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Conference Paper

Regional Characteristics of the Human Resources in Hungary During the Transitory Period

46th Congress of the European Regional Science Association: "Enlargement, Southern Europe and the Mediterranean", August 30th - September 3rd, 2006, Volos, Greece

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Rechnitzer, Janos; Smaho, Melinda (2006) : Regional Characteristics of the Human Resources in Hungary During the Transitory Period, 46th Congress of the European Regional Science Association: "Enlargement, Southern Europe and the Mediterranean", August 30th - September 3rd, 2006, Volos, Greece, European Regional Science Association (ERSA), Louvain-la-Neuve

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János Rechnitzer – Melinda Smahó

**Regional Characteristics of the Human Resources in
Hungary during the Transitory Period**

Conference Paper

Győr, May 2006

1. Human resources and regional development

The precise definition of the human resources, a concept heard so often that it now almost seems a common place, is not an easy task. What is the point? It is that the human resources, the institutions contributing to their development, and the total of the social conditions and endowments together constitute those assets that a spatial unit disposes of. These factors are present both in themselves and jointly, they have impacts, they shape – reinforcing or weakening each other – the given spatial unit, and by the multitude of the spatial units, the whole of the spatial structure (*Enyedi, Gy.* [1996]).

The recognition of knowledge in regional science as a factor determining regional development only started in the 1990s. The theories analysing regional development always reflected the current paradigms of economics, so for example the neoclassical theory dealt with the capital and labour effects (*Richardson*, [1969]); then the export base theory considered the role of the sectors shaping the economic structure in regional growth (*North* [1955]). In the 1970s, the theory of endogenous development already featured human resources among the internal factors. The focal points of the analyses were nevertheless the endowments of the economic structure (*Hahne* [1985]) or the shaping of the institutional system of regional policy, the handling of the limits and shortcomings in this system (*Stöhr* [1987]).

The theories explaining the development of the national economies and the factors of their competitiveness also tried to follow and model the changing economic environment, which led to the elaboration of “new growth theories” (*EC* [2004]). The followers of the “new (endogenous) growth theory” challenged the hypotheses of the neoclassical experts – who excluded the role of the technological changes on economic development – and integrated technological externalities in their model. One of their excellent representatives, *Romer* [1990] emphasises the importance of knowledge creation in his growth theory. He argues that knowledge is a dominant form of capital, and the volume of economic growth primarily depends on the accumulation of knowledge. The most important feature of the knowledge-based societies is that the creation and utilisation of knowledge is the central element of the value creation processes. He also emphasises that the technological changes occur as a consequence of the investments in new technologies and the human resources, as a return of these investments. Accordingly, technological development is to be seen as an endogenous factor of economic growth.

The theory of endogenous growth also supposes that all existing – codified and implicit (“*tacit*”) – knowledge is freely available for the creation of the new technical knowledge. However, this has not been reinforced by the latest researches, as the findings revealed that the spread of the new technological knowledge – especially of the implicit knowledge – has geographical limits (*Anselin et al.* [1997], *Varga* [1998], *Braczyk et al.* [1998]; *Malecki-Oinas* [1999]).

According to the Schumpeterian endogenous innovation model, the businesses carry out technological developments built on *innovations* in order to maximise their profits. The model considers these technological developments as the most important source of economic growth. This theory says that the businesses are engaged in research and development activities mostly to build out temporary monopolies and realise an extra profit (*Romer* [1990]).

Due to the imperfect competition, the businesses are able to realise enough profit from their new products to cover their research and development expenses. The innovations involving better quality and more service content than the previous products are capable of replacing previous generations of the products; consequently they secure the extra profit of the innovator. These innovations then serve as inputs for the development activities of other businesses, contributing this way to the development of the general technological level and to economic

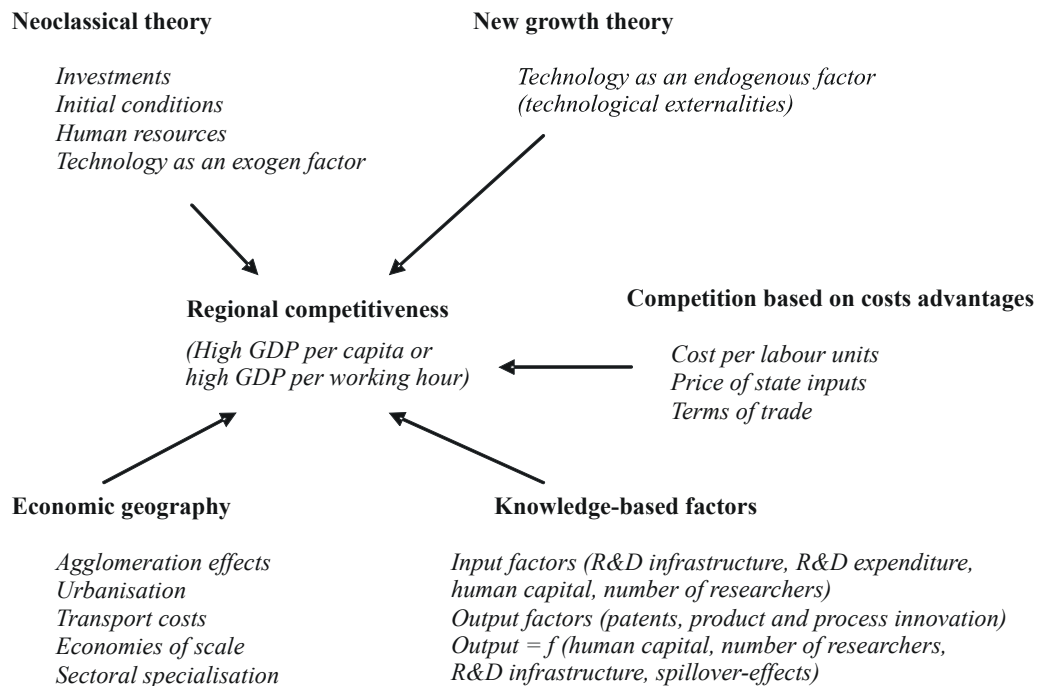
growth. Typical examples for these innovations are information and communication technologies. In the Schumpeterian model the volume of growth is determined by the returns of the research costs, which depends on the magnitude of resources spent on innovation, the size of the market, the profitability of the research and development activity and the market positions of the innovators.

The theories that belong to the economic approaches of the *new economic geography* try to find out what factors lead to the concentration of the economic activities and which factors influence primarily regional competitiveness. The equilibrium model of the new theory of economic geography, by *Krugman* [1991/2003] can explain not only the geographical concentration of the economic activities but also the factors motivating the spatial reallocation of production and the transition of the interregional division of labour. *Krugman's* model combined the theories of *Weber*, *Marshall* and the evolutionist economists (*Nelson*, *Winter*) in an innovative way. While *Marshall* e.g. builds his theory on the ideal of perfect competition, *Krugman's* approach also considers imperfect competition and the increasing returns. In his model, parallel to the decrease of the transport costs, the local markets lose some of their importance and the production becomes more and more mobile in space.

It comes from these theories that the competitive advantage of the advanced economies comes from their skills of knowledge production and knowledge utilisation in the first place. These days it is knowledge which is the basis of product, process and service innovations that also create new markets or make the production of the existing products and services cheaper. Knowledge comes from a continuous research and development activity that is carried out by highly skilled experts during an efficient technology transfer and the market implementation of the new ideas.

Knowledge-based economic development is typical for half of the OECD member states, an organisation involving the developed industrial countries. Knowledge production and the number of those employed in knowledge industries are rapidly increasing in these countries (*OECD* [1996]). The production of medium technology intensive and high-tech product increased from 44% in 1985 to over 50% by the turn of the millennium. The growth rate of these sectors has been significantly higher than the GDP growth rate for years (*Simmie* [2003]).

1. Figure: A different approach to regional competitiveness



Source: EC [2004], p. 131.

It is a generally accepted view that the wide spread of knowledge-based activities is playing an increasingly important role in the competitiveness of the respective countries and regions. Knowledge – as an essential component of innovation – is part of the circulation that leads to innovation and thus to the increase of export capacities and competitiveness. On the one hand, the export base of national and regional economies is the main driving force of growth. On the other hand, export and trade are most important mediators of internationally available knowledge and the transfer of skills indispensable for innovation – and the innovation loop is closed.

The models introduced by *Hagerstrand* [1952], describing the spatial spread of innovation launched those surveys that lead to the description of the innovation milieu where the role of the human resources is already of utmost importance (*Camagni* [1991]; *Rechnitzer* [1993]). Only one step further is the theory of knowledge regions that sees the new driving force of development in the accumulation of skills and in the institutions and actors responsible for that, also defining a new paradigm for regional development (*Scheff* [1999]; *Rösch* [2000]).

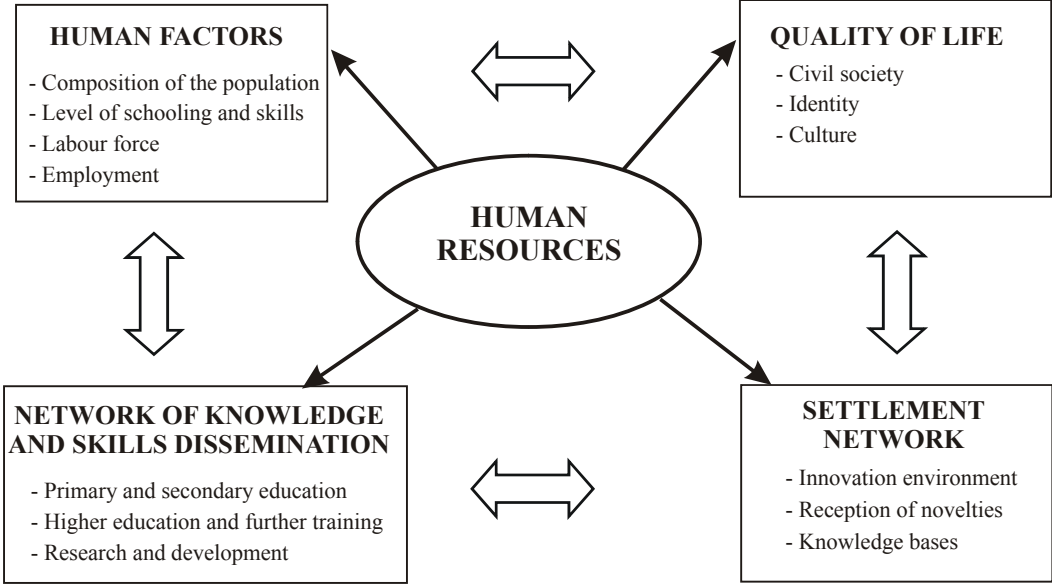
Meusburger [1998] devoted a comprehensive monograph to the introduction of the regional dimension of knowledge and training, in which we get an insight not only into the theoretical bases necessary for the survey of the new factor of economic development but also find the most important aspects and methods for the analysis of the human resources.

The Hungarian regional researches have neglected the analysis of knowledge of a new element in regional development so far. Essays were written on the independent, individual analysis of the respective elements of human resources, but these assessed the processes of the last decade and a half or the spatial transition of certain constituent factors not systematically, but from the aspect of the sectoral factors or the traditional regional resources (*Vámos* [1992] *Tóth-Trócsányi* [1997], [2000]).

It is a new challenge thus to analyse the spatial aspects of the human resources, as we do not wish to describe this resource of innovation by one single factor, i.e. population; instead we

focus on the effect mechanisms and the system of factors that mostly influence the human resources in a respective region. We divided this system into **four** constituents (human factors; quality of life; knowledge and skills dissemination; settlement network), as seen in *Figure 2*.

2. *Figure: Spatial factors influencing human resources*



Source: compiled by the authors

Each of these elements deserves a separate study, so we have selected a few of their components – for which territorial information is available –, and we attempt to introduce the processes of the 1990s on the basis of these.

In our essay we used the results of the Hungarian literature and the findings of Hungarian researches, we summarised them from the aspect of the human resources, and we carried out supplementary survey where we found it necessary, or we updated the data. In our work we tried to grab the processes of the 1990s in the first place, expanding our skills on the regional characteristics of the human resources in the transitory period.

2. The network of knowledge and the communication of information

The spatial characteristics of the institutions and personal conditions mediating knowledge have a fundamental effect on the human resources. We could presume that education as a public service is spatially equally distributed, as it should be available to each citizen. However, neither the network nor its quality is spatially even; several differences can be seen in both factors, accordingly the distribution of the human resources shows considerable differences, too.

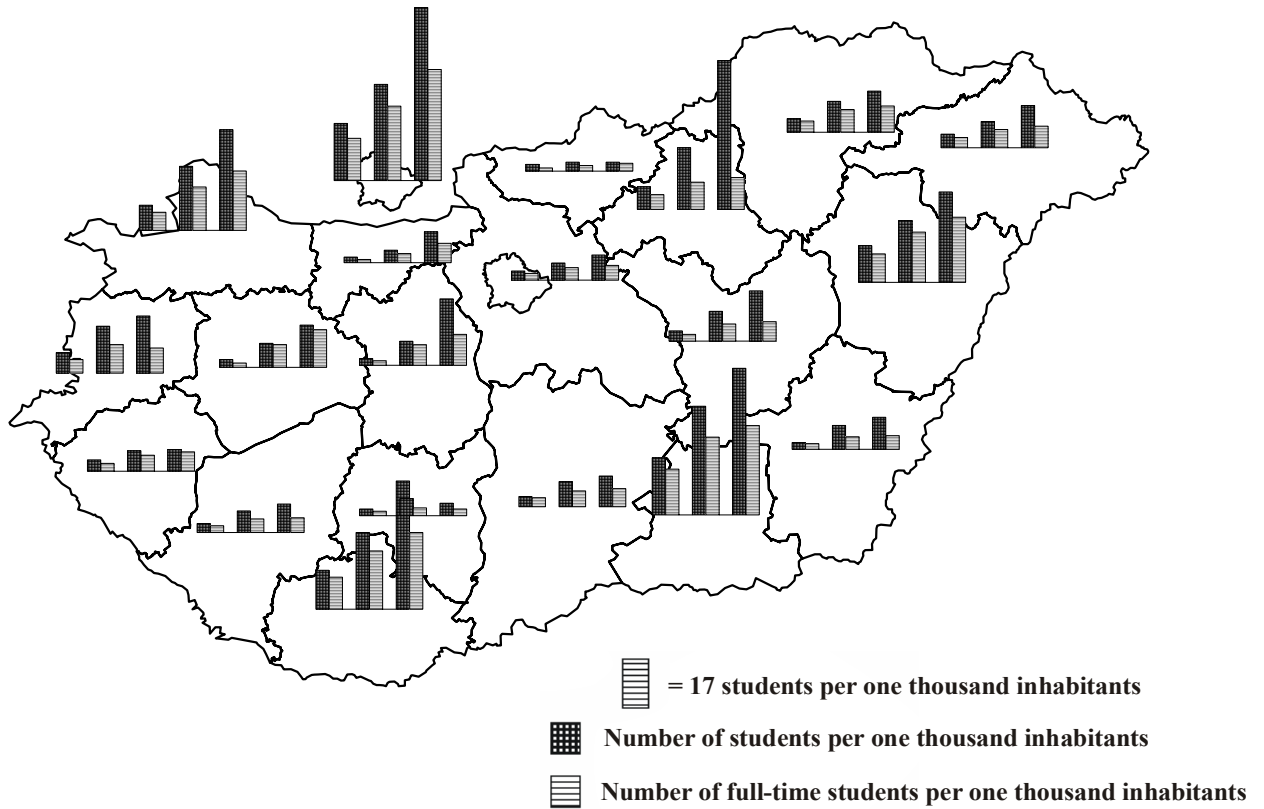
The network of higher education and knowledge mediators

The role of higher education is dominant in the development of human resources. While in the early 1990s 15.1% of the population aged 20–24 studied at higher education institution, and the proportion of full-time students was 11.3%, in 2001 the same figure for the respective age group was 42.9%, and 23.8% of this generation participated in full-time training. While in 1990 there were about 102,000 students participating in higher education, their number grew to 3.42-fold by 2001 (349,000 students), within that, the growth of students participating in full-time training was 2.51-fold. Actually 250,000 students had to be given new forms of training (e.g. post-secondary, remote training), new institutions had to be organised, new specialisations and the training of new professions had to be launched¹. The reforms started in the 1980s, already, but the systemic change created a more open system of higher education, more sensitively reacting to the economic and social processes and also a system with a bigger independence – together with its more and more complex contradictions.

The regional breakdown of the growth of the number of students is not even (*Figure 3*). Budapest kept its leading position, although the share of all enrolled students in the institutions of Budapest fell from 44.1% in 1990 to 38.5% in 2001, and within that the participants of full-time training were not more than 42.1%. A balanced spread of the higher education institutions was typical in the 1990s, which led to the decrease of the spatial disparities on the whole (*Forray–Kozma [1999]*). Every county seat or second order centre that had any pride and also some traditions in higher education tried to build out or develop their positions in some way, as a result of which there are 42 settlements in Hungary now with higher education institution (*Figure 4*).

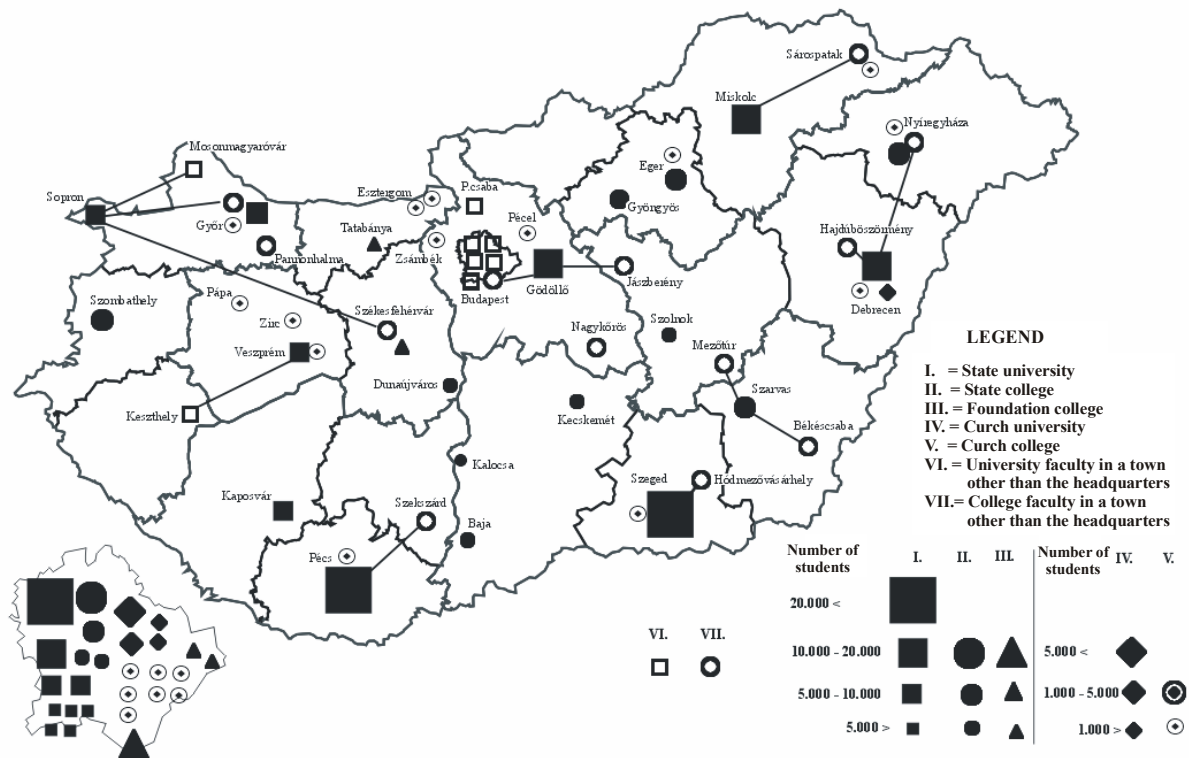
¹ The register of the Hungarian Accreditation Board follows the university and college majors, whose number is continuously growing, partly due to the competition of the institutions and partly because of the more and more specialised demands (www.mab.hu).

3. Figure: Number of higher education students in the counties, 1990, 1996, 2001 (students per 1,000 inhabitants)



Source: calculation by the authors based on HCSO data

4. Figure: Spatial distribution of the higher education institutions in 2002



Note: we did not feature all institutions in the map, as we only considered the units down to the faculty level, excluding institutions and other smaller forms of higher education (for example centres of consultancy).

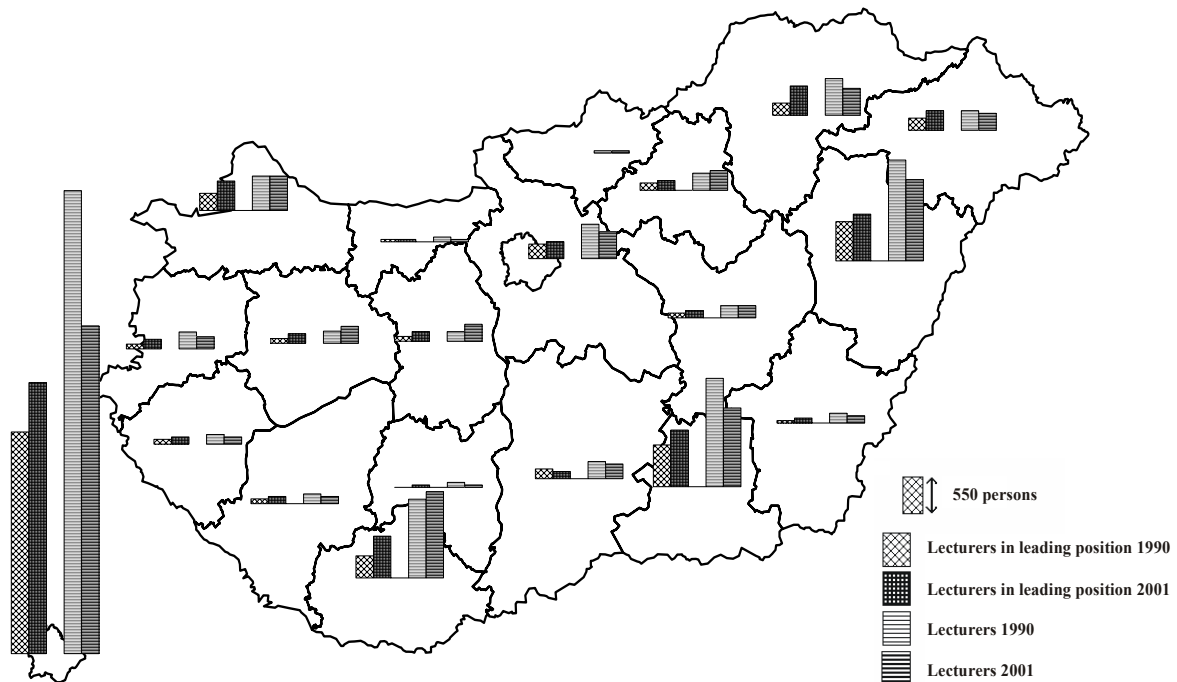
Source: Ministry of Education, Department of Statistics

We can witness a spectacular growth of the number of students and of the places and supply of training, as the new institutions received a large mass of students and offer almost all forms of training (post-secondary, graduate, professional further training, doctoral school). The counties home to institutions established in the 1990s mainly on local initiatives (mostly as foundations or organisations created as outlets of some Budapest institutions in the county seat, gradually becoming independent) have outstanding positions (Fejér, Komárom-Esztergom, Jász-Nagykun-Szolnok, Békés). In the development of the existing networks some counties or their centres are also very dynamic (Heves, Veszprém, Győr-Moson-Sopron, Baranya, Pest and Szabolcs-Szatmár-Bereg)². The division line of development might be 1996: from 1990 until 1996 the number of students had been steadily growing, but in the counties listed above and their centres of higher education the number of students grew by leaps again. There is a long list of reasons; the dominant is the appearance of several market elements in training (e.g. paying courses, remote training), also, the demand for certain professions grew extremely rapidly (e.g. for economists, ICT experts, lawyers, communication experts etc.), whereas some profession lost their popularity steadily (e.g. teachers) or temporarily (e.g. training of engineers). Some institutions were able to better adapt to these market effects than the others, so a new, spatially quite even structure of higher education can be seen now in Hungary, assisted by the integration of several state-owned higher education institutions in the late 1990s (in 2000).

By the late 1990s the number of those participating in higher education more than tripled. The question is what human resources this spectacular growth is built on. Higher education requires well-trained experts and trainers, so it can be set as a requirement that the lecturers should be experts with adequate qualifications (professional qualifications, scientific degrees). The comparison of the staff of lecturers in 1990 and 2001 reveal thought-provoking characteristics (*Figure 5*).

² Only taking growth exceeding the national average into consideration.

5. Figure: Number of full-time lecturers in the higher education institutions of the counties, 1990, 2001



Source: Calculation by the authors. Source of the data: Statistical Bulletin. Felsőoktatás 1990/91; Felsőoktatás 2000/2001. Ministry of Education.

While the number of students multiplied, the set of lecturers remained intact both in its number and structure, or their number even slightly decreased (by 5.9%) during the decade of great reforms³. The number of senior lecturers (university or college professors, associate professors) actually did not change much, and the structure of the set of such lecturers did not change significantly, either. Parallel to the decrease of the share of the capital city in higher education, there was only a slight decrease in the proportion and number of the senior lecturers of the Budapest institutions (50.7% in 1990 and 47.7% in 2001). The newly employed lecturers actually substitute those leaving the institutions, so the larger number of students is served by the same number of lecturers as before⁴. The structure of the lecturers' status did not become better, as in the larger university centres the growth of the proportion of the senior lecturers did not keep up with the increase in the number of students. In the new centres of higher education, the number of lecturers was adjusted to the growth of the number of students. Presently it is frequent that the senior lecturers travel, commute from the capital city or some large regional centres of higher education to the new institutions. The everyday lecturing is done by the local lecturers who usually do not (yet) possess scientific degrees. However, the qualification system of higher education requires that the persons responsible for the majors or the subjects should be

³ On the basis of statistics published by the Ministry of Education, the number of full-time lecturers decreased, while the data published by the Hungarian Central Statistical Office reveal a growth in the number of lecturers. According to the oral statement of the HCSO, the difference is due to the fact that the HCSO data contain not only the data of the full-time lecturers.

⁴ Personal fluctuation is strengthened by the fact that the number of PhD doctors was 3.300 in the new qualification system, and a total of 6.500 people received scientific degrees, habilitation (university private lecturer status) was achieved by 2.150 persons (www.mab.hu). These figures show that the majority of the scientific qualifications are absorbed by higher education; they actually secure the continuous supply of qualified personnel.

senior lecturers, which is the case formally, in paper – but in practice this requirement is only met with difficulties in the new institutions and majors.

This leads to survival of the intellectual leading and organising role of the capital city in the long run, in fact, the intellectual resources are further concentrated, as the capital city did not become an “exporter” but remained an “importer” of intellectual goods in the 1990s. The new centres of higher education in the countryside can only become the intellectual centres and promoters of their regions with great difficulties, as they have an extremely low proportion of qualified personnel, and they are engaged with lecturing; also, those who are responsible for majors and professions (at least formally), are usually not more than “commuters”, in the professional jargon they are called “intercity professors”. The regional disparities, the concentration of the highly qualified experts in the capital city can be best demonstrated by the spatial distribution of the members of the public body of the Hungarian Academy of Sciences (*Table 1*).

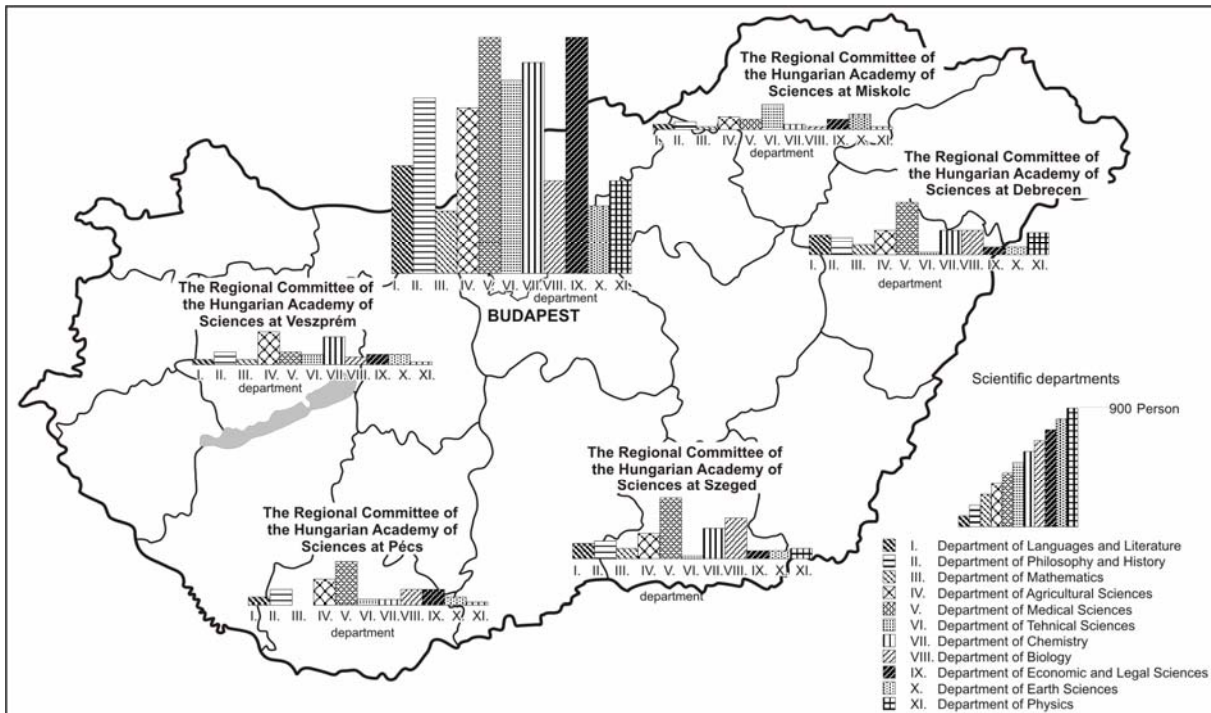
The distribution of the members of the public body of the Hungarian Academy of Sciences according to their place of residence shows a clear dominance of Budapest, supporting our statement above that the capital city is the greatest “supplier” and also the receiver of the highly qualified intellectual resources these days. The regional disparities can be further elaborated by highlighting the structural problems, i.e. looking at the number of members in the different science classes of the public body, in a breakdown by the regional academic committees (*Figure 6*).

1. *Table*: Regional distribution of the members of the public body of the Hungarian Academy of Sciences, 2000

Region	D.Sc. (persons)	Doctor of the HAS (persons)	C.Sc. (persons)	Ph.D. (persons)	Total	
					(persons)	in %
Budapest and its hinterland	1434	103	4138	524	6199	65,7
Debrecen and its hinterland	141	12	534	130	817	8,7
Miskolc and its hinterland	42	1	273	49	365	3,8
Pécs and its hinterland	93	5	370	55	523	5,5
Szeged and its hinterland	195	15	532	104	846	9,0
Veszprém and its hinterland	84	6	375	54	519	5,4
No data available	25	1	118	28	172	1,9
Total	2014	143	6340	944	9441	100

Source: Data on the non academy doctor members of the public body of the Hungarian Academy of Sciences (as of 24 September 2000.) Research Organisation Institute of HAS, Budapest

6. Figure: Breakdown of the public body members of the HAS by science classes in the territories of the respective regional committees, 2002



Source: HAS.

The structure is stable, in other words: it is extremely conservative. Looking at the structure of the regional committees, the number of qualified persons in the traditional university and higher education professions is outstanding. For example, in the Veszprém Academic Committee working in North Transdanubia, the number of agricultural experts (Keszthely, Mosonmagyaróvár), and of chemists (Veszprém) is the highest. The proportion of economists and lawyers is low among the members of the public body (8.2 per cent), although such trainings at university level are done in three places of the region (Győr, Sopron and Veszprém), parallel to college level training in four places (Dunaújváros, Tatabánya, Székesfehérvár and Szombathely). This phenomenon is typical in all academic regions, which implies the inner content of the regional disparities of the intellectual resources and thereby the lasting, long-term contradictions of the Hungarian human resources.

Regional disparities and characteristics of research and development

In regional policy there is a more and more definite demand to integrate technology development both into its objectives and into the tools and institutional system of implementation. It has been recognised that the competitiveness of a given region can only be enhanced by the more and more sophisticated systems of research and development. It is absolutely necessary to explore all forms of research and development at regional level and to activate them, partly to strengthen the regional endowments and partly to adjust them to the general processes of R & D. The national monopoly of science and technology has ceased to exist; its gradual decentralisation has started by the promotion of regionalisation. This resulted both in the transformation of the institutional system and the more equal spread of the central resources, the elaboration of new financing models and the novel measurement of the efficiency of developments.

The transformation had a deep impact on research and development, similarly to the other sectors of the economy. The elimination or transformation of the system of large state-owned companies tore apart the previous economic and R & D co-operations. The decreasing number of orders from companies at the turn of the 1980s and 1990s, the declining national income and then the consolidation of the state budget, together with the concomitant consolidation of higher education and the academic sector postponed the fall of the R & D sector to the end of the decade (*Table 2*). While the GDP has been continuously increasing since 1994, although at a slowing pace, the decrease of the share of R & D reached its nadir in 1996. In 1987 the R & D expenditure made 2.6% of the GDP, in 1989 it was still 2.0%, then it fell to 0.7% of the GDP by 1996. This figure stagnated until 1999, since then the positions of R & D have improved by 0.1% annually, exceeding 1% by now, still lagging far behind both the Hungarian figures of the late 1980s and the present figures of the European Union.

2. *Table: Conditions of research and development*

	GDP index (1989=100)	R & D expenses in % of GDP
1989	100	2.0
1990	94	1.6
1991	83	1.1
1992	80	1.1
1993	79	1.0
1994	81	0.9
1995	82	0.8
1996	81	0.7
1997	85	0.7
1998	88	0.7
1999	90	0.7
2000	95	0.8
2001	98	0.9

Source: calculation by the authors based on HCSO data

The positions of the scientific researches in the last decade were characterised by the narrowing down of the resources on the one hand, and a considerable restructuring, on the other (*Magyarország 1990–2001* [2002]). The available – human and financial – resources decreased in the time of the decline or stagnation of the economic performance, later stagnated in the years following the start of the economic growth, and still later they moderately grew. The present level – approximately 1 per cent of R & D expenditure from the GDP – is far below the European average and only half of the Hungarian figure ten years ago.

The restructuring in the field of research and development resulted in the decrease of the state financed researches, on the one hand, and the relative strengthening of R & D in the company sector and even more in higher education, on the other. The share of R & D employment – parallel to a significant decline in total employment – decreased significantly, although not to the same extent as the resources, later it stagnated. The total of R & D expenditure grew significantly in numbers, but it did not reach the extent of the inflation. The most significant financial source of R & D expenses is still state budget. In the second half of the decade – as a consequence of the foreign investments and the accession process to the European Union, e.g. the participation in the 5th and 6th framework programme of the EU –, the role of foreign and international organisations is also visible now in financing.

In 1989 almost half of the R & D expenditure was used in state-owned research institutes and other research places, 38 per cent in the business sector and the rest in higher education. The share of budgetary sector has continuously decreased, the reasons for which are the transformation of certain research institutes into business ventures or the closedown of some institutes, and the decrease of the budgetary support. The proportion of budgetary organisations fell to less than 30%, the share of businesses grew to 44%, that of higher education to 28%.

As regards the number of employees, the shares of the business and the higher education sectors changed the most dramatically (*Table 3*). The number of employment in the state-owned R & D sector fell to one-third by the middle of the decade, and its share from the whole sector also fell from 42% to 29%. This situation did not change much until the turn of the millennium. Higher education suffered a more moderate loss of employment, and by the beginning of the new decade it had 10% more researchers, but 5% less auxiliary staff than in the late 1980s. The proportion of research and development staff in higher education grew from 26% to 40% in 12 years. In the public sector, the number of researchers fell to almost a half in the period in question, while their proportion from the total number of researchers moderately decreased. The fall of the number of auxiliary staff was larger than that of the researchers and developers, so the share of R & D staff grew from 48% in 1989 to 64% by now.

3. *Table: Employment in research and development**

	R & D staff,					
	number (thousand people)			proportion (per cent)		
	1989	1995	2001	1989	1995	2001
Budgetary sector	15.9	7.7	7.8	37.6	39.3	33.9
<i>of which: research and development</i>	7.4	3.9	4.7	36.3	37.1	32.0
Business sector	17.7	5.6	6.8	41.8	28.6	29.6
<i>of which: research and development</i>	7.7	2.6	4.1	37.7	24.8	27.9
Higher education	8.7	6.3	8.4	20.6	32.1	36.5
<i>of which: research and development</i>	5.3	4.0	5.9	26.0	38.1	40.1
Total:	42.3	19.6	23.0	100.0	100.0	100.0
<i>of which: research and development</i>	20.4	10.5	14.7	100.0	100.0	100.0

* Number calculated for the full-time employees in proportion with the time spent on research and development activities

Source: calculation by the authors based on Magyarország 1990-2001 [2002] p. 70. and Hungarian Statistical Yearbook 2001. p. 513.

The impact of the transformed system of scientific qualifications is now visible; the number of those with such qualifications is 49% higher now than it was in 1989. Almost 60% of those in this category – doctors of science, candidates of science, PhD-s – work in research and development places. The structure of the activity transformed, too. As regards expenditure, in the late 1980s experimental researches, in the mid-1990s basic and applied researches, in 2001 experimental researches once again were the primary activity.

Changes of the territorial structure

In our survey we were able to calculate the first spatial order on the basis of three parameters for 1995 (number of R & D places, R & D expenditure per one inhabitant, number of researchers and developers per 10,000 inhabitants), so we can relate to the deepest crisis of the Hungarian R & D capacities and performance. If we add up the positions, we get a sort of order for the R & D potential of the respective countries for the given year. The second order was made on the basis of the last available data, the data for 2001. Although a six-year period is a relatively short time for monitoring the major changes, (*Table 4*).

The table shows that hardly any change occurred in the relative R & D potential that had emerged by the middle of the last decade. Breaking down the order into groups of five we can see that for the majority of the counties maybe the position within the respective group of five changed somewhat.

The same five counties can be seen in the first – best – group: Győr-Moson-Sopron and Baranya changed positions, due to the relatively better R & D expenditure proportions of the previous county. This is attributable to the revival of the business R & D (e.g. by the Audi automotive company) and also to the expansion of the higher education capacities. The improvement of the position in the R & D expenditure projects that the total R & D potential of the county will improve, too. This makes it possible that Győr-Moson-Sopron will come up to position three, if the present trends continue.

4. Table: Order of the R & D potential, 1995, 2001

Final order	County	R & D places (1996)	R & D expenditure per one inhabitant	Research and development staff per 10,000 inhabitant	Total of positions
1995					
1.	Budapest	1.	1.	1.	3.
2.	Csongrád	2.	2.	2.	6.
3.	Hajdú-Bihar	4.	3.	3.	10.
4.	Baranya	3.	7.	4.	14.
5.	Győr-Moson-Sopron	6.	5.	5.	16.
6.	Veszprém	8.	4.	6.	18.
7.	Pest	7.	8.	8.	23.
8.	Borsod-Abaúj-Zemplén	5.	11.	7.	23.
9.	Fejér	12.	6.	12.	30.
10.	Szabolcs-Szatmár-Bereg	9.	10.	11.	30.
11.	Heves	10.	12.	10.	32.
12.	Jász-Nagykun-Szolnok	13.	13.	8.	34.
13.	Békés	16.	9.	15.	40.
14.	Vas	11.	17.	14.	42.
15.	Somogy	17.	14.	13.	44.
16.	Bács-Kiskun	14.	15.	16.	45.
17.	Tolna	18.	16.	18.	52.
18.	Zala	15.	19.	19.	53.
19.	Komárom-Esztergom	18.	18.	20.	56.
20.	Nógrád	20.	20.	16.	56.
2001					
1.	Budapest	1.	1.	1.	3.
2.	Csongrád	2.	2.	2.	6.

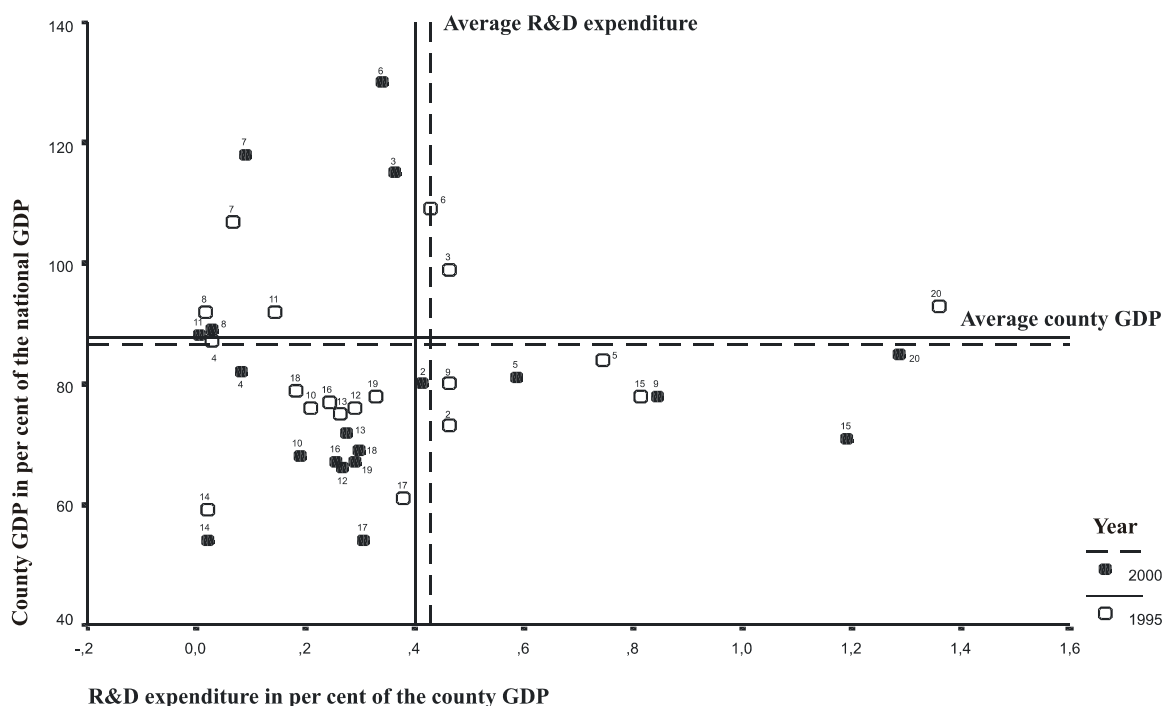
3.	Hajdú-Bihar	3.	4.	3.	10.
4.	Győr-Moson-Sopron	6.	3.	5.	14.
5.	Baranya	5.	6.	4.	15.
6.	Veszprém	7.	5.	7.	19.
7.	Pest	4.	8.	8.	20.
8.	Fejér	11.	7.	6.	24.
9.	Borsod-Abaúj-Zemplén	8.	13.	9.	30.
10.	Bács-Kiskun	10.	10.	13.	33.
11.	Somogy	13.	12.	10.	35.
12.	Békés	12.	9.	15.	36.
13.	Heves	14.	14.	11.	39.
14.	Szabolcs-Szatmár-Bereg	9.	17.	14.	40.
15.	Jász-Nagykun-Szolnok	17.	11.	17.	45.
16.	Vas	15.	18.	12.	45.
17.	Komárom-Esztergom	16.	15.	16.	47.
18.	Zala	18.	16.	18.	52.
19.	Tolna	19.	20.	19.	58.
20.	Nógrád	20.	19.	20.	59.

Source: Bulletin of the West Transdanubian Research Institution, CRS of HAS, 152/d

In the group containing the weakest five counties there are no more than two changes. On the one hand, Komárom-Esztergom and Tolna county changed positions 17. and 19., now Komárom-Esztergom has the better position; on the other hand, a new actor showed up at position 16: Bács-Kiskun county was replaced by Vas county. As regards the change of the positions in the order, the position of three counties changed considerably for the better and also three for the worse; the total position of Bács-Kiskun improved by 12 scores, moving the county from position 16 to 10, while the positions of Somogy and Komárom-Esztergom improved by 9 scores in both cases. For Somogy county it meant two, for Komárom-Esztergom four positions advance in the order. The biggest decline was shown by Jász-Nagykun-Szolnok and Szabolcs-Szatmár-Bereg counties: the total of the scores increased by 10 for Jász-Nagykun-Szolnok, so it fell 4 positions back in the hierarchy, while Szabolcs-Szatmár-Bereg's total of scores increased by 11, putting the county three places back in the order.

While the orders highlighted in *Table 4* only measure the relative potentials and the changes of those, the two-dimension scaling of the county R & D performance within the county GDP and economic development level (specific regional GDP) better reflects the positions of R & D within the respective counties. Also, it has important messages for the R & D and regional policy (*Figure 7* and *Table 5*). If we feature the two indices on the two axes of a coordinate system, the four fields represent four basically different groups of counties, as regards their R & D potential. The horizontal axis of the system demonstrates the R & D performance of the respective counties compared to the county GDPs, while the vertical axis was used to show the specific economic performance of the respective counties compared to the national average.

7. Figure: Regional development level and the level of R & D, 1995, 2001



The identification numbers of the counties are in Columns 1 of Table 5.

Note: the value of Budapest is in the upper right corner in both years, but its position compared to the GDP average will not fit into this figure.

Source: Bulletin of the West Transdanubian Research Institution, CRS of HAS, 152/d

There are two possible solutions to set a dividing axis. The first is to compare the value of both factors to their average; the other is the use of a theoretical division line. We used the latter in our analysis. In the case of the R & D performance, the value of 1.0% within the GDP was the limit above which a county has relatively favourable R & D performance or potential by the Hungarian standards. Below the 1.0% level, the R & D positions of the respective county are moderate or weak. In the case of the specific GDP values, we set the value of 100 as the limit above which a county has strong, below which weak it has positions. The coordinate system thus features the following four groups:

- strong economic potential and favourable R & D capacities (upper right field);
- weak economic potential and favourable R & D capacities (lower right field);
- strong economic potential and moderate R & D capacities (upper left field);
- weak economic potential and moderate R & D capacities (lower left field).

5. Table: Regional development level and the level of R & D, 1995, 2001

County*	1995			2000		
	R & D expenditure in per cent of the county GDP	county GDP in per cent of the national GDP	L: low H: high	R & D expenditure in per cent of the county GDP	county GDP in per cent of the national GDP	L: low H: high
Budapest (1)	1.44	181	HH	1.50	196	HH
Pest (2)	0.46	73	LL	0.41	80	LL
<i>Central Hungary</i>	<i>1.28</i>	<i>144</i>	<i>HH</i>	<i>1.29</i>	<i>154</i>	<i>HH</i>
Fejér (3)	0.46	99	LL	0.36	115	LH
Komárom-Esztergom (4)	0.03	87	LL	0.08	82	LL
Veszprém (5)	0.74	84	LL	0.59	81	LL
<i>Middle Transdanubia</i>	<i>0.44</i>	<i>91</i>	<i>LL</i>	<i>0.36</i>	<i>94</i>	<i>LL</i>
Győr-Moson-Sopron (6)	0.43	109	LH	0.34	130	LH
Vas (7)	0.07	107	LH	0.09	118	LH
Zala (8)	0.02	92	LL	0.03	89	LL
<i>West Transdanubia</i>	<i>0.22</i>	<i>103</i>	<i>LH</i>	<i>0.20</i>	<i>115</i>	<i>LH</i>
Baranya (9)	0.46	80	LL	0.84	78	LL
Somogy (10)	0.21	76	LL	0.19	68	LL
Tolna (11)	0.14	92	LL	0.00	88	LL
<i>South Transdanubia</i>	<i>0.29</i>	<i>82</i>	<i>LL</i>	<i>0.41</i>	<i>77</i>	<i>LL</i>
Borsod-Abaúj-Zemplén (12)	0.29	76	LL	0.27	66	LL
Heves (13)	0.26	75	LL	0.27	72	LL
Nógrád (14)	0.02	59	LL	0.02	54	LL
<i>North Hungary</i>	<i>0.24</i>	<i>73</i>	<i>LL</i>	<i>0.23</i>	<i>66</i>	<i>LL</i>
Hajdú-Bihar (15)	0.82	78	LL	1.19	71	HL
Jász-Nagykun-Szolnok (16)	0.24	77	LL	0.25	67	LL
Szabolcs-Szatmár-Bereg (17)	0.38	61	LL	0.31	54	LL
<i>North Great Plain</i>	<i>0.51</i>	<i>71</i>	<i>LL</i>	<i>0.64</i>	<i>64</i>	<i>LL</i>
Bács-Kiskun (18)	0.18	79	LL	0.30	69	LL
Békés (19)	0.33	78	LL	0.29	67	LL
Csongrád (20)	1.36	93	HL	1.29	85	HL
<i>South Great Plain</i>	<i>0.64</i>	<i>83</i>	<i>LL</i>	<i>0.65</i>	<i>74</i>	<i>LL</i>
<i>Total</i>	<i>0.76</i>			<i>0.79</i>		

* The numbers in the brackets are the identification numbers of the counties used in Figure 7.

Source: calculation by the authors based on the Hungarian Statistical Yearbook 1995 (p. 458.) and 2001 (p. 518.)

The applied two-dimensional scaling shows a rather homogeneous picture of the economic development and R & D positions of the Hungarian counties (Table 6). Three-quarters of the counties can be found in field 4, both in 1995 and 2001. The figure also shows that in these counties the stagnation or moderate growth of the R & D performance, a decline of the economic potential compared to the average is typical. This tendency will remain typical in the coming years, despite the increasing spatial disparities of the economic development measured with the GDP and the catching-up programmes of regional development policy. It comes from the fact that the foreign direct investments arriving at the more advanced counties in the middle of the 1990s implement at least the supplementary investments necessary to secure the competitiveness of the counties, whereas the counties with a shortage of capital received less capital injections compared to the more developed counties in the last years (with the exception of the multinational retail networks).

6. Table: R & D potential and the types of economic development

<p><u>III. Strong economy, moderate R & D</u> <i>Fejér, Győr-Moson-Sopron, Vas</i></p>	<p><u>I. Strong economy, intensive R & D</u> <i>Budapest</i></p>
<p><u>IV. Weak economy, moderate R & D</u> <i>Baranya, Bács-Kiskun, Békés, Borsod-Abaúj-Zemplén, Heves, Jász-Nagykun-Szolnok, Komárom-Esztergom, Pest, Nógrád, Somogy, Szabolcs-Szatmár-Bereg, Tolna, Veszprém, Zala</i></p>	<p><u>II. Weak economy, intensive R & D</u> <i>Csongrád, Hajdú-Bihar</i></p>

Source: Table 10.

In the Hungarian circumstances it is only Budapest that belongs to the ‘strong economy–favourable R & D performance’ category. In the figure we did not show the values of the capital city, as in this case the national average calculated with the capital city would have narrowed down the other categories, and the changes of the positions of the respective counties between the two years in question would have blurred. The good R & D potential is unfortunately coupled with weak economic performance in Csongrád and Hajdú-Bihar counties, as the good R & D performance is incapable of improving the economic performance to a level that increases the overall relative economic positions of the respective counties.

In the case of three counties – Fejér, Győr-Moson-Sopron and Vas – we can see a disharmony between the R & D capacity and the relatively advanced economic performance. It is not surprising that the regional development programmes of both West Transdanubia and Middle Transdanubia treat the development of the innovation milieu as a selected priority and both regions have worked out their *regional innovation strategies*.

The figure shows that the positions of two counties changed considerably over the period in question, which means that they moved from one field of the coordinate system to another. Hajdú-Bihar county moved from field 4 – with a worsening economic potential – to the sector with favourable R & D capacities. Fejér county, also from sector 4, moved to the sector that implies good economic performance, besides worsening R & D performance.

As a summary we can say that in the short run the good R & D capacities did not affect the growth of the county GDP values in Hungary, and vice versa, the outstanding economic performance – by Hungarian standards – is not founded by the increase of the R & D capacities.

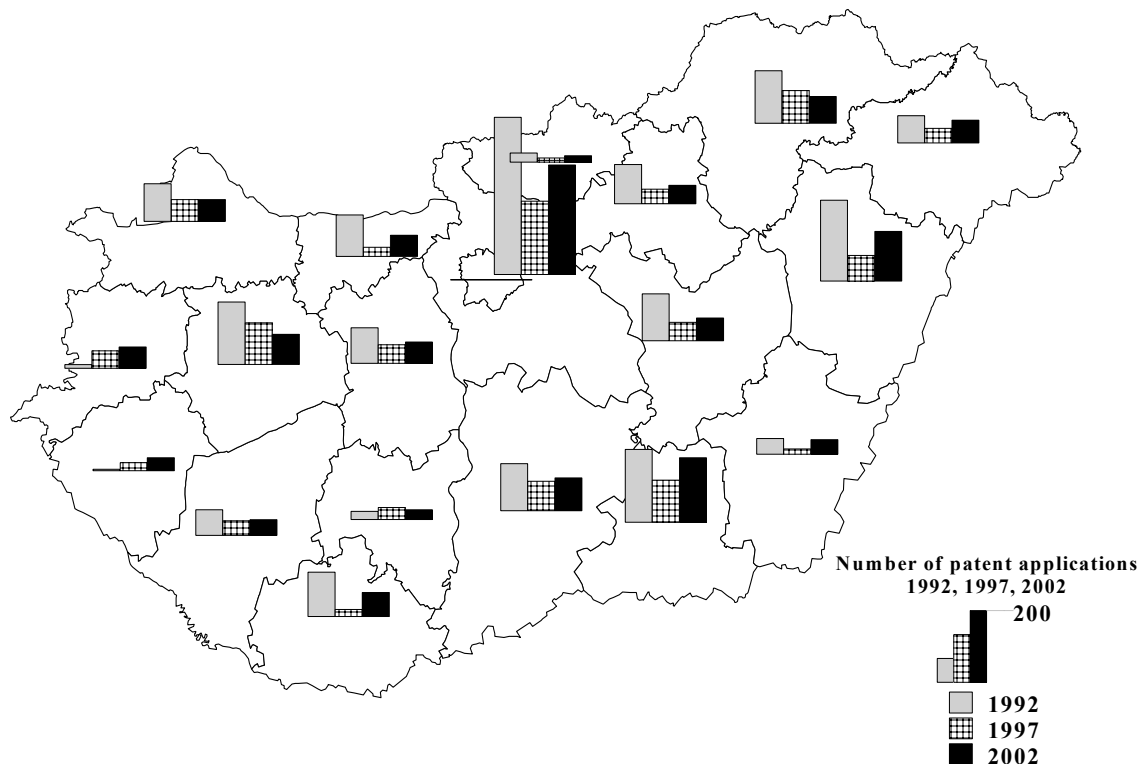
Characteristics of the transitory period

The concentration of the resources of research and development in the capital city did not decrease; in fact, it increased in the years of the transition. The activities, organisations and also the information carrying the innovations are all concentrated in Budapest. The significant organisational changes taking place in the research and development sector hit the capital city too, nevertheless Budapest kept its leading position in this sector.

As an example let us take a look at the applications for patents, which well illustrates the spatial structure of research and development. While in 1992 almost 2,700 applications for patents were submitted to the Hungarian Patent Office, the number of applications continuously decreased over the decade, reaching the nadir in probably 1998. The national tendency of the change in the number of applications for patents could also be seen in most of the counties, while the spatial distribution of the applications shows a very much differentiated picture (Figure 8).

In absolute terms, the most dramatic changes took place in the case of Budapest in the previous decade: while in 1992 a total of 1,544 applications for patents were submitted in capital city, in 1997 this number dropped to less than half, and the number applications submitted in 2002 was just over that in 1992. Parallel to the changes following the national tendencies, the concentration of Budapest was typical all the time, although its scale decreased somewhat: in 1992, 57% of the applications for patents were submitted by Budapest persons or organisations, by 1997 this figure decreased to 55%, and to 50% by 2002.

8. *Figure:* Number of applications for patents at the Hungarian Patent Office by counties*, 1992, 1997, 2002



* The Data of Pest county without Budapest

Source: edited by the authors based on the data of the Hungarian Patent Office

The number of applications for patents per one million inhabitants was 262 in 1992; this figure fell back to 130 by 1997 and then started to rise again after the nadir, to reach 154 applications per one million inhabitants by 2002.

The total number of research and development units decreased, the majority of them was reorganised. Those organisations that were closed down were usually the ones outside Budapest, in the countryside centres. A limited number of research and development businesses appeared, as in a few centres (Győr, Székesfehérvár) the developers of the large businesses founded smaller organisations, several of whom still successfully operate, having expanded their activities.

A few large multinational companies have located or are planning to locate research and development units to Hungary, and these units are usually concentrated in Budapest and its region, too. Their connections to the universities, to higher education and to other research units are still weak, it has only been initiated in Budapest and a few other cities of Hungary so far that innovation parks should be organised parallel to the universities, creating thereby a considerable intellectual concentration that also entails economic and regional development

effects. In the rural higher education and economic centres the will to found innovation and technology centres is given, but the resources are missing, the organisational structure and the development directions are unsettled yet and the permanent interest conflicts of the stakeholders set back the initiatives.

While the renewal of the economic structure was faster and more successful in the western and north-western parts of Hungary, these regions were and still are in a very bad situation as regards research and development and also higher education. The only progressive connection that we can see is the one between the restructuring of the economy of the capital city and the research and development and higher education basis of Budapest – due to the large-scale concentration –, but such a phenomenon is completely missing in the non-capital city centres, in fact, just the opposite is the typical case.

The renewal of the territorial structure of Hungary and the performance of the economy is not connected directly to research and development and higher education in the transition in Hungary (*Table 7*). It is clear that not these capacities are the main motivators of location, the attractors of foreign and Hungarian direct investments or the generators of the restructuring of the economy. Probably the first phase after the establishment of the market economy, the phase of quantitative growth and restructuring, is going to be followed by another phase when the relationships among the economic units and the resources of science higher education are gradually established. A few signs of this can already be seen in the case of Budapest (e.g. the location of research and development centres and the increasing volume of orders for R & D).

7. Table: Amounts paid to higher education from the resources of the National Technical Development Fund in 1996–2000, by planning-statistical regions

Planning-statistical region	1996	1997	1998	1999	2000	1996-2000		Share of regions from GDP (%)
						Million HUF	Share (%)	
Central Hungary	154.2	716.7	246.4	199.6	234.8	1551.8	55.60	43.11
Middle Transdanubia	8.7	60.5	9.8	12.8	8.6	100.3	3.59	11.08
West Transdanubia	9.5	13	23.1	16.6	7.2	69.4	2.49	11.23
South Transdanubia	28.1	145.2	32.7	11.7	22.7	240.5	8.62	7.26
North Hungary	13.3	45.2	6.4	17.3	18	100.1	3.60	8.15
North Great Plain	22.7	275.6	34.8	22.4	32.6	388.1	13.91	9.61
South Great Plain	29.6	185.7	29.1	44	51.5	339.9	12.19	9.56
<i>Total</i>	<i>266.1</i>	<i>1441.8</i>	<i>382.2</i>	<i>324.5</i>	<i>375.4</i>	<i>2791.1</i>	<i>100.00</i>	<i>100.00</i>

Source: Positions of the research and development in higher education. Ministry of Education, Budapest, 2001

In the rural centres of science and higher education, the available capacities allow a faster territorial development and can also offer more favourable conditions for the restructuring of the local and regional economies. It is evident, on the other hand, that regional and local resources (of local governments, economic organisations and interest representations) are inadequate for the realisation of these efforts.

The local and regional self-governments have attributed so far a varying significance to the settlement and regional development possibilities lying in higher education and, to a more limited extent, scientific research. What we can say is that those smaller centres were more determined to assist the development of this sector (mostly by the provision of establishments and to a lesser extent by the donation of financial means) that usually did not have higher education at all or where higher education had been one-sided – or where the effect of the personal relations reinforced the significant traditions (a few university towns). The bigger centres are slower to recognise that the development of the scientific and higher education capacities have a considerable impact on the future of the respective settlements. Today it is

demonstrated also in Hungary that the existence of higher education in an adequate volume does have an impact on the local economy (*Hardi-Rechnitzer* [2003]). Regional and local actors are interested in the short-term results, whereas the effect of research and development and its institutions can be seen in a longer period of time, so enthusiasm cannot replace either the resources or the continuous lobbying for the development of the institutions.

Regional policy and science and technology policy have not had much in common in the past fifteen years. Both policies were engaged with the creation of their own identities, thus neither regional policy had concrete messages for science and higher education nor the shaping science and technology policy was interested in spatial structure and regional processes.

The *National Regional Development Concept of Hungary* (1998) mentioned the spatial structure of research and development and higher education in Hungary⁵, but there were no comprehensive researches behind the development paths designated in the Concept. In addition, the Concept was more rejected than accepted, due to the lack of professional reconciliations.

At certain organisational developments the weak signs of the assertion of spatial aspects could be seen, such as in the establishment of the institutions of the Bay Zoltán Research Foundation, the instrument centres of OTKA (Országos Tudományos Kutatási Alap, National Scientific Research Fund) and the de-centres of the European Union 5th Framework Programme (Győr, Veszprém, Pécs, Miskolc, Debrecen, Szarvas and Szeged), but these were not parts of a conceptual approach but were aiming at the managing the lack of it.

At the development concepts of higher education and its new industrial system, regional aspects (e.g. lack of certain fields of science, accessibility, concentration of capacities) were not given much emphasis; these concepts were not built on the development and renewal ideas of the regional economies. At the transformation of the institutional and tools system of regional development (e.g. decentralised resources), research and development and higher education capacities were not taken into consideration, or if they happened to be, without resources allocated to them.

A careful initiative was made in the last third of the 1990s for the regionalisation of research and development, when the county chambers of commerce were given limited resources by the former National Technical Development Committee. The few years of experience does not allow us to draw far-reaching conclusions. The support of research and development at regional level was raised again in 2004, in connection with the act on the innovation fund. Besides the regional development councils, regional innovation councils could be created. They can handle decentralised innovation resources on the basis of the principles set by the regional level, and their activity can be assisted by the newly established regional innovation agencies. A

⁵ The Concept puts the centres that harmonise research and development and the development of businesses into three categories. The first group is made up by the regional innovation centres where the organisation of science parks is desirable: such centres are Pécs, Szeged, Miskolc, Debrecen, Sopron and Veszprém. The second category involves the innovation centres that “possess comparative advantages” as links of the chain. These are Mosonmagyaróvár, Keszthely and Gödöllő. The third group are the junctions of industrial restructuring, where technology centres directly assisting the region-specific production and its services should be located, together with industrial parks and de-centres of higher education: they are Győr, Dunaújváros, Székesfehérvár, Tatabánya, Szombathely, Zalaegerszeg, Kaposvár, Kecskemét, Nyíregyháza, Szolnok, Eger and Békéscsaba. The text of the concept and the map in its annexes do not correspond to each other, it is actually not explained what the authors mean under the certain categories, probably what they did was the simple categorisation of the university centres and sub-centres and the colleges. Since then, however, the structure of higher education has changed after the structural integrations. Finally, the authors did not give specific research directions; they were not connected to the business structures of the respective regions. In our opinion this categorisation, the ideas of this “institutional models” is not feasible enough professionally. The research and development chapter of the *National Regional Development Concept of Hungary* is a good example for the lack of adequate analyses and strategy for the territorial structure of this activity, accordingly the development suggestions are inadequate, too, as they are not built on the inner correlations of the regions and are not connected to the renewal of technology policy itself, either.

considerable shift towards regionalisation and also decentralisation was made this way, the results of which will probably become visible in the long run.

The institutional system of regional development was gradually built out both at county and regional level. The development concepts and programmes of the counties and primarily of the regions deal with research and development; they specify the demands and plan the enlargement of the institutions, mainly in the regional centres and the locations of the research and development institutes. The research and development ideas appearing in the concepts⁶ are not integrated into an adequate organisational system, they are not supported by resources, so research and development appears as a rather general objective of regional development and not as part of a structure promoting the internal renewal of the regional economy. The concepts cannot fit research and development into the institutional level, either, because there are no adequate models and alternatives for solutions for this in the Hungarian regional development practice. Also, the international programmes do not take this segment into consideration yet.

On the other hand, it is a definite achievement that there is an expressed demand for the support of research and development at territorial (regional) level. However, without models and suitable partners (governmental or regional bodies) and interest representation, no specific tools and institutional system has been created so far in the spatial units, accordingly the concepts and programme are mainly concentrating on the conservation or the minimum development of the existing structures.

⁶ Those county development concepts have chapters on research and development where there are universities or significant higher education institutions in the county. In other concept we can read general statements, most of which specify demands but not exact development ideas.

References

- ANSELIN, L.–VARGA, A.–ACS, Z. [1997]: Local Geographic Spillovers between University Research and High Technology Innovations. *Journal of Urban Economics*, Vol. 42. pp. 422–448.
- BRACZYK, H.-J.–COOKE, P.–HEIDENREICH, M. (szerk.) [1998]: *Regional Innovation Systems. The Role of Governances in a Globalized World*. UCL Press, London.
- CAMAGNI, R. [1991]: Local “Milieu”, uncertainty and Innovation Networks: Towards a New Dynamic Theory of Economic Space. In: Camagni, R. (ed.): *Innovations Networks: Spatial Perspectives*. Belhaven, London–New York, pp. 121–144.
- ENYEDI, GYÖRGY [1996]: Regionális folyamatok Magyarországon az átmenet időszakában.
- Ember, település, régió (Regional processes in Hungary in the time of the transition. Humans, settlements, regions). Hilschler Rezső Social Policy Foundation, Budapest
- FORRAY R., KATALIN–KOZMA, TAMÁS [1999]: Regionális folyamatok és a térségi oktatáspolitikai (Regional processes and regional educational policy). *Educatio Füzetek*, Centre for Educational Studies, Budapest
- HAGERSTRAND, T. [1952]: *The Propagation of Innovation Waves*. Lund Studies in Geography, 4. Gleerup, Lund.
- HAHNE, U. [1985]: *Regionalentwicklung durch Aktivierung intraregionaler Potentiale*. Florentz, München.
- HARDI, TAMÁS–RECHNITZER, JÁNOS (eds.) [2003]: *A Széchenyi István Egyetem hatása a régió fejlődésére (The impact of the Széchenyi István University on regional development)*. Széchenyi István University, Science Papers No. 5, Győr
- KRUGMAN, P. [1991/2003]: *Földrajz és kereskedelem (Geography and trade)*. Nemzeti Tankönyvkiadó, Budapest.
- MAGYARORSZÁG 1990–2001 [2002]: *Beszámoló a társadalom és a gazdaság főbb folyamatairól*. KSH Budapest, 2002.
- MALECKI, E. J.–OINAS, P. [1999]: *Spatial Innovation Systems*. In: Malecki, E. J.–Oinas, P (eds.): *Making Connections. Technological Learning and Economic Change*. Ashgate, Aldershot, pp. 7–33.
- MEUSBURGER, P. [1998]: *Bildungsgeographie. Wissen und Ausbildung in raumlichen Dimension*. Spektrum Akademischer Verlag, Heidelberg–Berlin.
- EC [2004] *A new partnership for cohesion. Convergence, competitiveness, cooperation. Third report on economic and social cohesion*. European Commission, EUR-OP, Brussels
- NORTH, D. C. [1955]: *Location Theory and Regional Economic Growth*. *The Journal of Political Economy*, No. 63. pp. 243–258.
- OECD [1996]: *The Knowledge-Based Economy*. OECD, Párizs.
- RECHNITZER, JÁNOS [1993]: *Szétszakadás vagy felzárkózás. A térszerkezet alakító innovációk (Disintegration or catching up. Innovations shaping the spatial structure)*. CRS of HAS, Győr
- RICHARDSON, H. W. [1969]: *Regional Economics: Location Theory. Urban Structure and Regional Change*. Weidenfeld and Nicolson, New York.
- ROMER, P. M. [1990]: *Endogenous Technological Change*. *Journal of Political Economy*, Vol. 98, No. 5. pp. 71–102.
- RÖSCH, A. [2000]: *Kreativ Milieux als Faktoren der Regionalentwicklung. Raumforschung und Raumordnung*, 58. pp. 161–172.
- SCHEFF, J. [1999]: *Lernende Regionen. Regionale Netzwerke als Antwort auf globale Herausforderungen*. Linde, Vienna.

- SIMMIE, J. [2003]: Innovation and Urban Regions as National and International Nodes for the Transfer and Sharing of Knowledge. *Regional Studies*, Vol. 37. No. 6–7. pp. 607–620.
- STÖHR, W. B. [1987] A területfejlesztési stratégiák változó külső feltételei és az új koncepciói. *Tér és Társadalom*, 1. pp. 96–113.
- TÓTH, JÓZSEF–TRÓCSÁNYI, ANDRÁS [1997]: A magyarság kulturális földrajza (Cultural geography of the Hungarian nation). Pannónia Tankönyvek, Pécs
- TÓTH JÓZSEF–TRÓCSÁNYI ANDRÁS [2002]: A magyarság kulturális földrajza II. (Cultural geography of the Hungarian nation II). Pannónia Tankönyvek, Pro Pannonia Kiadói Alapítvány, Pécs
- VÁMOS, DÓRA (ed.) [1992]: A szürkeállomány fehér foltjai. A szellemi potenciál térszerkezete Magyarországon (White patches of the human resources. The spatial structure of intellectual potential in Hungary). Felsőoktatási Koordinációs Iroda, Budapest
- VARGA, A. [1998]: University Research and Regional Innovation: A Spatial Econometric Analysis of Academic Technology Transfers. Kluwer Academic Publishers, Boston, Dordrecht, London.