakshmanan, T.R. 2011. The broader economic consequences of transport infrastructure. *Journal of Transport Geography* 19. (1): 1–12.
Molnár, L.J. and Skultéty, L. 2000. Az autópályák hatása a gazdasági növekedésre (The influence of motorways on economic growth). *Cégvezetés* 22. 101–114.
Móricz, S. and Szegedi, Zs. 2008. A csodavárók hoppon maradnak (People trusting to wonder will be disappointed). *Népszabadság* 66. (27 Sept.): 6–7.
Nikodémus, A. 2002. Ipari parkok Magyarországon (Industrial parks in Hungary). *Területi Statisztika* 5. (2): 111–130.
Rakusz, L. 2000. *Ipari parkok 1994–2000* (Industrial parks 1994–2000). Budapest, IPE, 68 p.
Regős, Zs. 2007. Rostálás előtt a hazai ipari parkok (Hungarian industrial parks before selection). *Népszava* 128. (3 Febr.): 6.
Tiner, T 1996. Nagylétesítmények telephely-kiválasztásának gazdaság- és társadalomföldrajzi feltételei (Economic and social conditions of site selection of large-scale investments). In *Nagyberuházások és veszélyes hulladékok telephely-kiválasztásának földrajzi feltételrendszere*. Eds. Schweitzer, F. and Tiner, T. Budapest, MTA FKI, 89–125.

Tiner, T. 2003. The Hungarian ISPA strategy for the transport infrastructure and its effects on regional development. *Geografický Časopis* 3. Bratislava, SAV, 223–233.
Tiner, T. 2010a. Far from the core – regions and industrial parks in economic shadow in Hungary. Part one. *Hungarian Geographical Bulletin* 59. (2): 89–106.
Tiner, T. 2010b. Far from the core – regions and industrial parks in economic shadow in Hungary. Part two. *Hungarian Geographical Bulletin* 59. (3): 241–254.
Tóth, G. 2002. Kísérlet az autópályák területfejlesztő hatásának bemutatására (An attempt to demonstrate the effect of motorways on regional development). *Területi Statisztika* 5. (6): 493–505.
Tóth, G. 2006. Az autópályák területfejlesztő hatásának vizsgálata (The analysis of the impacts of motorways on regional development). *Közlekedéstudományi Szemle* 56. (4): 137–149.
Tóth, G. 2008. A közúti elérhetőség és a társadalmi-gazdasági folyamatok alakulásának vizsgálata Magyarországon (Investigation on road accessibility and socio-economic processes). *Közlekedéstudományi Szemle* 58. (3): 14–29.

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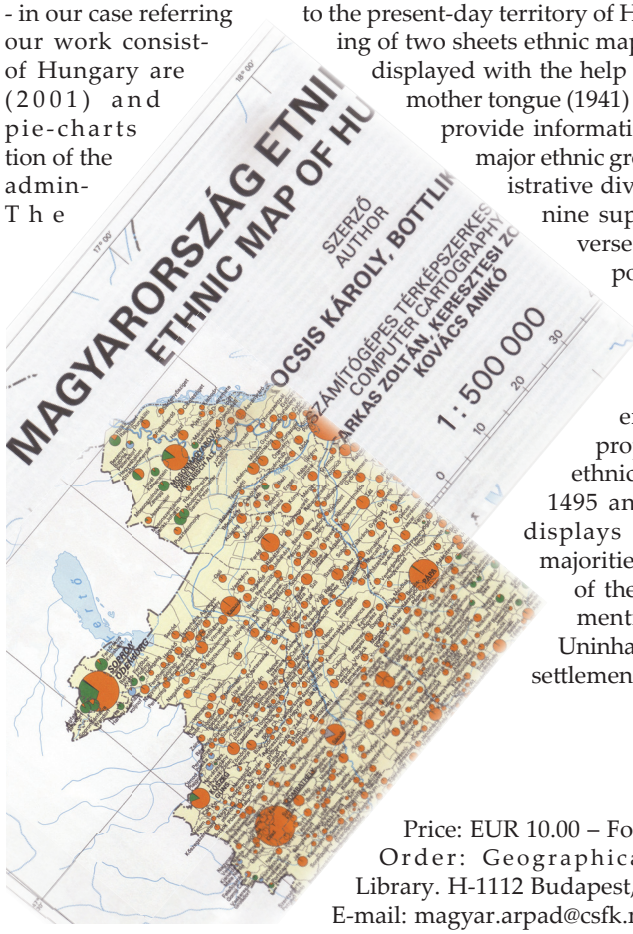
Ethnic map of Hungary 1941 + Ethnic map of present territory of Hungary 2001

Scale 1:500 000

Authors: KOCSIS, K. and BOTTLIK, ZS.

Geographical Research Institute, Hungarian Academy of Sciences, Budapest, 2009

The latest (eighth) piece of ethnic map series of the Carpathian Basin was an attempt to draft the changes that have taken place in the ethnic structure during the past five hundred years as well as to display its present state with the help of ethnic maps and a chart - in our case referring to the present-day territory of Hungary. On the front pages of our work consisting of two sheets ethnic maps of the present-day territory of Hungary are displayed with the help of pie-charts, based on ethnic mother tongue (1941) data. Population-proportional pie-charts provide information on the territorial distribution of the major ethnic groups and on the contemporary administrative division.



The nine supplementary maps on the reverse show the lingual-ethnic composition of the present-day territory of Hungary in 1495, 1715, 1784, 1880, 1910, 1930, 1941, 1990 and 2001 respectively. The chart here explores the quantitative and proportional changes of the main ethnic groups' population between 1495 and 2001. The series of maps displays absolute or relative ethnic majorities only in the inhabited areas of the settlements which had been mentioned in the source referred. Uninhabited areas with no permanent settlements are shown as blank spots.

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