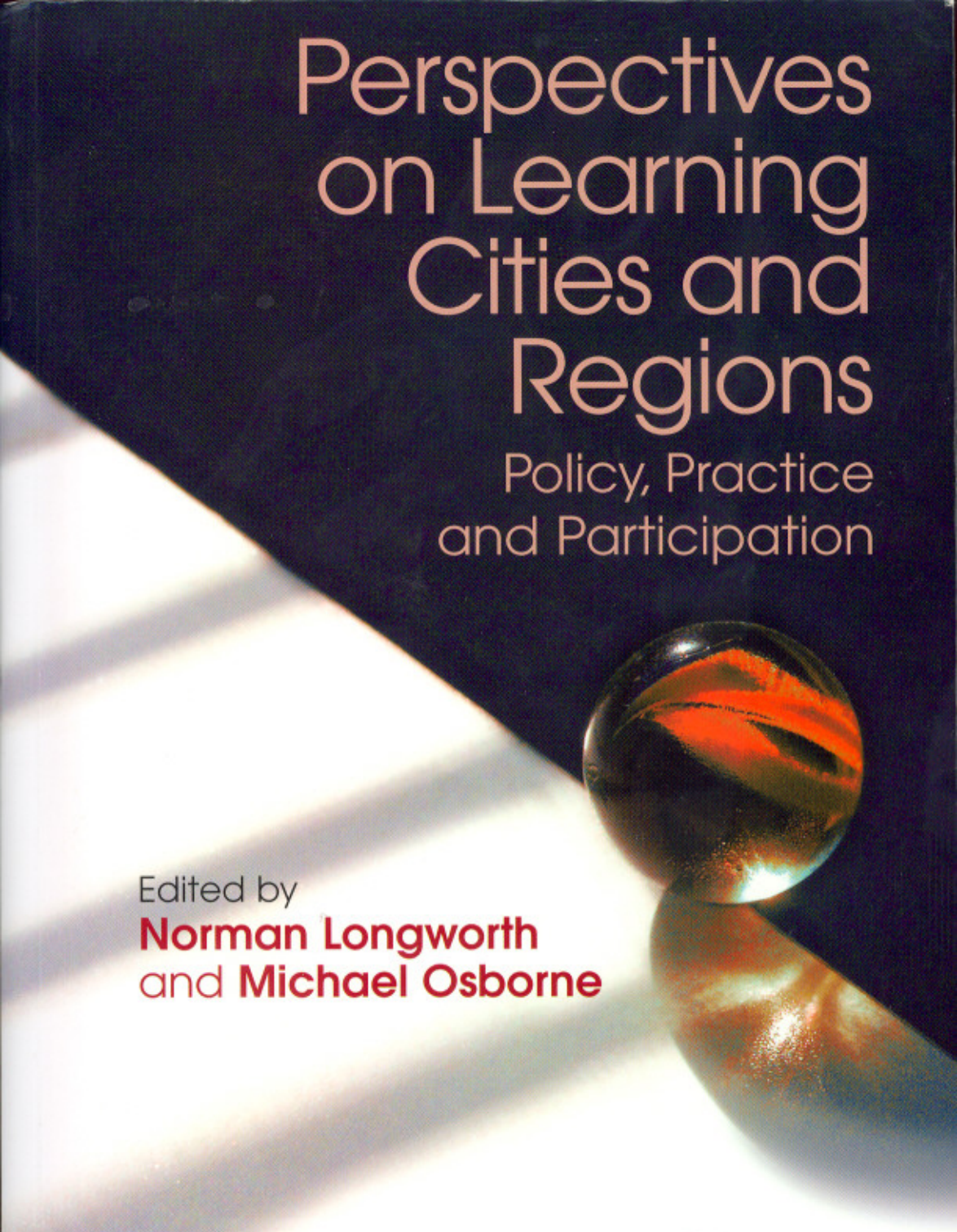
Perspectives on Learning Cities and Regions

Policy, Practice and Participation



Edited by
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niace
promoting adult learning

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Chapter 6

The role of research universities in regional innovation: The case of South Transdanubia, Hungary

Zoltán Gál

Knowledge creation and regional competitiveness

There is general consensus in the literature on innovation-oriented regional development that the utilisation of a regional knowledge base, innovation potential and co-operation between businesses and research institutions continues to play an increasing role, not only with regard to business success but also in the competitive economic performance of a region (Lackenbauer, 2004; Cooke, 1995). Although several factors are influencing regional competitiveness, its main driving forces can still be identified. The European Union's regional reports consider innovation, research and technology development to have the major potential in gaining competitive advantage. The competitiveness of regions can be increased by successful R and D activities within the region and by the creation and spreading of innovation in a wider sphere. Regional-level innovation, and especially the practical implementation of R and D results may be directly revealed through the competitive advantage of the region's business enterprises (Döry, 2001; Lengyel, 2000).

The development of science and technology and their accumulated knowledge bases have become one of the key factors in the development of a regional economy. Universities and research institutes as knowledge centres, extending and disseminating comprehensive scientific information, are playing an increasing role in regional development. A wide range of literature has studied the regional spillover effects of the universities' research-development potential (Ács and Varga, 2002; Fischer and Varga, 2003; Sá

et al., 2003). Not only has the direct support of universities increased significantly, but for regional governmental budgets the subsidisation of projects involving universities in various forms with the support of university-industry links are the biggest items of expenditure (Varga, 2004).

The EU's regional policy is also deeply affected by the new challenges of the 21st century. During the past few years, innovation and the development of a knowledge economy have played a key role in the formation of innovation-oriented regional policy (Landabaso, 1997). The primary objectives of research in applying a spatial economic approach to innovation concepts highlights the strong correlation between regional development and technology development, and demonstrates the strong connection between regional innovation potential and regional knowledge bases in their respective regions (the second and third roles of universities) (Cooke, 1996; Tödtling, 1994; Andersson *et al.*, 2004; Srinivas and Viljamaa, 2008). As well as highlighting the links within and between business organisations, research was focused on network co-operation, thus by-passing the traditional forms of market-based relationships. These co-operations are the manifestations of the spatial formation of innovation, information and knowledge sharing (Varga, 2000; Koschatzky and Sternberg, 2000).

Spatial differences in economic development have serious impacts on the network relationship of universities and business organisations. The differences between advanced core regions of metropolitan agglomerations and the more backward regions are clearly apparent in the relationship between universities and their region. In his research, Attila Varga points out that agglomerations are not negligible factors of the efficiency of regional development policy. With the same amount of university expenditure the impact of university knowledge transfer is significantly higher in areas of high industrial density than in smaller towns (Varga, 2000). This observation is highly important from the point of view of economic policy, suggesting that the support of university research for stimulating local economic development may be important for advanced regions but not necessarily for more backward areas.

This chapter provides an overview of the ERAWATCH regional benchmarking surveys – in which the Southern Transdanubian region participated – on investment into research on the special role of regional universities in the growth of collaborative research networks (Gál and Csonka, 2007). The introduction will be followed by a case study highlighting the role of universities in national and regional knowledge transfer, thus emphasising

that the spatial (regional) structure of innovation is very much determined by the realisation of university potential and its widening participation in economic transition in Hungary. The next section will introduce the findings of the ERAWATCH survey (2007) on the role of universities in regional innovation and university-industry links, and will discuss those factors that are supporting or hindering the establishment of a regionally embedded university model. The last section assesses the robustness and the coherence of the Southern Transdanubian knowledge base with regard to the needs and capacities of the regional economy.

The role of universities in regional innovation

The spatial dimensions of innovation had been greatly determined by the transformation of universities during the transition years in Hungary. This involves not only the extension of their research profile but also the transformation of the traditional university into the organisational structure of a research university.

Higher education has a potential influence on regional development, not only because of its place in the R and D sector, but also because of its dominant position in the training of experts and its responsibility for producing research and technical development (RTD) outputs and technologically-developed products (Table 6.1).

Table 6.1 Share of Higher Education in Hungarian RTD indicators, 2006.

Input	Output
RTD units: 70%	Published books: 77%
RTD expenditure: 25%	Published studies: 70%
RTD personnel: 57%	Patents: 32%
RTD personnel (FTE): 38%	Patents at EPO and USPTO: 16%
Share of doctorates: 72%	
RTD investment: 12 per cent	

Source: Central Statistical Office statistics, 2006.

Universities can have an impact on the economic development of their own region in two ways (Florax, 1992): on the one hand, through the multiplier effect of the purchasing power of students (a so-called expenditure effect) and on the other hand, through the knowledge transfer from the university into the business sector (knowledge effect) (Varga, 2004). A very important side-

effect of technology transfer is that industries and companies manufacturing competitive products are selecting their sites on the basis of the quality of university support.

Higher education is an extremely attractive factor for capital development, not only because it creates competitive advantage in the local labour market but also through its potential for creating innovation. It can be seen all over Europe that the development of large technology systems concentrated in metropolitan agglomerations was mostly determined by the research and development units of large companies. By contrast, the innovativeness of SMEs was, in the majority of cases, initiated by institutes of higher education, through the creation of local and regional clusters. The driving force of regional higher education can affect the development of the Western European core regions (Bennett and Krebs, 1991). In several Hungarian regions the higher education sector is also the largest knowledge potential and value generator, yet at the same time it has fewer links with the industrial sector than it should, if that potential is to be realised. The potential of the links between the two sectors needs to be identified, and the institutional background of these links created. Successful cooperation between the business and university sectors may secure a favourable environment for innovation.

The mobilisation of the higher education system to exercise its innovative functions and to be capable of performing its integrative functions as an element of the innovation system involves certain preconditions (Horváth, 2003):

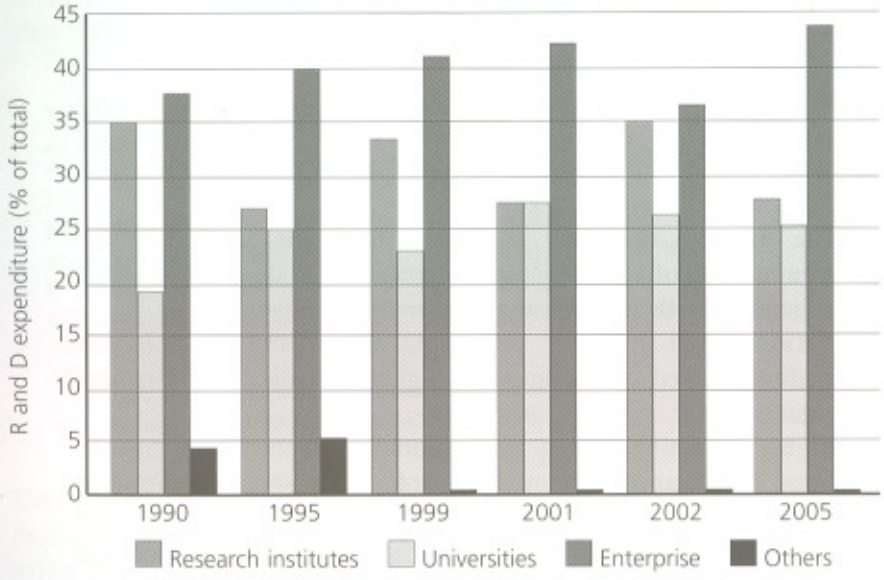
- Research can be regarded as a primary function of higher education. This should be reflected in its financing, and the development of the knowledge potentials of university research bases should also have a key role.
- The structure of higher education should be adapted to the requirements of a post-industrial economy and should be capable of generating technological and economic innovations.
- National and regional policy-makers should support the institutionalised co-operation of higher education and business organisations.
- Higher education should be territorially decentralised. Institutional development and university integration should conform to economies of scale. An optimal efficiency of scale with the institutions of the core region can create equal chances, both for accessing research funds and for internationalising labour in research and development.

The placing of higher education among R and D performing sectors is very much in the national interest as it can play a significant role in regional innovation processes. The economic attractiveness of the regions and spread of knowledge depend largely on a spatially-balanced network of university-based research facilities, and especially with regard to their relationships with companies. The Act on Higher Education defined the tasks underpinning a dual transformation of the universities so that research might be returned to them and traditional universities transformed into research ones (Gál, 2002).

Higher education in Hungary has increased its position among R and D generating sectors during the transition (Figure 6.1).

While its share in governmental R and D spending is similar to Western European ratios, a lagging behind may be observed regarding two indices. One is the very low ratio of business-sector funded research departments, and the other is the very weak links between university research and the business sector. While in OECD countries the average rate of corporate-funded R and D is 70 per cent, in Hungary, this figure was only 51 per cent in 2007. The ratio of BERD to the Hungarian GDP is also low (0.4 per cent),

Figure 6.1. Distribution of RTD expenditure by performing sectors in Hungary.

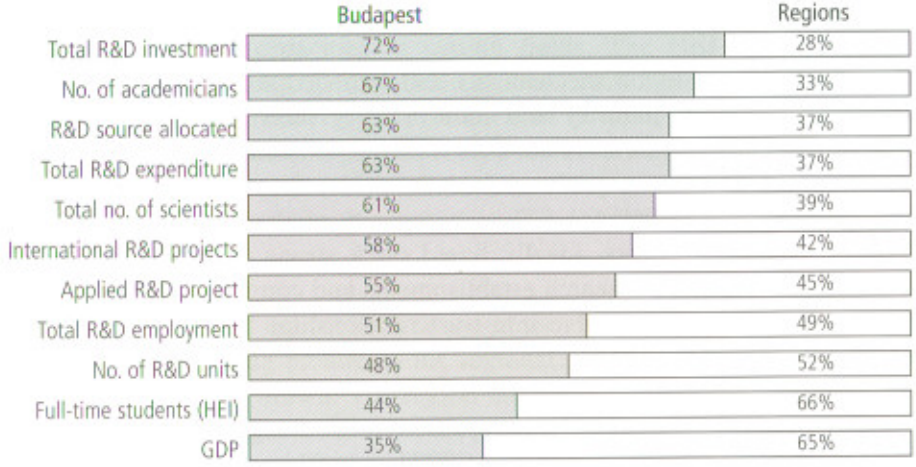


Source: Calculated by the author based on Central Statistical Office statistics.

especially when comparing it with the 0.87 per cent of Slovenia or with the 1.2 per cent EU-15 ratio. At the same time the expansion of universities was mostly perceptible by the increasing number of students and by the growth of university centres. The number of full-time students by the year 2002 increased to nearly 200,000 which is a 280 per cent growth compared to 1990. The number of students has been growing rapidly since 1990, especially in the newly-established provincial tertiary education centres, although their value for R and D is much smaller. Due to university developments in other Hungarian towns the heavy dominance of Budapest has decreased to some extent in respect to its share in university students. From this point of view, the rapid development of tertiary education, especially outside Budapest, plays a balancing role. However, the share of Budapest from the total number of full-time students is still very high (44 per cent in 2007).

The dominance of Budapest and the gap in research potential between capital city and provincial universities is even larger. The territorial distribution of R and D expenditure shows that the ratio of R and D funding in Budapest only slightly diminished since the economic transformation, and stabilised at an approximate level of 66 per cent. By contrast the absorption capacity of the provincial university towns increased only slightly from 17.4 per cent in 1990 to 21.2 per cent in 2005 (Figures 6.2 and 6.3).

Figure 6.2. Share of the capital city (Budapest) in the main R and D, tertiary education and economic indicator, 2007.



Source: calculated by the author based on Central Statistical Office statistics.

Higher education centres in the regions (Budapest, Szeged, Debrecen, Miskolc, Pécs, Veszprém) are still the major sites of R and D, the remaining counties and cities are lagging far behind. Therefore the development of provincial university centres into regional knowledge centres is a desirable objective (Gál, 2005).

In fact, most of the university-based research units are too small to be effective both in terms of their share of researchers and overall R and D expenditure. Despite increased co-operation between universities and the private sector, and participation in multilateral scientific programmes, the R and D budgets of universities are dependent on governmental subsidies to a large extent (Inzelt, 1999).

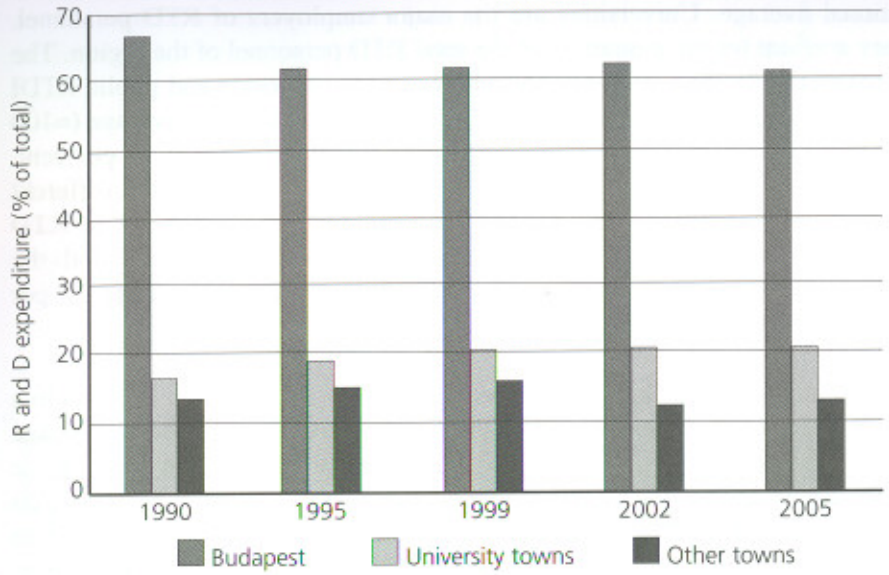
The regional knowledge base in Southern Transdanubia (Hungary)

The knowledge (RTDI) infrastructure, which includes universities and research centres, plays a significant role in the knowledge creation capacity of the regions. This infrastructure, which is easily accessible to companies, may constitute the basis for innovative development, but this is not automatic. Many cases have been reported where HEIs or research laboratories operate in relative isolation from the regional production processes, in particular where they concentrate predominantly on formal education, rather than covering the wider range of functions of a modern university e.g. where they are active in sectors that promote better connections with firms outside the region or where they focus exclusively on basic research (Koschatzky and Sternberg, 2000).

Knowledge transmission mechanisms and knowledge enhancing linkages, including university-industry and intra-industry links such as technology intermediaries, spin-offs and inter-firm research collaborations, as well as the development of science parks and technopoles, are important factors in strengthening the knowledge diffusion capacity of the regions. The knowledge enhancing linkages, ideally based on a strong interaction of inter-dependencies between research establishments and companies and/or among companies themselves, evolve into trust relationships that characterise, for example, economies of scope.

Southern Transdanubia is not among the wealthiest regions in Hungary. Its regional GERD was €22 million in 2004, which is only 3.2 per cent of Hungary's total. Until the mid-1990s the region had the poorest R and D

Figure 6.3. Territorial breakdown of R and D expenditure in Hungary.



Source: calculated by the author based on Central Statistical Office statistics.

capacity in Hungary (in 1995 only 3.5 per cent of all R and D employees worked in the region and not more than 1.5 per cent of the total expenditure was realised here). In spite of this, the Southern Transdanubian Region has one of the largest provincial university centre in Hungary (Pécs) in terms of the number of students (34,000), and the two universities[1] in the region have significant research capacities in certain fields. The HEI sector plays a dominant role in R and D performance as it accounts for 78 per cent of total RTD expenditures. However, the outputs of R and D, and the uneven administrative structure of higher education are not always very advantageous for innovation. Perhaps because of this, the RTD creation of the business sector in Southern Transdanubia is limited (€3.4M BERD in 2003) (Gál and Csonka, 2007).

Based upon the key indicators (measured as a percentage of the national average) the following picture of the regional knowledge base of Southern Transdanubia can be drawn. The region has large public RTD infrastructure mainly based on the two universities absorbing more than two thirds of regional GERD. Among them, the University of Pécs has a dominant position. It hosts 87 per cent of the enrolled students and 84 per cent of the research

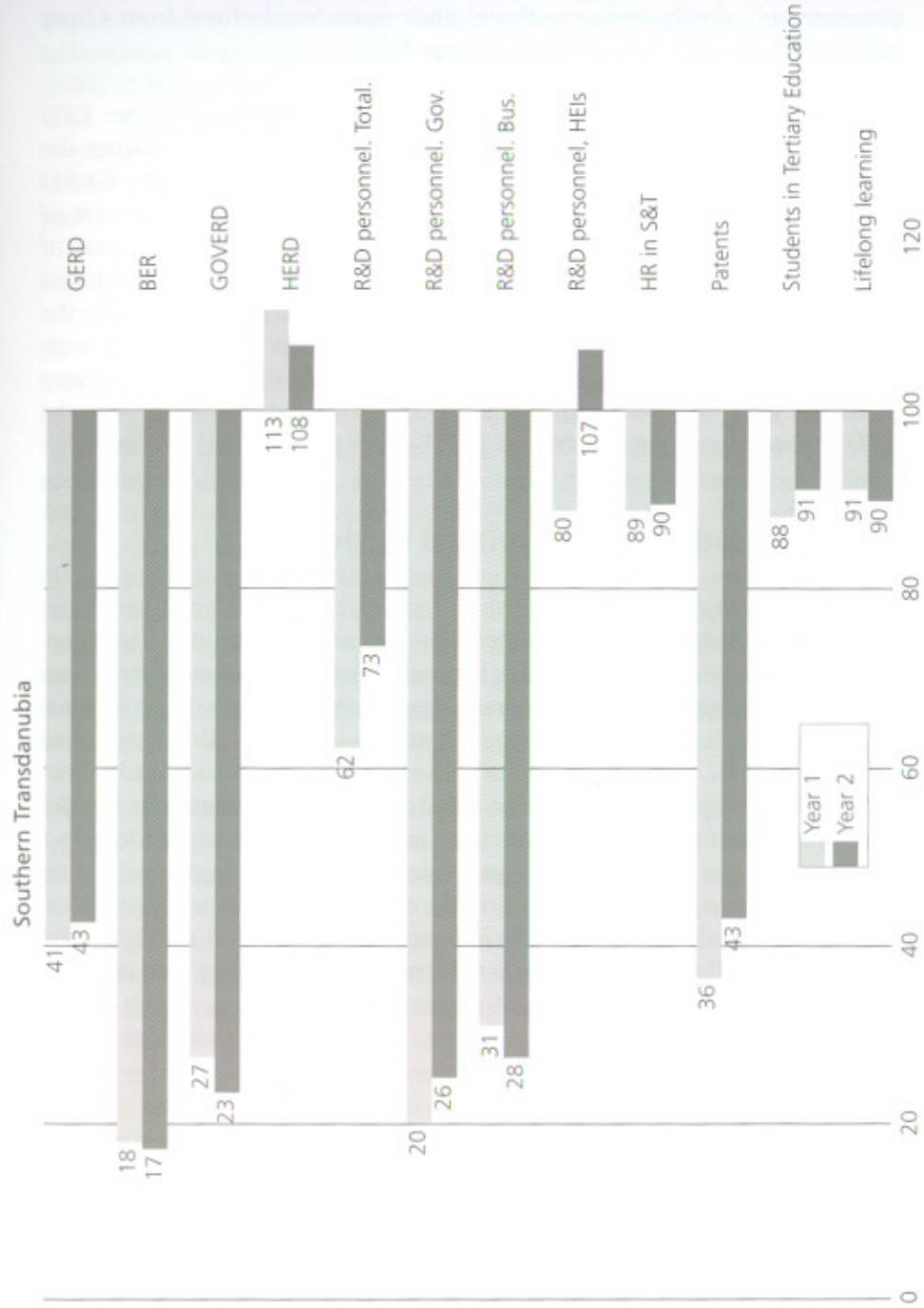
staff of the HEIs. Unlike the public RTD sector, the visibility and the performance of the business sector is very low, even in comparison with the national average. Universities are the major employers of RTD personnel. They account for three quarters of the total RTD personnel of the region. The remainder is divided almost equally between the corporate and public RTDI sectors. As a percentage of total employment with the national average (=100 per cent), Southern Transdanubia's share of RTD personnel is 73 per cent. However, there are huge differences in expenditures between the different sectors. HEIs exceeded the national average (107 per cent), while RTD personnel make up very small shares of the total in business and the government sector, accounting respectively for only 28 per cent and 25 per cent of the national average (Figure 6.4).

The orientation of the knowledge creation activity of the region is based to a great extent on the scientific profile of its universities. Of all the knowledge creation sectors, the two HEIs have the strongest potential in life science (biotech and animal cytology) research and they also have a good reputation with measurable RTD outputs in laser physics, environmental and agrarian research. At the same time, engineering and some fields of science (informatics, electronics and chemistry) are proving to be the weakest elements of the regional RTD base.

The strength of the life science (biotech) research base is demonstrated by its large share of total input-output indicators and also by the increase of RTD spending in this field (64.8m in 2004). In addition, the 11 university spin-offs in the biotech sector are tightly connected to the Medical School (MS) which has 48 employees (40 of them with an HEI degree) and produces a turnover of €3 million (2004). In contrast to this positive trend, the share of engineering in total RTD personnel especially in the fields necessary for technology change (micro-electronics, informatics, automation), dropped from 8.9 per cent to 6.9 per cent during the short period from 2002 to 2004. Due to the uneven administrative structure of HEIs the outputs of the RTD sector in the region are not very advantageous and from the point of view of innovation are clearly characterised by a lower patenting activity in the region. There was a similar decline in the proportion of researchers in natural sciences and also in agrarian science (which declined from 6.6 per cent to 5.4

Figure 6.4 (opposite): Source: Calculated by the author based on EUROSTAT data, Gál and Csonka, 2007.
Note: The following years were used for BERD, GERD, HERD GOVERD, 1999, 2003; R and D personnel 1999, 2004; HR 1997,2004; Patents 1999, 2003 and Lifelong learning 1999, 2004.

Figure 6.4. Key indicators on Southern Transdanubia's knowledge base development in comparison to the national average



per cent, and from 8 per cent to 7.3 per cent respectively). The traditional overrepresentation of researchers in social sciences and humanities is changing only slowly, and even though their share has declined from 42 per cent to 29.5 per cent, it is still high (Figure 6.4).

The disadvantaged position of the region is best expressed by the RTD expenditure indicators measured as a percentage of GDP. Comparing the performance of the region in relation to the country as a whole, the GERD only improved slightly during the last decade, reaching only 43 per cent of Hungary's average. The largest increase in R and D expenditure in the case of Southern Transdanubia can be observed in the HEI sector, illustrated by its high HERD figure of 108 per cent (above the national average). Unlike the HEI sector, the limited RTD activity of the business sector is the main characteristic of regional RTD performance, accounting for only 17 per cent of Hungary's average as a percentage of GDP. This figure is lower than the RTD expenditure of the government RTDI sector (23 per cent) (Figure 6.4).

University–industry links: cultural barriers?

As we have emphasised, through their integration into national and international knowledge networks, universities and research institutes are functioning as potential knowledge bases for companies in their own environment, even where universities are generally less embedded into their regional context and prefer national and international co-operation (Koschatzky and Sternberg, 2000). The importance of universities as information and knowledge bases compared with customers and suppliers is presently far less for the business sector. Small companies are co-operating with universities to a lesser extent and local SMEs in particular rarely communicate with universities for technology information. In the case of co-operation, geographical proximity certainly plays a key role in connection building. It seems that the co-operative willingness of SMEs is the smallest, yet it is they who are most in need of co-operation. When it comes to co-operation, SMEs would naturally prefer establishing relations with local knowledge bases (Koschatzky and Sternberg, 2000).

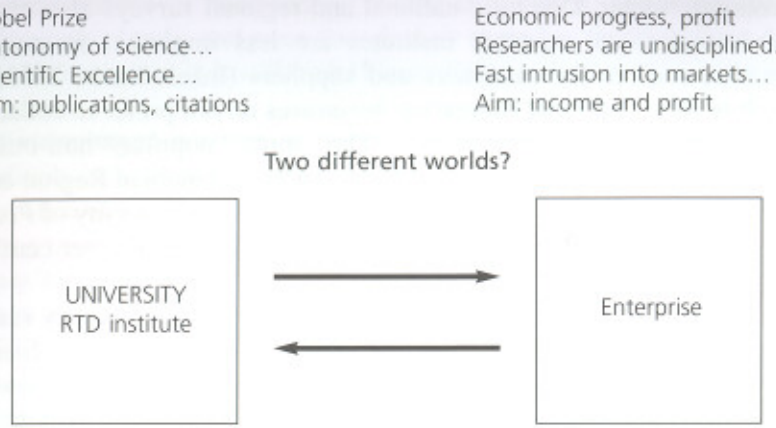
In regional innovation surveys special attention is paid to universities as major sources of regional innovation. One thing that our survey assesses is the importance of universities in comparison to other actors of innovation systems, with the channels of knowledge transfer and also the geographical features of knowledge flowing between universities and industrial companies.

In some less developed regions the university sector has no links at all with the economic sector. Domestic national and regional surveys also revealed that universities and research institutes are less important as corporate information sources for customers and suppliers (Inzelt-Szerb, 2003; Gál, 2000). It is clear that most Hungarian businesses do not prefer to collaborate with non-business organisations. The most popular non-business organisations for co-operation in the Southern Transdanubian Region are the chambers of commerce and industry (47 per cent), the University of Pécs (40 per cent), and the regional development agency (DDRFÜ) (37 per cent).

The spatial aspects of knowledge flows emanating from university research laboratories has attracted considerable attention in international literature (Boisot *et al.*, 2007). There are theoretical arguments for localised knowledge transfers (the importance of tacit knowledge, the role spatial proximity plays in easing maintaining interactions etc) which are to a large extent supported by empirical evidence; however, substantial variation can be observed according to company size, industrial sector or the stage of innovation (Varga, 2002). It is clear that university research units collaborate more frequently with local (within the region) firms and the intensity of co-operation diminishes with distance. There are also notable differences across research fields. Whereas for some scientific fields we can observe that active local collaboration is followed by interregional and international activities with firms (physics and surgery), for other fields (such as informatics and construction) localised connections are more important than collaborations with distantly located companies (Koschatzky, 1999).

Universities may be responsible for several of the negative factors in building regional-level relations. Universities operate by their own rules and principles, which are hard to make compatible with the objectives of the business sector. Both universities and companies are governed by their own differing logical, cultural and organisational procedures, which often raises difficulties in co-operation between the two parties (Figure 6.5). The majority of university research departments carry out basic or applied research, but very few university research organisations are joining experimental development projects. The interest of universities in co-operating with the business sector is much more oriented towards short-term fund-raising than towards a strategic development of the innovation chain. Universities with industrial links are rather more interested in projects involving large-scale funding than in the support of SMEs. In several cases the purchase of technology licenses from outside the region is much more profitable for companies than intraregional co-operation (Koschatzky, 2002).

Figure 6.5. Cultural barriers between university and businesses.



Thus, the potential areas of co-operation should be identified between the two sectors and an institutional background should be created for these links (Table 6.2). A successfully co-operating business and university sector may secure an innovation-friendly environment. The majority of researchers is doing basic research and despite the difficulties in the financing of higher education are uninterested in direct co-operation with the business sector as yet. Research tasks are fragmented, the concentration and their corporate relation system are weak, and market-oriented research is still a rare phenomenon. To provide an example from the University of Pécs as one of the largest provincial universities in terms of student numbers, recently a half-decade contribution by the business sector contracts to the university's total income was about the third of the average annual budget. Spin-off ventures originating from universities have important functions, although they are rare in the LDRs (Gál, 2003).

Generally, the co-operation of universities and research institutions with businesses, and especially pre-competitive research, have positive impacts on the business success of companies and the region's economic performance; large and medium-size companies have more extensive relations with universities outside the border of their region and this seems to support the theory of the low impact of universities on their respective region. For all that, the building of information and technology transfer links between SMEs and university R and D bases, and the co-ordination of university re-training and information courses are potentially very important for both sectors.

Table 6.2. Motivations behind university–industry co-operation.

University	Industry
Decreasing state support: gain additional financial resources	Knowledge has become the main factor of business competitiveness
Increasing cost of R and D: force to co-operate	Access to knowledge base/R and D infrastructures
Developing the service and knowledge transfer function of the university	Outsourcing: involving academic expertise
Increasing researchers' practice in outer contracts	Strengthening external relations of companies
New challenges of experimental R and D	Increasing pre-competitive R and D
Direct link to the labour market; an increasing labour mobility	Acquaintance with students as potential future employees
Practice-oriented training	Influence on improving the training structure and curriculum
Strengthening spin-off enterprises	Favourable start-up conditions
Stimulating regional development	Stimulating economic development

Source: edited by the author

Embeddedness of the Southern Transdanubian knowledge base in the regional economy

Here we try to assess the efficiency and coherence of the Regional Innovation System with regard to the needs and capacities of the regional economies, and the extent of matching or mismatching between knowledge and economic specialisation. Southern Transdanubia is considered to be a backward region in terms of RTD and knowledge absorption capacity in its economy, and the basic conditions for change in the technology sphere were rather unfavourable in the region during the transition period (Table 6.3).

Public sector RTD infrastructure investment, which is dominated by the local universities, is much larger than the investment and RTD capacity of the business sector in Southern Transdanubia. The orientation of the knowledge creation activity of the region is to a large extent based on the research profile of the two universities. As regards the relationship between RTD and economic specialisation, we found a stronger correlation in certain

traditional fields with a considerable research background (agrarian research). Universities have also built up strengths in biotechnology, laser physics and in environmental science, supporting the most promising and deeply rooted avenues of research for the future development of the region. The new cluster initiatives of the biotech, health and environmental industries have been built on the expanding knowledge creation capacities of the affiliated faculties and the enterprise networks. Nevertheless, the industrial background of the region in these fields is still weak. Therefore, the research outputs from biotech (produced by the university spin-offs) are still mainly utilised outside the region.

When comparing the matching of the economic structure in the region with its knowledge specialisation, some discrepancies can be observed. In contrast to the positive trends in RTD, some fields of natural science are rather under-represented in terms of the research capacity in engineering, while social sciences and humanities with less direct economic benefits are over-represented. The absence of a strong research capacity in S and E during the 1990s became one of the serious obstacles to the modernisation of industry, as it was unable to meet the demand coming from the high-tech companies located in the region. The shortage of highly skilled engineering graduates at the University of Pécs and the lower standard of RTD performance at the Faculty of Engineering in the fields of informatics and electronics contributed in large extent to the relocation of the NOKIA plant from Pécs in 1999. In the case of engineering, both the weaker research capacities and the lower demand from the underdeveloped branches of local industry compound their respective handicaps (Gál, 2004).

The private sector in the region is dominated by SMEs operating in low/medium-tech sectors (LMT) characterised by a lower level of innovation. The smaller number of indigenous large companies mainly specialise in traditional LMT industries (food, textile, leather). A few large enterprises in high tech electronics (mainly multinationals or locally based joint-stock companies) have been engaged in high-tech activities, but their influence on the local RTD sector is considered to be marginal, as they usually rely on the in-house RTD activities of their parent companies importing the technology from outside the region. Nevertheless, a few dozen innovative SMEs with significant RTD performances are to be found in the biotech, IT, plastic and the mechanical engineering sectors. In general it can be said that the RTD capacity and visibility of the business sector is still low and the region is heavily dependent on public funding.

However, the main reasons for the poorer performance in RTD activities are the following: on the one hand, the mismatch between the economic and research specialisations, combined with the low share of the business sector in RTD investment, the high share of the traditional lower tech sectors, the small size of local SMEs and the consequent lack of resources to invest into RTD and absorb its results and, on the other hand, the lack of demand for research results from larger (mainly foreign) companies and, to some extent, the lack of the necessary knowledge supply in the region in certain fields. These factors, together with other mismatches in economic and RTD specialisation, explain why demand for research in the region remains low. From a study of the relationships between the regional economic structure and knowledge creation it can be concluded that the establishment of a local knowledge base in some cases (e.g. laser research) did not take the existing sectoral specialisation of industry into consideration. In other cases, the extensive agrarian research base, strongly linked to the agro-food sector, is slightly losing its importance due to the structural decline of agriculture during the transition. The biotech sector, based on the Medical School research teams and university spin-offs, relies to a much smaller extent on local RTD co-operation. As a result, the players have integrated into the interregional RTD networks, establishing co-operation with companies outside the region (Gál and Csonka, 2007).

Other research bases in Science and Engineering were established in order to extend the disciplinary profile of the HEIs during the 1980 and 90s, and their development was based on their internal dynamics rather than on local economic development. RTD processes have been speeded up recently, mainly through increased public investment. In the future, RTD investment ought to rely much more on business sector contributions in order to ensure the direct economic benefit of RTD activities which can foster industrial modernisation and economic restructuring of the regional economy.

The conclusion can be drawn from the findings of the survey that RDTI intensity is not necessarily a decisive element of regional growth. It should be emphasised that the region needs to build on existing capacities rather than attempting to build their strategies by reference to as yet undeveloped or non-existent technologies, industries or fields of research. Nevertheless, an international reputation in university-based RTD activities (e.g. biotech), even without an extensive local industrial background, would make the regional knowledge centres more attractive for business sector investment, which may attract new plants into the region. Also, when making RTD investment

Table 6.3 Strengths and weaknesses of the regional innovation system.

	Strengths	Weaknesses
Knowledge creation capacity	• Strong university base with wide disciplinary profile • The largest provincial university centre in Hungary in terms of the number of students (UP) • Strong RTD base at HEIs in agro and life sciences	• Weak and biased RTI base • Uneven disciplinary structure in HEIs' RTD (over-representation of social sciences, weaker S and E base) • Limited RTD activity of business sector • Lower share of national GERD indicates the lower fund absorption capacity in the region • LMT sectoral dominance in the case of SMEs • Low level of patenting activity
Knowledge diffusion capacity	• The region has developed technology and business park infrastructure • High-tech oriented university spin-offs with good performance in Biotech	• Technology transfer/liaison infrastructure still in its initial phase and lacks resources to supply all needs of SMEs
Knowledge absorption capacity	• General HR endowment of the region is close to the national average	• Participation rate in Lifelong Learning is half of the EU-15 average • Share of HR in S and T is below the national average • Students in tertiary education is lower than the national average
Interactions of main actors	• Huge variety of collaborative programmes from informal networks, clusters to the Regional University Knowledge Centres introduced • Active participation by a few innovative firms in a variety of collaborative ventures	• Difficult to orientate and choose among the forms that best fit the participants' needs • Overall low intensity of participation and low level of utilisation of results • Weak communication among the different sectors / potential partners
RTDI governance capacity	• Reorganised RTDI governance structure following EU recommendations, growing regional awareness	• Centralised policy-making but rather weak coordination among the different national bodies • Lack of legislative and decision-making right and financial resources of the regions

Source: Gál and Csonka, 2007

decisions, the importance of the regional context and established policies have to be taken into account.

Concerning appropriate regional policies, 'one-size-fits-all' solutions often fail to yield the anticipated results. Policy making should be clear not only about the heterogeneity of regional techno-economic situations which reflect strongly diverse situations in terms of RTD-related policy making, but also about different possible development paths. Therefore, European and national RTD policy-makers should take into account the variety of regional techno-economic situations and develop different approaches tailored to the specific type of region concerned. Furthermore, it cannot be ignored that almost all regions in the new Member States have only recently identified their RTD policy and become involved in the EU initiatives. Therefore, the regional techno-economic system in question needs to achieve a certain degree of maturity in order to be able to determine the foci of research and innovation-oriented regional development. As long as the issue of regional catch-up stays at the top of the policy agenda, it may be more important to reach a minimal critical mass of activities at regional level rather than to take the risk of a selective approach which may subsequently prove to have been too narrow (Dóry, 2008).

Conclusion

The role of universities and research institutes as knowledge centres improving and disseminating comprehensive knowledge have an increasing importance in regional development. Today the facilitation of the spatial diffusion of knowledge, spatial mechanisms of knowledge transfer and the access of business sector to knowledge bases are priorities in support and development policies (Landabaso, 1997). A general consensus exists on

innovation-oriented regional development which, through the co-operation between businesses and universities, continues to play an increasing role not only in regard to business success but also in the economic catching up of a region.

Most of the sample businesses still view the university as a traditional educational centre. The most significant impediment of a stronger co-operation between university units and businesses is the limited information about each other. Most firms have no information about what the university is doing besides education, while university researchers and staff have only rather dim ideas about business needs and the potential business application of their research. It is very positive that, recently, most university researchers now at least recognise the requirements of the practical applicability of their research, but acceptance and appreciation of business requests are still under way.

The impact of investment in research largely depends on the regional techno-economic situation of a region. In many peripheral regions, including Southern Transdanubia, increasing R and D investment does not have an automatic and immediate impact on growth and job creation because technological change, as an outcome of research, is only one more indirect way to generate wealth. Only a few developed regions have reached the limits on factor growth and therefore have no option but to rely on research for further shifts in their production possibilities frontier (Cooke *et al.*, 1998). Nevertheless, in peripheral situation the lack of research capacity in science and engineering can be a serious obstacle to the modernisation of the industrial structure, which is in fact the case of Southern Transdanubia. In this region, due to the mismatch between knowledge-production specialisation and the economic structure, the networking measures introduced support inter-regional collaboration between the HEI and private sector rather than the development of collaborative networks and clusters within the region itself. However, recent policy measures are aimed at supporting the establishment of spin-off companies, public-sector research and the development of regional knowledge centres (techno parks) that match the specialisations of the public research base.

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Notes

[1] University of Pécs (1367) and University of Kaposvár (2000).