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Regions in Information Society – a Hungarian Case-Study

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Introduction

Some phenomena of regional development – in our opinion – bring 'special content and forms' into the evolution of information society. On the one hand, shortly after easing the gaps of 'traditional' regional disparities new development shortages arise in the field of information infrastructure but, on the other hand, the spread of new technical-informational devices and technologies has or may have some pull-up effects on the development and catching-up process of underdeveloped areas. (*Nagy,* 2000b, *About the information society* 1996)

Space has a new interpretation in this 'special' world of telematics (*Mészáros,* 2003). Information and knowledge can access any part of the world at a fantastic speed. The development of information networks all over the world, Europe and Hungary is filtering into every segments of life including spatial changes and regional development as well (*The information society,* 2000).

Its consequences on regional policy and regional development are as follows:

- First, *as a new factor of networking, technical and human infrastructure, it may have a pushing force on spatial development,*
- Second, with its accumulation of enormous *data, knowledge and information capacities* from different areas of human knowledge it may facilitate the innovation process of complex spatial development,
- Third, according to its *character it functions decentralised, which is in perfect harmony with the basic principles of regional development and policy,*
- Fourth – with an adequate technical basis – it may facilitate the development of human resources and lifespan learning (e.g. through distance education)
- Fifth, it may *facilitate* – partly in new dimensions – *the integration into the spatial distribution of labour, the efficiency of regional and urban marketing, and also may strengthen regional identity,*
- Sixth, it may quickly and effectively set up *the multilateral partnership system of regional development,*
- Seventh, – through its data and information basis – it may have a key role in the *monitoring of regional development*.

Thus, the development of information technology starting whether from information infrastructure or from the development of information society – in case of adequate co-ordination and multilateral co-operation – *may have a key role in the future of regional development in Hungary as well.*

In our paper we are going to provide an analysis on *the existing special interactions between the spatial features information technology and the evolution of society. We are also going to investigate the special role of regions, the 'spatial locations' of the development of information society.*

The answer for the first issue is relatively easy. It covers only the review of the spatial features of the installation and evolution of information infrastructure and technology of the near past. However, this problem arises a new interesting question: whether the spatial diffusion of IT development follows a similar pattern to that of traditional linear infrastructure (telephone, public road) or implies new forces of spatial development? (*Dilemmas of information society,* 2001.)

The answer for the second issue is far more complicated. The concrete regions within the 'virtual space' of information society – several so-called 'intelligent region' projects are running within West European states – may be interpreted in two ways. Partly in concrete, partly in abstract forms (*Fehér–Varga,* 2002).

The concrete results of scientific or public interpretations on regions and other spatial units (counties, micro-regions) – they are available on different information channels and networks – may only be evaluated in an indirect way. However, the extremely high visitors' traffic at the websites of regional development verifies that there is a growing general interest for regional science information. This indicates that the development of information society and infrastructure has some spatial features and regional aspects that deserve special attention.

The importance of information sector within national economy

Telecommunication was the only sector within the national economy, which had a straight and intensive development trend. The rate of development was extremely high after the completion of privatisation within this sector. By taking a glance at the annual development indicators of telecommunication and broadcasting industry one can notice that the development rate of this sector had by far exceeded the annual growth rate of GDP between 1996 and 1999 *(Table 1)*.

Thus, the share of telecommunication and broadcasting sector from the GDP increased to 3.5% by 1999. According to the Central Statistical Office, the volume of communication sector was 850 billion HUF, of which the total revenue of telecommunication and broadcasting was 228 billion HUF. Although this sum is increasing every year, it is still below 20% of the average revenue of the Euro zone countries (*The info-communication sector...* 2001).

According to estimations, the average annual growth rate of the three most dominant service branches of telecommunication is about 30%. Within these three branches data transfer services are producing the most dynamic growth, though in comparison with other segments of telecommunication it is still standing on a low base level.

Table 1

Some economic indicators of telecommunication and broadcasting industry

(Running costs in billion HUF)	1996	1997	1998	1999	1997/1996	1998/1997	1999/1998
Total revenues	281.0	399.3	532.8	728.4	142.1	134.9	135.2
Operational revenues	38.0	65.9	97.3	138.7	173.4	147.6	142.5
Investments	106.7	142.7	141.9	192.5	133.7	99.4	135.7
Change of GDP (%)	–	–	–	–	104.6	104.9	104.4

Source: Ministry of Transport, Communication and Water Management, Central Statistical Office, 1999.

Between 1996–1999 the total valorised value of assets invested into the telecommunication sector exceeded the value of 145 billion HUF (with an annual average of 146 billion HUF). The preparation for the liberalisation of telecommunication is well illustrated by the fact that the total value of assets invested into telecommunication companies was over 200 billion HUF in year 2000. This is 10.9% of the total value of investments into the national economy (*Business outlook,* 2001).

The economic perspectives of telecommunication and data communication are clearly illustrated by a permanent increase in the number of registered companies and private businesses since the political and economic transformation *(Table 2–4)*. However this did not generate an automatic change in the number of employees within this sector. By this we mean that while on the one hand some new segments (data network services, Internet services) significantly increased both market activities and the number of new jobs, other areas (wired voice services) were rather initiating the rationalization of their existing resources.

Within the major tendencies of global digital revolution the concentration of telecommunication and information sector has become the most dominant during the past ten years. *It has created a homogenous info-communicational sector*, which through the integration of all the major media sectors, beginning from the production through the storage, processing and dissemination of information may turn into a complex system of *information economy* (*Farkas,* 2000).

This process requires foreign capital involvement for some firms and trusts, accelerating in this way the concentration of telecommunication profiled ventures. In such a small market as Hungary the chances for starting a large-scale competition among several companies are very small. The chances are far better for an *oligopolic market system* with few competitors to achieve dominant positions on the market with a large number of small firms to fill out the gaps within this sector.

These small firms would at first establish their presence in the market then look for chances of further expansion. Another driving source of concentration is that a company striving for long-term competitiveness should either have dominant positions within some partial segments or should be transformed into a complex communicational trust to reduce its economic risks in the global competition for markets (*Farkas,* 2001).

Table 2

The number of businesses and employees within the telecommunication sector

	1996	1997	1998	1999	1997/1996	1998/1997	1999/1998
Number of registered businesses	–	1249	1,312	1,532	–	105.0	116.7
Of them: the number of companies	–	446	497	624	–	111.4	125.5
the number of private businesses	–	803	815	908	–	101.4	111.4
Employment (number of employees)	21,481	21,765	21,350	21,732	101.3	98.1	101.8
Of them: employed at wired services	–	17,456	16,329	14,958	–	93.5	91.6
employed at mobile services	–	1,932	2,098	2,417	–	108.6	115.2

Source: Central Statistical Office, Statistical Yearbook of Communication, 1999.

Table 3

Changes in the number of businesses between 1995–1998
(previous year = 100.0)

Name	1996/1995	1997/1996	1998/1997
Changes in the number of businesses in ICT sector	116.5	113.6	110.6
Changes in the number of companies with double entry book-keeping in national economy	116.5	114.1	108.6
Changes in the number of total businesses within the national economy	103.2	103.8	108.6

Source: The Information and Telecommunication Sector in Hungary 1995–1999, Central Statistical Office, 2001.

Table 4

The share of ICT sector within companies with double entry book-keeping within the national economy (percentage) between 1995–1998

Name	1995	1996	1997	1998
Gross output	6.3	8.4	11.4	11.7
Gross added value	8.0	10.0	11.4	12.0

Source: The Information and Telecommunication Sector in Hungary 1995–1999, Central Statistical Office, 2001.

The future development potentials of the information sector will mostly depend on education, R&D, brain potential, creativity, the demand for improving living conditions and for high quality services.

It is expected that information services will be the most rapidly developing economic sectors, which will be manifested in the employment structure as well. It is difficult to forecast what economic impacts will ICT technologies have, but the current tendencies are showing some basic trends and changes.

In some areas of ICT sector (information services, e-commerce) such business organisations can be established with a relatively small investment that may flexibly follow the changes of the demand side of market. Their number and economic importance may significantly increase in the next few years.

In all segments of economy the information about market changes will have essential importance. For this reason, a growing number of business organisations are building up their internal and external information networks.

New schemes of corporate organisation and layout models are being introduced (e.g. the spread of telework projects is expected after passing the relevant legal regulation system). The intensity of horizontal inter-firm relationships will increase. Due to the small size of the Hungarian market company fusion's and new strategic alliances are expected within the telecommunication, information industry and media sectors (*Havass,* 1995).

Site selection criteria are also in change. Instead of traditional factors (natural and energy resources, the abundance of manpower) the elements of qualitative production will enjoy priorities. Not only easy physical accessibility, but also the presence of innovative and adaptive consumer markets that count.

Due to their high demand of human capital ICT companies during their site selection are taking special care for the proximity of research and high education institutes that offer advanced technological and creative brainwork environment. Therefore, the core areas of the "new economy" and advanced information services

will be Budapest and Hungary's regional centres (Pécs, Szeged, Debrecen, Győr, Miskolc, Székesfehérvár) where information activities are on the highest level. At the same time in the "semi-peripheral areas" – even if their potentials of information technology are improving – the traditional industrial sectors, agriculture and public services will keep their dominance (*Nagy,* 2001).

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1 The theory of information society

Theoretical specialists generally agree that the major trends of economy have fundamentally changed during the past twenty years. The majority associate these changes with the long-term cyclical periods of economy, i.e. they think we are facing a new Kondratev cycle, which has two leading sectors: information science and biotechnology.[1] This new technological paradigm has two basic features. On the one hand, new technologies are in close relationship with information. Information may be considered both as resource and final product. On the other hand, the major impacts of innovations here can far better be observed in processes than in products. Although there are very important renewal processes in production and the distribution of new products has vital importance in economic development, it is the transformation, the changing of ongoing processes that have the deepest impact above all (*Bell,* 1979).

This period is characterised by the free generation, distribution, access and utilisation of information and knowledge, by the establishment of their social environment, the globalisation of several areas of life, all of which are the products of the rapid development of computerisation, telecommunication, entertainment electronics and media industry (commercial and public media, printed and electronic press and their services) and their co-ordinated and accelerated integration process[2]. Within their impacts the possibility of multilateral communication and the access to an enormous volume of information are the most dominant (*Havass,* 1998).

1.1 Basic trends in the revolution of information technology

The information age is based on quite different organisation models, processes and phenomena from the period of modern industry, its previous socio-economic paradigm, which was also completely differing from the previous formation characterised by the dominance of agricultural society and economy. In this chapter we are

[1] Each periods of the Kondratev cycle has different technological-economic paradigms. They are characterized by a coherent and hierarchical structure of activities and technologies, by the complexity of technical standards, by the utilization of dominant materials, instruments and systems, by the restructuring of the institutional models, by the assimilation of new phenomena, and by the changing relationship between economic partners. For this phenomenon *Gershuny* (1987) in used the term social-technological system.

[2] In literature this process is described as the simultaneous concurrence of development and convergence.

going to describe those trends that – in our opinion – are the most adequately represent the mainstream of the whole transformation process.

1 *The big turns into small – Schumacher's* (1991) model on the shifting of economic standpoints seems to work in other areas too but behind the surface these phenomena are not so definite and clear. It is true, that the degree of individual autonomy and the independence of small communities are increasing – just as the local dependency of small communities is decreasing, the freedom of decision is increasing and the equalisation of spatial distribution processes is accelerating. But on the other hand, the new global systems allow less and less actors and potential competitors on the market, they are creating uniformed firms, institutions and they are also trying to create standardised consumers on their markets. The standardisation of large regions and the growing demand of small regions for autonomy are simultaneous spatial tendencies now.
2 *Material stuff is pressed out by information* – the turning of information into equal or even superior productive force has already been mentioned but in this context the dilemma of cultural values here is that whether, to preserve traditions and/or their modernity (*Gerken,* 1993). Thinking over this matter one should realise that here the preservation of socialised mankind as the consumer of social values is the question (*Hamelinck,* 1994).
3 *The industrial age turns into post-industrial* – according to *Bell's* (1973) theory, post-industrial refers to a service-based economic structure, while in social context this term means the dominance of services, the transformation of knowledge into primary resource. The majority of innovations cover the fields of computer science, telecommunication and media. As a result of convergent development these sectors are integrated into a homogenous information economy.
4 *Centralisation turns into decentralisation* – there is a kind of reaction between large industrial organisations to tackle those problems they have created themselves (*Erdősi,* 1991).
5 *National turns into global* – according to *György* (in: *About...* 1996), radical globalism is such an economic environment which has been developed through various networks representing such an enormous intellectual, financial and technological power which has not been seen before since the evolution of modern capitalism. An elite structure is evolving on the basis of technological dominance, marginalizing those local societies and technological cultures which are not suitable or unable to follow their technologic development trends.

6 *Hierarchical structures turn into networks* – these issues will be discussed later when describing their sectoral and spatial impacts (See: *Batten, 1995; Graham,* 1994).
7 *Representation democracy turns into participation democracy* – quite often fears are expressed that the age of uninformed and under-informed society is coming because the majority of human society will be unable for orientation in the quickly growing mass of information due to the absence of their selection abilities and on the basis of acquired information they cannot make right decisions (*Naisbitt,* 1993).
8 *The emergence of self-aid and solidarity as a response to alienation* – this will be a final result of rather contradictory processes. On the one hand, in general, the position of the poor and the old generation will worsen, spatial disparities will grow and there will be worse chances for equal living conditions (*Gershuny,* 1987). On the other hand, the weakening force of geographical determination, the spread of new activities at the same time will reduce the existing disadvantages the spread of globalisation will counterbalance regional disparities.
9 *The emergence of new (virtual) reality with a new (virtual) space in which a part of processes is going on* – this will result in a fundamental transformation of time and space. This is simultaneous with the commercialisation of new and traditional mediums of cultures (such as the Internet since the early 90s!) (*Graham – Marvin,* 1996).
10 *A radical change is undergoing in values* [3] – knowledge has of the greatest value (*Knight,* 1995). Not any knowledge but such as needed for a particular – sectoral or local – market segments, but this does not exclude the devaluation of several traditional – technical, cultural, ethnical elements of knowledge.

1.2 The economic impacts of transformation into an information society

A flexible, transformable kaleidoscope-type economy is being built. New economic sectors are being shaped and very profound, sometimes fundamental changes are going on within the existing economic sectors as well. The development of information sector is permanent, education, culture, knowledge, human resources, living standards, economy and their service areas are the strongest driv-

[3] *Hamelink* (1994) defines the major trends of transition from industrial into information age as follows: digitalisation, deregulation, concentration, globalisation, consolidation and the intensification of civil initiatives.

ing forces of growth. The information content of products in other sectors is also increasing.

New corporate organisation models have been introduced that are based on the development of horizontal organisation and networked corporate structures (*Nahrada,* 1995). Within the corporate system priorities are given to the application of computer technology and high-tech communication devices. Internal and external information networks are being built the automatization level of production and office work is increasing.

Virtual companies' are being established and they are in a continuous transformation process. Due to these transformations only their original company trademark will remain the same (*Gerken,* 1993).

Sale systems are also in change. Consumer relations and the configuration of services to changing individual demands have an increasing importance. Not only export, the direct investments and presence of foreign capital but also the agreements with local distributor systems are the key factors of the transformation process (*van der Knaap–Tortike,* 1991).

In countries of central location services, namely high-volume information oriented services, the so-called *information services*, are the most rapidly developing sectors and a growing rate of employees are involved in the information sector. In semi-peripheral areas the industrial features of the economy remain strong, due to the increase of producer capacities transferred there from central locations. Here the transfer of local industrial capacities into less developed countries is not a general phenomenon. Usually the number of decision centres does not increase, services are rather organised on national level with less number of employees and weaker centre-forming force than in developed countries (*Cséfalvay,* 1999).

The *production organisation system* is undergoing a reform at first in the new industrial sectors, then in the remaining sectors of economy. The earlier fordist and taylorist type mass production system is being replaced by small-scale just in time specialisation, which is much more tailored to the customers' needs through the utilisation of the highest production, communication, storage and distribution methods and technologies (*Fuá,* 1993).

The postfordist production system is characterised by a small number of direct employees, by the simplification of technology and by the segmentation of production into small units, which can serve as a basis for deconcentrated location even in rural areas. The company seat may build a spatial network of economic relations around itself, which is elastic, flexible and not limited to traditional economic zones (*Buijs–Pellenbarg,* 1989).

The average energy consumption per manufactured product and the volume of goods transportation are decreasing and the demands for storage and working capital are also getting lower but the demand for human capital is increasing.

Monetary and real economic processes are getting more and more separated. The levels of management, control and financial market are getting independent from real manufacturing process (*Naisbitt,* 1992). This process started with the stock-market crisis in 1987, the scandals around cheap bonds, real estate and secondary bond transactions, and some speculations against some national currencies and economies (Mexico, Thailand, Argentina).

Services, especially *business services are undergoing a comprehensive modernisation process*, which is simultaneous with the growing externalisation of these activities. The building of advanced information networks and the introduction of a wide-range telematic services are indispensable for the renewal of the whole sector (*Charreyron-Perchet,* 1990).

Site selection criteria are in change now. Instead of traditional factors (natural and energy resources, the abundance of manpower) the elements of qualitative production (accessibility, availability, information flow, specially trained labour force) with some non-economic factors (information oriented, creative environment, good living conditions, rich cultural life, large variety of recreational facilities, valuable built-in environment, positive local image) will enjoy priorities (*Enyedi,* 1996).

The intensity and extent of these processes and impacts will be influenced by technical facilities, the degree of competition dependence, the quality of company site, the degree of urbanisation, the company's marketing strategy, professional competence, financial situation, and by the users' professional competence, readiness and accommodation of innovation. All these emphasise the importance of individual and community attitudes towards innovation (*de Castro* et al. 1995).

The exclusivity of national economic organisation model will disappear and the whole economy will stand on new spatial platforms. Globalisation, which at first covered only multinational firms expanding through acquisitions and purchasing property rights, will further expand (*Erdősi,* 1998). But now the strategic alliance of those companies will get into key positions that had built up an oligopolic market structure in several economic sectors.[4] With globalisation markets are becoming fragmented (*Barta,* 1998).

On the level of cross-national integration the expansion of free trade zones is the most significant phenomenon. However the European Union's example has shown how decreasing of economic competitiveness enforces giving up national sovereignty in some areas and tightens the trends of integration.

On subnational level districts and regions having strong inbound cohesion and identity will gain more and more autonomy in tackling their own economic prob-

[4] Extremely strong concentration is going on within the information sectors. For example in advertisement markets in the field of sound carriers or in the world of news. The 20 largest communication firms have leading market positions at least in two important sectors enabling them to operate in perfect size. Through this structure they can eliminate their competitors, earn their R&D costs and cross-finance their activities.

lems and development issues. The more homogenous spatial and social structure than national level will make the recognition of problems, the ranking of their importance the decision-making on possible intervention, the effective application of available instruments easier. Micro-regions, the organisations of settlements of the same or similar rank and problems become more and more important spatial units of economy (*Dumford–Kafkalas,* 1992).

1.3 The social and cultural challenges of the information age

The impact of new technologies on social processes is not unambiguous. It was expected to eliminate the existing regional disparities or at least significantly reduce them through integrating marginal groups and reducing the dominance of vertical organisation models. *The vision of 'good technology'* solving all social problems without creating new ones was very popular during the 1980s. But at the same time the Rome Club Report (*Microelectronics – Is It a Bless or a Nightmare, 1984*) had already described the potential impacts of technology at the end of the 1970s and the majority of its forecasts have come true[5].

During the transition period into the information age real economic processes are sharply polarised. The first gap is marked by *the presence or absence of technologies* and *having or not having information on new technologies*. The second gap is marked by differences in *schooling, professional skills and special knowledge* (*Csörgő,* 2002). The third dimension of inequalities is related to the *nature of work* (creative or routine) to be done. Actually, these phenomena were described by *Castells* (1989) in his analysis on the metropolitan features of *'dualistic society'*.

Differences are sharpening between managers and their subordinates. Although the intensity of vertical separation seems to diminish, the steps between hierarchical levels are getting much higher. *The chances of equal opportunities are decreasing*, favouring for the social adoption of the rich and the young, and disfavouring for the old and the poor (*Dillmann* et al. 1998).

The new technologies are changing traditional structures. They increase the top managers' role and potentials in process controlling and decision-making but at the same time significantly limiting the middle-level management's autonomy. As a result of automation a series of "blue collar" jobs are terminated, or fulfilled by high-trained expertise or unskilled workers (*Gertler,* 1993). As a result of decen-

[5] It is quite interesting that in the USA during the euphoria in the early nineties several neoliberal authors (Dyson, Keyworth, Gilder, Toffler) return back to the outdated schemes, speaking of the 'completion of American dream' or 'new frontiers of the information age', attaching too much importance to real processes and impacts.

tralisation new groups are emerging in the labour market. Eight the spread of home working, the flexible forms of work open up new perspectives pregnant or child caring mothers and the disabled to work in full-time or part-time jobs.

Economic changes *may increase social disintegration, creating the feeling of alienation*, loneliness and anarchy. This may generate an extremely strong group and place identifications (with landscape, micro-region, settlement, borough, neighbourhood) in return (*Vámos,* 1998). *The increasing role of locality* marks the importance of the bottom-up organisation of local communities, the initiative power and growing self-identity of an organic society (*Stöhr,* 1990). These communities are capable to organise their own activities, to integrate their members to find sensible and useful jobs for themselves. They are capable to satisfy their own needs and to bring decisions on their future. The growing number of electronic services, the 'cash and carry' slogan are all pointing towards a powerful trend of commercialisation, which has rather an adverse impact on the traditional values of culture, civilisation and ethics.

The system of social values is in change. High priority is attached to elements of living conditions; high salaries, career promotion chances. There is a growing demand for intensive and valuable leisure time activities, community and personal services (*Jensen-Butler* et al. 1997).

Some elements of necessary *spatial motions may be eliminated* (daily, weekly commuting to work, school) but at the same time *others motivated by different reasons* may show up (maintenance of personal relations, sports and recreation activities) (*Erdősi,* 1992).

Due to the growing volume of information flow the traditional, geographically based social formations will slowly be transformed (*Stehr,* 2000).

More efficient governance can be organised within the public administration system. ITTs will contribute to a more optimal utilisation of state property, to a more powerful use of the existing databases, to a more efficient management of affairs and the exercise of control over the rules of democracy. Theoretically ITTs may also create a basis for building up a comprehensive monitoring system through which the ruling political powers can exercise control over individuals or groups (*The information society,* 2000).

The accessibility to various sources of information is the greatest advantage of ITTs that they can offer in the area of culture and education. Apart from the communication with large systems the chances of gathering information at home are continuously improving. The provision of home electronics, the everyday e-government, e-administration through information networks and telework (*Qvortrup,* 1992; *Handy–Mokhtarian,* 1996) being done separately from traditional workplaces open up new perspectives for everyday life.

1.4 Prognosticated impacts on spatial structure

The spatial impact of the new ITTs is not unambiguous! They were *potentially* expected to increase the decentralisation of activities and to ease the traditional disparities among spatial units. The major opportunities what ITTs are offering are as follows: closing up peripheries to national and international trends, reducing the distance between the centre and peripheries, the approach of the peripheries' economic, social and living standards indicators to the level of the most advanced regions, the execution of restructuring programmes in industrial crisis regions[6]. (*Erdősi,* 1998).

At the early stage of the diffusion of ITTs real processes enhanced the development of cities and central places, which resulted in the sharpening of regional disparities. Therefore a serious of theories stated that ITTs themselves are not capable to have a serious impact on the development of a territory or settlement. They can only accelerate or enhance the ongoing spatial processes (see: *Castells,* 1996–1997; *Cas,* 1995; *Campisi–Tesauro,* 1995).

More realistic forecasts prognosticate that *at the present stage of diffusion* urban agglomeration zones cannot be the major beneficiaries of decentralisation. A powerful suburbanisation trend is manifested during the site selection of companies and institutions. *Van der Knaap and Louter* (1989) say that further peak points may be expected within the urban hierarchy. A horizontal structure will dominate on the top but going down towards the bottom all changes into a strongly fragmented system. It consists of not only one centre ruling over the whole structure but rather of some independent decision centres which together have an overall control over the whole settlement system.

Medium-size cities are the other potential winners. Among them mainly those with important research-development (R&D) capacities, with strong higher education system, with diversified industrial structure and with high level services. *Ter Heide* (1990) thinks the diffusion of ITTs in medium-size cities may generate several positive processes. On the one hand, it contributes to a more intensive utilization of urban centres, real estates, infrastructure networks and local labour force. On the other hand, core cities will have more power to supervise their region and to utilise its resources, which may stabilise the spatial formation of the whole concentration process. This concentration also involves the consolidation of inner city territories, the reform of architecture and functional regeneration (*Longcore–Rees,* 1996).

[6] According to *Erdős* (1990) the major trends are as follows: suburbanisation, i.e. microregional decentralisation; regional level mass migration; the centralisation of power, management and economic activities in large cities; the decentralisation of operative activities; the sharpening of development differences among agglomerations.

On national and regional levels large cities may realise their competitive advantages resulting from a new technological-economical paradigm (*Paquette,* 1992). The development of new methods and technologies in all cases will result in a reorientation of traditional specialization, in the devaluation of earlier competitive advantages, in opening up new perspectives for new areas to join the ongoing processes and to turn their previously disadvantaged situation for a better one (*Nagy,* 2001).

There is an increasing polarisation within the settlement network system and even within settlements themselves! The major frontlines are between metropolis-village, core-periphery, city centre-residential area and central city-suburban zone. At the same time several tendencies bear the marks of decentralisation; such as the mixture of functions in residential areas, the spread of company seats and offices in suburban zones etc. (*Gillespie,* 1991; *Graham–Aurigi,* 1997).

In spite of the ongoing decentralisation processes *Gillespie* and *Goddard* (1986) exclude the alternative of full spatial equalisation, because the spatial pattern of the availability of knowledge and information – the key resources of development – is not homogenous and market trends may even increase the spatial differences of development. Information economy – as they say – cannot be work more efficiently than developed industry based economy because its key sectors have oligopolic-type markets in which rivalry and hidden compromises exclude the elements of traditional competition. The new information and communication networks – in their present form – are in favour only of the biggest firms of the information sector.

None of the extreme models of settlement development has been proved by the practice. Neither large agglomeration systems have been dissolved nor the computer based urbanisation period has arrived (*Enyedi,* 1988) even if some new or traditional centres have been developed through the coming ITTs and the utilization of their potentials. Earth has neither changed into a *global village* as *MacLuhan* had prognosticated nor into a *global city* (*Jabbar,* 1995) of "*standardised and extended urban supermarkets*"

The development of new networks is a slow and long-lasting process but its consequences on spatial structure can already be observed. The main streamlines of this process are marked by decreasing population in lagging cities and rapidly increasing population in prospering cities, the lessening density of urban population, slowly restructuring urban spaces, a loose organisational coalition of cities (*Turnock–Nagy,* 1998).

The major problem ITTs are facing in the performance of their regional development function is not how to tackle technical problems but rather how to tackle social problems. By this we mean the transformation of social values, the changing of norms, the overcoming of institutional incompetence. While network develop-

ment is primarily a passive[7], mostly a background-style process, ITT based services have an active role in regional development (*Nagy,* 2001).

2 Telecommunication infrastructure, networks, services

2.1 The development of telecommunication and data transfer networks

The historical past – role of telecommunication services

The demand for the transmission of the most important information for everyday life from one community to other distant ones has already existed in the "early societies". The information transfer technologies (starting from fire and smoke signals through electronic telegraphs, electromagnetic signallers, computer networks) were in a continuous development and they all contributed to the invention and development of the telecommunication, the most advanced technology for bridging large distances (*Erdősi,* 1992). At the present economic and social development stage the access to information and universal availability have vital importance in building up personal careers, localities and large spatial units (regions, countries, country groups). A country's overall development, economic wellness, and regional competitiveness largely depend – apart from economic, political, institutional and human factors – on its telecommunication and data communication systems and networks. To understand the present situation and results and to illustrate the dynamism of development we should overview what has resulted the ongoing processes of Hungarian telecommunication since the changes political and economic changes during the past few decades.

The legacy of Hungarian telecommunication

Hungarian telecommunication was in the leading edge of the European telecommunication at the end of the 19th century. The Hungarian Post Company, the supervisor of telecommunication devices implemented West European technology quite soon after its appearance. Several Hungarian technical devices and implementations (telephone exchange centres, international telegraph connections, underground cables, radio telegraphs) were in the "mainstream" of the development of

[7] The term 'enabling' technology is used for ITTs generally in this sense.

European telecommunication technology. The First World War, its following Trianon Peace Treaty, the political atmosphere and the economic crisis around them resulted a shortage of financial resources in the telecommunication sector as well, and this strongly hindered the development and the implementation of the latest technologies in Hungary. Therefore, there was a large development gap between Hungary and Western Europe within the telecommunication sector. Between 1945 and the early 1950s the level of expert knowledge and the relatively modern technology made possible to stabilise the quality of telecommunication infrastructure on the level of the previous periods (*Lajtha–Smideg,* 1994). But later on financial resources were so weak that they were hardly enough to keep the whole telecommunication sector alive. This situation was the result of the scarcity of money, and the priorities of the national economic policy of that time (the forced development of heavy industry). During the 1950s and 1960s telecommunication was characterised by quantitative shortages, the absence of maintenance and development and modernisation, which is very well illustrated by low investments into the telecommunication sector in the percentage rate of the GDP *(Table 5)*.

Table 5

The comparison of GDP with telecommunication investments (running costs, in million HUF)

Year	Gross Domestic product (GDP)	Telecommunication investments	Investments in percentage of the GDP
1960	186,395	183	0.10
1965	231,443	371	0.16
1970	332,548	993	0.30
1975	482,700	1,754	0.36
1980	721,031	2,469	0.34
1985	1,033,658	4,724	0.46
1990	2,080,900	13,335	0.64

Source: Statistical Yearbook 1991. Hungarian Telecom Service.

At the end of the 1960s the extremely poor condition of the Hungarian telecommunication system was a dangerous threat for turning out the economy from its normal running process. The government – in the spirit of the coming reforms in the economic regulation system – introduced several measures to modernise the telecommunication system. Modernisation was started with the import of Ericson model high frequency carriers and crossbar exchange centres in 1968 to replace those old Rotary devices that had been in use for more than thirty years. The manufacturing license of these crossbar exchange centres was also purchased from the

Swedish Ericson Company. The acquisition of the manufacturing license for small coax cables for wired telecommunication was a great step towards the development of network. All these significantly improved inter-urban networking. However this dynamic development was soon halted because during the 1970s the acquisition of licenses and the co-operation with Ericson were terminated. As a result of this, in 1985 the Hungarian telecommunication network was standing on the technology of the 1960s (*Lajtha–Smideg,* 1994). Hungary was significantly lagging behind the international standards *(Table 6)*.

Table 6

The number of fixed telephone stations in some European countries

Country	Number of fixed telephone stations per 100 persons (telephones)			
	1975	1980	1985	1988
Austria	28.13	40.11	49.22	54.34
Belgium	28.51	36.87	44.01	49.87
Czech and Slovak Republic	17.61	20.61	23.14	25.47
Denmark	45.36	64.10	78.31	88.22
Greece	22.13	28.88	37.40	43.05
The Netherlands	36.75	51.78	60.47	65.86
Poland	7.54	9.48	11.29	12.78
Hungary	*9.91*	*11.77*	*13.95*	*15.81*
Germany	31.70	46.43	62.11	68.22
Italy	25.88	33.72	44.76	50.93
Portugal	11.29	13.81	18.04	21.91
Switzerland	61.33	72.23	83.19	88.16
Sweden	60.07	79.60	62.72*	66.21*

*Main station density indicator.
Source: Statistical Yearbook 1991. Hungarian Telecom Service.

As the funding of telecommunication was very low, significant differentiation was planned among social groups, settlement groups and provisions, thus the density of telephone stations also showed large spatial and inter-settlement differences within Hungary itself[8] *(Table 7)* (*Nagy,* 1995).

[8] Among settlements, size, industrialisation level, transportation importance were the major differentiating factors, while within settlements institutional centres and residential areas had priorities in provision. In social dimension income was the most important factor, and this, depending on the type of settlement, was favouring for the richest. Within the development concept of telecommunication priority was given to meeting quality demands (*Nagy,* 1995).

By the mid–1980s the Hungarian telecommunication was lagging behind international standards by 25–30 years. On the basis of this recognition the government gave high priority to the development of the telecommunication sector (*Heller–Nádasdi,* 1990). An active development and market assessment programme started for the digitalisation of data transfer channels and large sums were spent on the development and installation of home-manufactured telecommunication devices.[9]

Table 7

The density of telephone stations by counties

County	Number of telephone stations per 100 person			
	1975	1980	1985	1988
Baranya	8.6	10.5	13.1	15.4
Bács-Kiskun	4.4	5.5	7.9	10.2
Békés	3.8	4.9	7.2	9.0
Borsod-Abaúj-Zemplén	6.8	8.4	11.2	12.9
Csongrád	6.5	8.5	10.7	14.1
Fejér	6.0	6.6	7.6	8.5
Győr-Moson-Sopron	7.1	9.7	12.5	14.1
Hajdú-Bihar	4.9	6.8	8.8	10.9
Heves	5.6	7.9	9.7	12.1
Komárom-Esztergom	5.9	7.8	9.4	12.2
Nógrád	5.1	6.9	8.9	10.0
Pest	5.3	4.2	5.2	6.0
Somogy	5.7	7.0	8.7	10.8
Szabolcs-Szatmár-Bereg	3.0	3.8	4.9	6.0
Jász-Nagykun-Szolnok	4.3	5.1	6.5	7.6
Tolna	4.5	6.5	9.3	10.4
Vas	5.8	7.2	8.9	10.3
Veszprém	6.6	8.4	10.3	12.2
Zala	6.0	7.9	9.8	10.7
Counties total	*5.4*	*6.8*	*8.72*	*10.4*
Budapest	28.7	32.6	35.48	37.5
Total	*9.9*	*11.8*	*13.95*	*15.8*

Source: Statistical Yearbook 1991. Hungarian Telecom Service.

[9] Since the mid–1980s there has been a rapid growth in telecommunication investments in Hungary. The volume of investments into the telecommunication sector in percentage of the gross volume of total investments was 3.5% which is significant even by West European standards.

New development trends following the change of regime

On 31st December the Hungarian Post Company was split into three sections. A separate postal, a broadcasting and a telecommunication company were established and this gave a start to the restructuring of the information sector. In December 1991 the Hungarian Telecom Company (MATÁV Rt.) as the legal successor of the previous telecommunication company was established fully remaining in state hands. The initial economic position of the monopolistic company was weak. Although some data transfer networks existed in Hungary since the second half of the 1980s their large-scale development was not completed. Hungary's underdeveloped telecommunication and data communication infrastructure may be illustrated by the fact that during the early 1990s the majority of inter-settlement communication – and local – communication networks were made of low capacity copper wires. The majority of exchange centres were analogue systems but in some villages they were manually operated. The number of digital exchange centres, the most essential components of advanced communication was very low at that time. 46% of telephone subscribers were living in Budapest and only 5% were village citizens. New subscribers had to wait 6–13 years until connecting them to the system (*Pártos,* 1990).

This was the situation when MATÁV launched its three-year very ambitious development programme in 1991 with the following objectives:

- The installation of a broadband digital, optical and microwave backbone system connecting Hungary's 54 key telecommunication nodes. (As it was planned, the 3400 kilometre long 560 kbit/s bandwith optical network – as the basic structure of the Hungarian backbone system – was completed by 1993 *(Figure 1)*.
- The qualitative and quantitative improvement of services by using digital exchange centres (with the elimination of COCOM embargo the first digital exchange was installed in Hungary in 1989. The spread of digital phone exchange centres made possible to increase the number of subscribers by 50% and to significantly improve the quality of services between 1991 and 1993.
- The installation of a high-capacity packet switch centre to provide and improve computer and data transfer services (packet switch centres were necessary for rendering telecommunication and data communication services (videotext, teletext etc.).
- The enhancement of international connections (for this purpose a link was established to the Intelsat Satellite telecommunication system and VSAT services were extended).

The MATÁV's three-year backbone development program was successfully accomplished though during the running of this programme it became clear that the absence of significant capital would make the continuation of the optical backbone

Figure 1

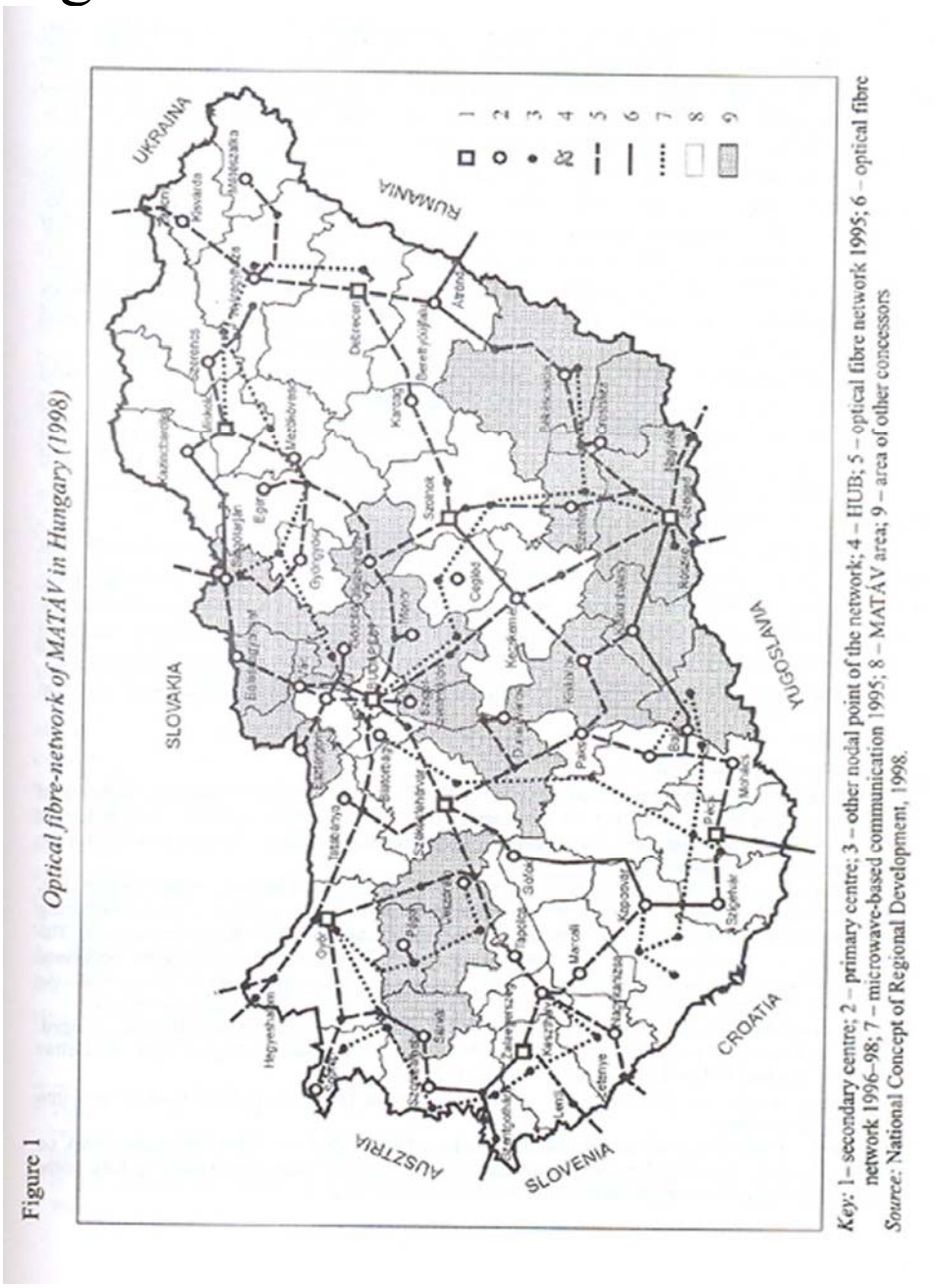

Figure 1 *Optical fibre-network of MATÁV in Hungary (1998)*

Key: 1– secondary centre; 2 – primary centre; 3 – other nodal point of the network; 4 – HUB; 5 – optical fibre network 1995; 6 – optical fibre network 1996–98; 7 – microwave-based communication 1995; 8 – MATÁV area; 9 – area of other concessors
Source: National Concept of Regional Development, 1998.

programme and the further development of services impossible. The partial privatisation (selling 30.2% of shares) provided additional funding sources for the company[10] being in the midst of its large-scale investment programmes. In addition to this privatisation the XVI/1991 *Act on Concessions* and the LXXII/1992 Act (*Telecommunication Act*[11]) enabled MATÁV to form a concession for providing inter-urban, international and in 29 primary telecommunication districts local telecommunication services. In September 1993 a tender was announced for rendering local cable telephone services in another 25 primary districts. As a result, MATÁV won service provider rights in another 10 districts, while in the remaining 15 primary districts 12 local telecommunication concessions (LTOs) were authorised for providing telecom services.[12] The present situation, the concession territories and their service providers are shown on the Concession Map *(Figure 2 – Annex)*.

Concession tenders were announced in mobile and pager services as well, and the winners launched their services in 1994–1995. In mobile business beyond Westel, Radio Telephone Company having been providing analogue services on 450 MHz frequency since 1990, two new GSM providers (Westel900 GSM and Pannon GSM companies) and two new pager service providers (Eurohívó Co., Easy Call Co.) started their activities.[13]

This was the time when the building of network and its qualitative improvement started at an accelerated speed. Manual switchboards and analogue exchange centres were transformed into digital ones and also some new exchange centres were built. Concession-bound telecommunication companies quickly started the building and modernisation of their telecommunication and data communication networks.[14] At the first stage of development the increase of the volume of subscribers was the

[10] The Hungarian government paid 400 million USD to MATÁV from the purchase incomes of MagyarCom. The company used it for the restructuring of its corporate structure, for the further development of its telecommunication network, for the establishment of seller's market and for the enhancement of its value added services.

[11] The Telecommunication Act stipulates that certain telecommunication services (public fixed phone, public mobile phone, public pager services, national, regional, radio and television broadcasting and programme distribution services) should be performed in the corporate form of concession. The Concession Act stipulates that concession-obligated activities (services) may only be performed within such agreements only that provide limited competition chances or may be rendered by the state or majority state shared companies having been established specially for these purposes.

[12] Due the corporate fusions of the past few years the ownership structure has significantly changed. New sevice providers emerged in some primary districts (e.g. the fusion of Digitel 2002 and Déltáv companies resulted V-Fon Rt. a subpart of the Vivendi Group).

[13] Today there is only one personal pager service provider in Hungary, as Easy Call merged into Eurohívó Rt. in 1999).

[14] Rapid development was motivated on the one hand by the conditions of concession agreements, on the other hand the growing demands of potential users (academic, education, public sectors, home business companies, multinational firms, public administration etc.)

major plan, which motivated them in building their end user networks[15] at an increased speed. Internet and data communication services (in most cases) were provided through a simple dial-up, X.25 or low speed leased-line networks.

Since 1997 the strategy of development has changed. This is explained by two major reasons. On the one hand, companies had to calculate on liberalisation starting in the year of 2002 in their long-term strategies, on the other hand due to the disappearing long waiting list of new subscribers, the period of large-scale plugging in new subscribers had gone. Naturally, the change in strategy was also the consequence of a dynamic development of data transfer and business communication sectors. To achieve a qualitative development in telecommunication the attention shifted towards creating better network facilities (greater capacities, better data transfer, SDH, ATM technologies, greater network security). More and more telecommunication nodes were equipped with digital exchange centres This resulted an increase in the share of digital centres from the level of 62% in 1996 to 92% at the end of year 2000 (*Nagy,* 2000b).

The modernisation and expansion of the existing telecommunication backbone system and local networks further continued[16]. As a result of these developments MATÁV, the largest concession-bound service provider became the proprietor of two high-tech international switchboard centres and an optical network equipped with SDH (Synchronised Digital Hierarchy)-based transfer technology crossing state borders at 11 transfer points. For providing a wider choice of communication transfer optical communication facilities were further extended by digital microwave communication services and an earth satellite station.

Beyond technical modernisation MATÁV has made several organisational and strategic decisions. The traditional subscribers' network was transformed into access network and with a more intensive marketing campaign they introduced several market-oriented products and services to increase their customers' orientation. In these years the improvement of business services the customisation of services for large subscribers seemed to be a second alternative. To become the largest telecommunication service provider over East Central-Europe was the third strategic objective of MATÁV, which was achieved by winning the MAK-TEL tender and through completing some projects in the whole regions' telecommunication development programme. The co-operation with strategic partners and fair competitors was the fourth and building stronger cohesion among the heterogeneous corporate structure of MATÁV was the fifth objective (the integration of the two WESTEL

[15] The concession structured telephone companies installed nearly 1 million of new telephone stations between 1994 and 1996. Thus, 2,651,000 main telephone lines had been statistically registered by the end of 1996.

[16] In year 2000 MATÁV had some 4000 km while other LTOs had 6000 kms fibre optical cable network.

companies into MATÁV was the most significant result achieved in this field). Apart from concession-bound telephone companies – since the Telecommunication Act of 1992 – the alternative telecommunication companies – through entering into the free segments of the telecommunication market – are also preparing for the liberalisation of telecommunication with a comprehensive development of their own networks. *Antenna Hungaria Company* has built a microwave network connecting 51 nodes and also became the proprietor of a 170 km fibre optical network in Budapest with another 1300 km fibre optical network having built together with Hungarian Electricity Company. *GTS Hungary Ltd* has built a 120 km fibre optical network in Budapest, a microwave network connecting more than 60 cities and the company has also been the proprietor of a satellite network system since 1993. The *Novacom Telecommunication Company*, by using the telecommunication network of Elmü and Émász electricity providers, has an 1100 km optical backbone system and also has developed a technology to transfer telecommunication signals to households through the electricity power circuit system.[17] *Pantel Rt* has laid down an optical cable network along the Hungarian railway lines in a total length of 3200 km. This practically covers the whole territory of Hungary. During the last few years there was a significant development in the building of international network connections, which has enabled the biggest alternative telecommunication companies to maintain connections with several countries through their own network.

Until liberalisation telecom companies were concentrating on value added services and a more intensive marketing but some of them emerged in the cable television service market (Monortel, Jásztel).[18] Following a quantitative development the concentration of service providers was expected, as the majority of companies needed bank loans to finance their intensive developments and in the late 1990s the quick spread of mobile services significantly reduced investment return rates. Several companies (Déltáv, Emitel, Hungarotel) have won spatially contiguous service provision areas while others (UTI) tried to integrate and coordinate their activities in spatially separated service regions. The concentration and the restructuring of proprietory structure resulted the integration of Jásztel into the Vivendi group and the proprietary change of Monortel (the new proprietorship was won by UPC a very

[17] PLC (Powerline Communication) network is planned for 2 Mbit/s speed capacity, which is 20 times faster than the present ISDN. As it needs no additional infrastructure and its maintenance is cheaper than the traditional phone cables, telecommunication experts see bright perspectives in this technology.

[18] The importance of cable television networks in data communication – since the emergence of the first multiple node networks being capable for bi-directional (duplex) communication – is in a continuous growth. This technology is now available in 60–70 per cent of those 1.5 million households that are connected to the network. This coverage is expected to grow to nearly 100 per cent within the next few years.

active participant on the Hungarian cable television service market). MATÁV has acquired the shares of Emitel an Israeli-owned company (with the exclusive service provision license in three contiguous districts within Bács-Kiskun county), while the radically expanding Vivendi won service provision license for the districts of UTI, because UTI is struggling with financial problems.[19]

Finally, in the formally (23 December 2001) and practically (22 January 2002) liberalised telecommunication market five companies won their four-digit call sign (which actually stands for four companies/consortia). This enabled them to enter the market (V-Fon, V-Com, E-Tel, Pantel Novacon). Of them only E-Tel, majored by Irish proprietors is new in the Hungarian market but it has wide experiences in the problems and strategies of entering into competition. As in West Europe, competition is present only in some partial segments of the market (for getting large business customers) and only in some concentrated markets (Budapest, large Hungarian cities). From this aspect the British market has several examples but real competition has been going on only in business communication and concentrated urban markets while the development of peripheral areas is significantly lagging behind them.

Concluding remarks

The transformation of centrally planned state socialism into a market economy brought fundamental changes for telecommunication services. Before the change of the regime Hungary had a poor telecommunication system lagging behind modern technologies by 25–30 years with an average 6–15 years waiting period for new telephone subscribers and only local telephone exchange centres operating on low level technology. After ten years we are experiencing disappearing waiting lists, ISDN, xDSL technologies, high network culture, Internet-based communication facilities and a wide range of applications. The technical parameters of networks and the applied network technologies – as a result of a ten-year development – are now approaching the European standards. This was very advantageous for providing telecommunication and information services for Hungarian users.

Due to the intensive development of the telephone network now we can see a sellers' market in voice communication services, which can be further expanded by the liberalisation of telecommunication. However in data communication – despite intensive development efforts – the building and operation philosophy of data transfer systems grant just zero profitability. For this reason they have an excluding character. Advanced data communication services are available mainly in districts

[19] This company entered into competition by signing an agreement with the local governments of Pécs and Székesfehérvár on building another telecommunication network to be rivalling with the existing local service provider.

with digital exchange centres. However the low population, the low number of business organisations, and the low level of user demands bring about large spatial differences in the availability of digital networks. Even now there are some primary districts with lower than 70 per cent of digital exchange centres, one of the most essential components of advanced information technology (*Nagy,* 2000b).

The building of technical/technological networks – especially now, at the brink of the Information Society – is (or may be) a differentiating factor in regional competition. We should never forget this, even if technical achievements, scientific research, technical innovations (GPRS, VMTS, ADSL, WLL, PLC) and a well-organised development policy may enhance them and the direction and intensity of spatial differentiation may significantly be modified by regional policy.

2.2 Telecommunication and data transfer technologies

Fixed telephony

After the change of the regime a special development programme was launched to develop telecommunication systems and to improve telephone station supply, in the hope of closing up Hungary to the European development of telecommunication technology. These efforts resulted in more than 10,000 km of fibre optical cable backbone system within ten years. Telecommunication, data transfer and telegraph services were modernised and the volume of international connections also increased. To raise the quality of network among LTOs the system of MATÁV was linked through X.25 network with 83 other network systems and through ISDN with another 40 countries.[20]

The capacity of digital exchange centres, one of the most critical technical parameters of advanced data and telecommunication services, increased to a 260-fold value of the earlier one in 1989. Between 1990 and 2001 the number of telephone stations increased by 380 per cent, reaching the volume of 3.75 million at the end of period. In the first four years the growth rate was 50 per cent only but as a result of a quickened development programme after the partial privatisation of MATÁV, the only national level service provider, the number of new subscriptions almost doubled in three years. After node districts had started to operate in concession-bound structure – as stipulated by the Telecommunication Act – a "sellers' market" was shaping up in the whole territory of Hungary. Since that time fixed telephony has been stagnating but a qualitative restructuring is making its way through the

[20] International connectivity is provided by joining to the global European Network (GEN), which is a high capacity integrated network management system that provides access to international leased lines.

existing system. This process is marked by a rapid increase of ISDN lines (it was almost ten per cent of the total in the middle of year 2001), the fast spread of ADSL lines (this may be explained by their cheapness) and the rapid growth of digitalisation. In 2000 the average of telephone supply was 36.8% on national level, 50% in Budapest and even exceeded 30% even in rural areas.

Concerning telephone supply indicators the ranking order of counties has also changed during the past ten years. Industrial counties, having had good positions before the 1990s, lost their advantages. On the other side, the Budapest agglomeration with the winner regions of restructuring is taking now far better positions than ten years before (*Nagy,* 2000a).

The counties of the Hungarian Plain – with the exception of Csongrád – were in a disadvantaged position regarding the quantitative indicators of telephone supply. The lower income of residents, the lower telecommunication culture resulted in lower social acceptance, which is clearly marked by a relatively lower penetration level. Though the speed of development there is not falling behind the national average, it neither eliminates the inherited disadvantages.

In the year of the privatisation of MATÁV before signing concession agreements the value of *micro-regional* telephone supply difference index was 12 between Balatonfüred being in the best and Monor in the worst telephony situation. This is well illustrated by the fact that within 26 micro-regions the number of lines *per one thousand head* was below 50. Four of these micro-regions were inside Pest county, just in the proximity of Budapest, the capital city, 13 were in Transdanubia (of them 11 in Western and Central Transdanubia, the most advanced regions of economic restructuring). However the number of micro-regions with more than 200 main telephone lines per one thousand head was only eight. At that time apart from Budapest the eastern basin of Lake Balaton, the cities of Sopron, Pécs in the Transdanubian region, Miskolc and Tiszaújváros, the central places of the North Hungarian industrial district, and Szeged the institutional, economic and transportation centre of the Hungarian Plain had the best telephony indicators *(Figure 3)*.

By 1998, the year of shaping up the sellers' market, the spatial structure of telephony has changed. The growth in the number of main telephone lines may be demonstrated by the fact that today only 12 Hungarian micro-regions have worse than 200 per one thousand head indicators. With the exception of two micro-regions (Sellye and Mórahalom) these weakly supplied areas are concentrated within one spatial unit covering the northern part of Borsod-Abaúj-Zemplén and some parts of Szabolcs-Szatmár-Bereg counties. There has been a similar fundamental restructuring within the group of micro-regions with advanced telephony situation. Of the total 18 micro-regions belonging to this category, only one is situated in the Hungarian Plain (it's Szeged again), one is in the North-Hungarian region (Eger) and the others are within the greater Budapest agglomeration, at Lake Balaton, or attached to one of the dynamically developing

Figure 3

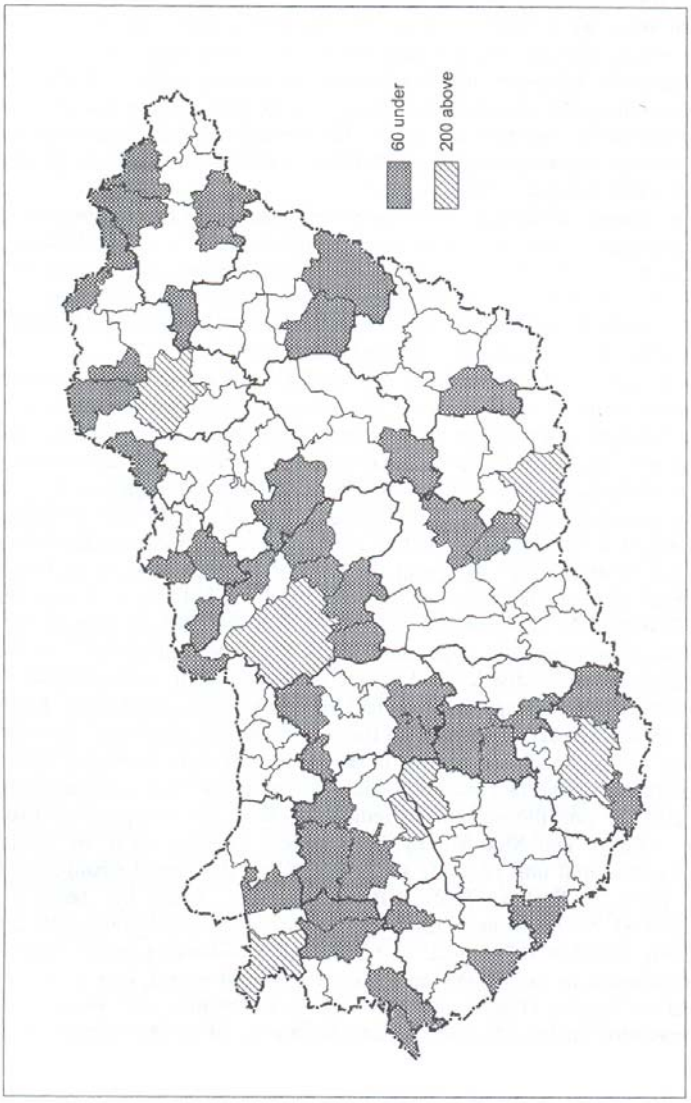

Figure 3 *Number of phone main lines by small regions (per 1000 inhabitants, 1993)*

Source: Small regions in Hungary, KSH, 1994.

cities in Transdanubia. It was Balatonfüred again produced the greatest density of fixed telephone network with an indicator of 510 phone lines per one thousand head but the difference index between the first and the 150th micro region in the ranking list (Baktalórántháza) is only 3 now (*Nagy,* 2000a).

Comparing year 1998 with the millennium the situation did not change radically. The best micro-regions are still around Budapest, Lake Balaton, and Lake Velence and the spatial spatial structure of the weakest micro regions also remained almost the same. The difference index between the greatest line density (Balatonfüred) and the smallest line density (Mórahalom) micro-regions has decreased to a value of 2.5. Today Hungary has no micro-regions with below 200 per one thousand head telephone lines but only one micro-region is producing a more than 50 per cent penetration indicator *(Figure 4)*.

It is clearly seen now, that the agglomeration zone around Budapest and Lake Balaton are the winners of telecommunication development. Only some specific – considered only in Hungarian dimensions as – large cities are suitable for the adoption and implementation of advanced telecommunication culture. At the same time it seems the most likely that in several micro-regions in the northern and eastern areas of Hungary these radical and revolutionary telecommunication changes will have only a moderate impact on their development because neither a solvent demand nor a critical mass of potential users are present for the implementation of advanced communication services for business and public purposes.

The dispersion diagram of national-level telephone supply showed a rather high value of 0.414 in 1990 and was only a bit lower in 1993–94 but due to the increasing amount of telecommunication investments it dropped below 0.124, which is fairly a good value. The fall off of the dispersion indicator is a clear sign of the disappearing dichotomy between Budapest and the remaining parts of Hungary within the telecommunication sector. Until 1995 the dispersion excluding Budapest was stagnating on a relatively low level (0.18–0.19) and dropped below half of the initial value within the next three years. Although the absolute value of decrease was behind the national average, the dispersion indicator of territories outside Budapest is still showing a strong spatial equalisation process (Regional-level dispersion indicators are lower than county-level indicators).

Meanwhile there has been an intensive levelling process in the technical and technological development process. Today every Hungarian region is ready for the implementation of various forms and channels of telecommunication, the present technical development of network and the existing availability of capacities are not limiting the chances of economic and social development. The low level of personal incomes is the only bottleneck of accessing information but now it is only a hope yet that liberalisation will bring success for this sector as well (*Nagy,* 2000a).

Figure 4

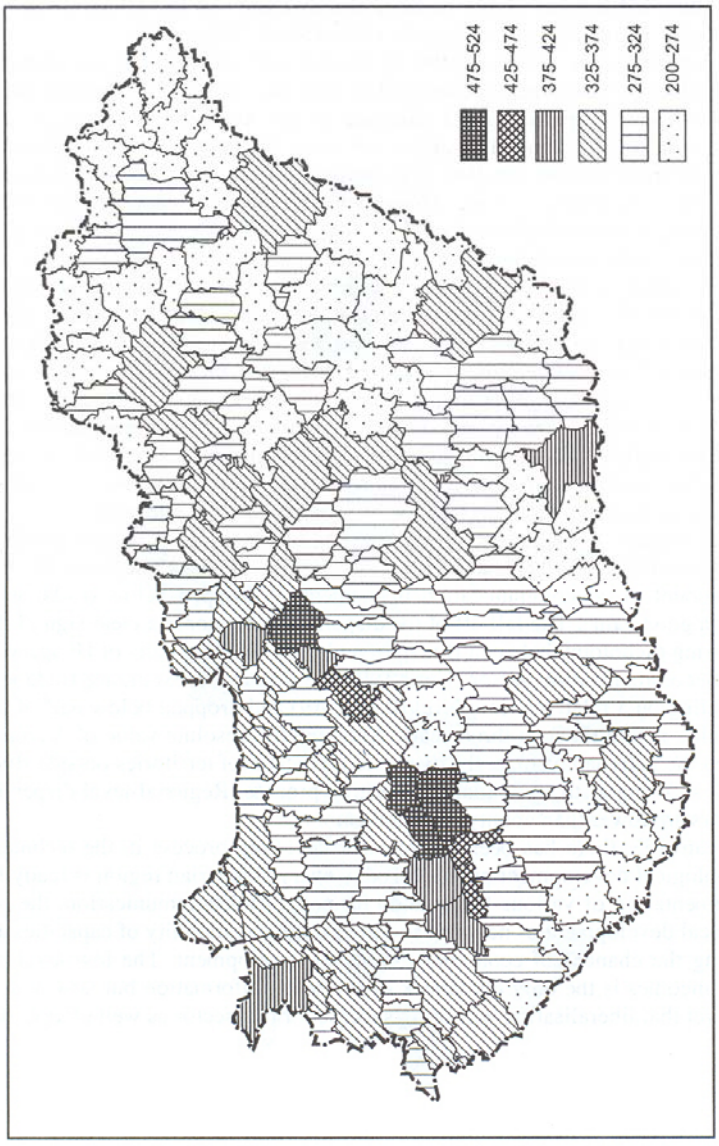

Figure 4 *Number of phone main lines by small regions (per 1000 inhabitants, 2000)*

Source: Regional Statistical Yearbook, 2000.

Mobile communication

Hungary was the first country in East Central Europe to have *mobile communication sector* after the introduction of the NMT system at MATÁV and USWest. Although this service had some history in Hungary (just think of CB radio system having been used for ten years) the massive expansion of this system through the whole country, the miniaturisation and cheapening of cellular phones, the widening choice of network services all were pointing towards a new stage of qualitative development in Hungarian mobile telecommunication. The dynamic development of the NMT network was not halted by the newcomer GSM providers but even increased and the number of NMT subscribers approached 100,000 by year 2000. The vitality of NMT networks was based on that technical modernisation's that made possible the introduction of such services (SMS, VoIP-based phoning, mobile Internet) that were earlier available only through GSM networks. Although the absence of roaming services is a spatial limitation in 450Mhz communication, the continuity of technical modernisation guarantees long-term viability for the system.

With the two GSM companies having been established in 1994, by the end of 1996 the number of service providers with the full area coverage of Hungary had been selling their best entry offers, cellular phones and services[21] increased to three. By the end of 1998 the potential full capacity of these three networks had reached the volume of two million, which was doubled by year 2000 but the speed and intensity of network development is still continuing, as the number of subscribers is growing exponentially. It was 17 thousand at the end of 1993, 55 thousand in 1994, 270 thousand in 1995, 480 thousand in 1996 and 670 thousand at the end of year 1997. 1998 was a special year from this point as this was the first time when the number of subscribers exceeded the volume of one million and mobile service coverage was 10% within the total population. By the end of 1999 the volume of subscribers increased to 1.67 million, of which 100 thousand were NMT subscribers. In that year Vodafone could collect only 20 thousand new subscribers within its first two months of operation. The growth of new subscribers continued on the same intensity, by the end of year 2000 the total number of subscribers increased to 3 million and it was 5 million by the end of year 2001. This resulted 30% provision and 50% penetration index. But the collection of new subscribers cannot be maintained at the present pace. According to estimations the number of new subscribers will increase only during the next 12–18 months, then competitors will concentrate on the redistribution and maintenance of their existing customers.

Development was based on the rapid development of networks, on the continuity of technical modernisations and on the extension of communication frequency bands. This is illustrated by the fact that starting from one switchboard centre

[21] The trilateral tender for DCS 1800 Mhz system was announced in 1999 and was won by Vodafone (V.R.A.M.) against the other two GSM service providers.

Westel is now operating 15, and Pannon 10 centres. Both companies had achieved national coverage by the end of year 1996 but the growing number of subscribers and the increasing demand for advanced services require continuity in opening new cells, i.e. building new base stations. Both companies had installed several thousands base stations by the end of year 2000. Local protest demonstrations against the building of these stations were held only in a few cases (in the organisation of local green organisations). Vodafone, having started in the Hungarian market far later than its competitors and having been authorised for the use of its two competitors for a definite period, is rapidly developing its own network. Through this development now 95% of Vodafone subscribers can communicate through Vodafone's own internal network.

The further development of intelligent network is guaranteed by the introduction of GPRS systems (it was first accessible on national level through the Pannon's network) and by winning the concession for rendering services on 1800 MHz frequency. WAP service, having been advertised at large costs as an access to mobile Internet, was a technical "failure", because its low speed (14.4 kbit/s) made impossible to use it as an alternative of low-speed modem connections. The three GSM competitors so far have invested nearly 1 billion USD each into the development of mobile communication system, which resulted in a modern, technically up to date network meeting the highest European standards.

There are several milestones in the ten-year development of the Hungarian telecommunication system. They are marked by the start in 1990, the two concessions (having been licensed for 15 years), the DCS 1800 Mhz tenders (in the autumn of year 1999) and the passing of Telecommunication Act(s). The exceed of the 10% level of service coverage was the first significant result, and this was followed by 25% in September 2000 and completed by 50% at the turn of years 2001/2002. As it is seen, the introduction of "pre-paid" card system, to facilitate the migration of users from one service provider to the other, was a necessity for the mass distribution of cellular phones. While the share of these constructions is 66% in Westel and Pannon, it is over 90% in Vodafone (though their presence rate among the new subscribers for the other two networks shows similarity). This means that pricing and customisation will have an increasing role in the formation of subscription categories.

The widening palette of services is one of the key elements of the increasing popularity of GSM services. It is quite interesting that the speed of the introduction of services had no serious impacts on popularity (it may be explained by the competitors' quick follow-up in providing similar services). Roaming the availability of the service providers' facilities outside Hungary is a great advantage of the GSM system. In this area – according to our latest information – Westel has gone further than its competitors by signing an agreement with 200 service providers from 87 countries. At the end of year 2000 147 service providers in 69 countries were

available through Pannon and 157 service providers in 77 countries were available through Vodafone's roaming facilities.

The spread of cellular phones showed a strong spatial hierarchy until their mass utilisation (2000–2001). Their fast spread was not followed by a levelling of user categories. The use of cellular phones for business was the most typical in Budapest (some 50%) and in the largest cities (20–25%). In settlements of lower importance the spread of cellular phones was largely depending on local economic development and personal incomes. The full territorial coverage of fixed telephone system put an end to the necessity of cellular phones to use as an alternative but they may applied as a second telephone just like as they are used in Scandinavian countries since the second third of the 1990s.

VSAT services

VSAT services have undergone a spectacular development within the *data transfer* sector. The four competitor companies were servicing for more than 1000 terminals at the end of 1996 and their service coverage included some East Central European regions as well. As a result of development Budapest has become the information hub of the greater region. Easy installation, portability and moderate operation costs are the greatest advantages of the VSAT system. A single central HUB station may establish and maintain point to multi-point connection with several thousand terminals. Time-divided multiple access (TDMA), operation makes the operation of the system very economical.

The majority of multiple site firms did not by accident select the satellite-based data communication system for their internal data exchange. The system enables company seats to monitor their affiliate's activities and intervene as needed. The Montana, MATÁVNet, Banknet, GTS-Hungary and Hungaro DigiTel are the five flagships of this sector. The activity scope of these firms covered the whole territory of Europe from London to Moscow. As it is seen from the activities of these reference companies, the number of targeted sectors and companies has increased since the previous years. Besides banking-insurance, retail and wholesale trade, they are interested in Stock exchange information, the servicing of public administration, the management of energy systems, transportation companies, and Hungarian manufacturing firms (Pick, Villeroy&Boch, MOL) and also have customersts from such sectors as computer industry, office technology and information service.

These systems are customised to the users' profile by three main categories:

- mono-directional (simplex) data broadcasting systems: news agency applications, stock market information, weather report broadcast, software remote maintenance etc.;

- data collection systems: warehouse stock reports, sales traffic collection, remote sensing data processing (electricity supply, oil and gas pipes, railway and seismologic observation points, meteorology stations, protection against flood);
- bi-directional (duplex) systems: banking applications, machine transactions, (bank card payment methods, POS terminals, ATM machines) online stock exchange transactions, in-advance booking (commercial networks, department store networks, public administration, health service).

Hungarian VSAT services are not only suitable for national level data communication but also for intercommunication with regional development institutions and agents as their security level is higher than 99.5% and their data transfer speed is high (minimum 2 Mbit/s).

Cable television networks

Until 1987 the decentralisation of Hungary from mass media aspects was very weak because all sectors of mass media were centralised. Even deconcentration was going on in a centralised way, which may be well demonstrated by the system of regional radio and TV studios and their districts. However, this institutional structure was a good starting point to the real deconcentration having started with the change of the regime.

Every year or two years there were large fluctuations in the survey data of cable television networks, which is an explanation why time series data are hardly recommended for use, as the annual change in the data of wired homes and cable TV subscribers exceeds the value of one hundred thousand.[22]

The number of wired TV households increased from 360 thousand in 1990 to 1.6 million in 2000. This means that during this period two from every five households joined the CATV system. The number of subscribers is a little bit smaller but the difference between the two figures is tending to decrease showing that at those places where this facility is available CATV services are generally subscribed. The technical parameters of CATV networks have significantly improved due to the increasing sum of investments. While in 1997–98 3–3.5 billion HUF was invested into CATV network development, this figure went up to 15 billion in 1999 and 28 billion in 2000. This increased the asset value of CATV networks from the value of 8.1 billion HUF in 1997 to 46.3 billion in 2000. This is an indicator of a giant technological development, which was generated by the change of the regulatory envi-

[22] Statistics provides no qualitative information on cable TV networks, even such simple parameters as the percentage of multiple-node networks and/or the percentage of bi-directional (duplex) data communication networks. These values are available only from the annual reports of the Hungarian Communications Authority.

ronment and carried out by service providers by significantly increasing network intelligence. By the end of year 2000 67% of wired homes had excellent or good quality multiple node (enabling bi-directional communication) cable-networks (this figure may go up to nearly 100% within the next two years). As CATV network is also suitable for high-speed data communication (2 Gbit/s) at moderate costs it may even be an alternative in the competition of last mile[23] technologies. Besides Budapest and some agglomeration settlements these technologies have been implemented in the settlements of Monor node district and mainly in some large and medium-sized cities (their cost-effective operation is expected within these categories) *(Figure 5)*.

Uneven network development is clearly illustrated by the fact that since 1995 regional-level dispersion indicator decreased only by 4 points (to the value of 0.26) while county-level dispersion indicator decreased by 10 points (though the start level – 0.46 – was also much higher). Micro-regional dispersion indicator is very high and stabile (0.57). This is clearly showing how large the difference among regions. At the end of year 2000 CATV services were completely missing in eight micro regions (Aszód, Szob, Sárbogárd, Püspökladány, Vásárosnamény, Nagykálló, Mórahalom) but on the other hand 30% of homes had CATV in five micro regions (Oroszlány, Tata, Tatabánya, Veszprém, Miskolc) and at least 25% of homes were wired in another 15 microregions *(Figure 6)*. On county level the indicators of Komárom-Esztergom, Zala and Veszprém counties are the best, on the other hand Pest, Szabolcs-Szatmár-Bereg and Jász-Nagykun-Szolnok counties have the lowest indicators. Since 1995 the position of the first and last counties has remained the same. The connection between the two channels of communication (telecommunication and CATV system) is weaker than expected and shows the marks of instability. As it has been seen the development of telecommunication infrastructure does not automatically generate the growth of CATV services and has no significance on the number of fixed telephones (*Nagy,* 2000a).

The change of legal regulation generated an intensive concentration within the CATV market, as several service providers were unable to fund the costs of the total modernisation of their network or transfer its costs to subscribers. UPC the Dutch CATV provider is the most aggressive company in this market – due to its special interpretation of telecommunication acts and decrees – was able to grow into the largest CATV service provider in Hungary. The affiliate of MATÁV is the second in the competition. Between 1998–2000 these two companies won the majority of those market segment in places with offering concentrated demand for mid-term period. This left only moderate development chances for small and

[23] Through the utilisation of the capacities of digital telecommunication networks several alternative technologies are competing for the best position in plugging in local subscribers into their network to obtain larger share within data communication sector as it is regarded to be the most dynamically developing market segment.

Figure 5

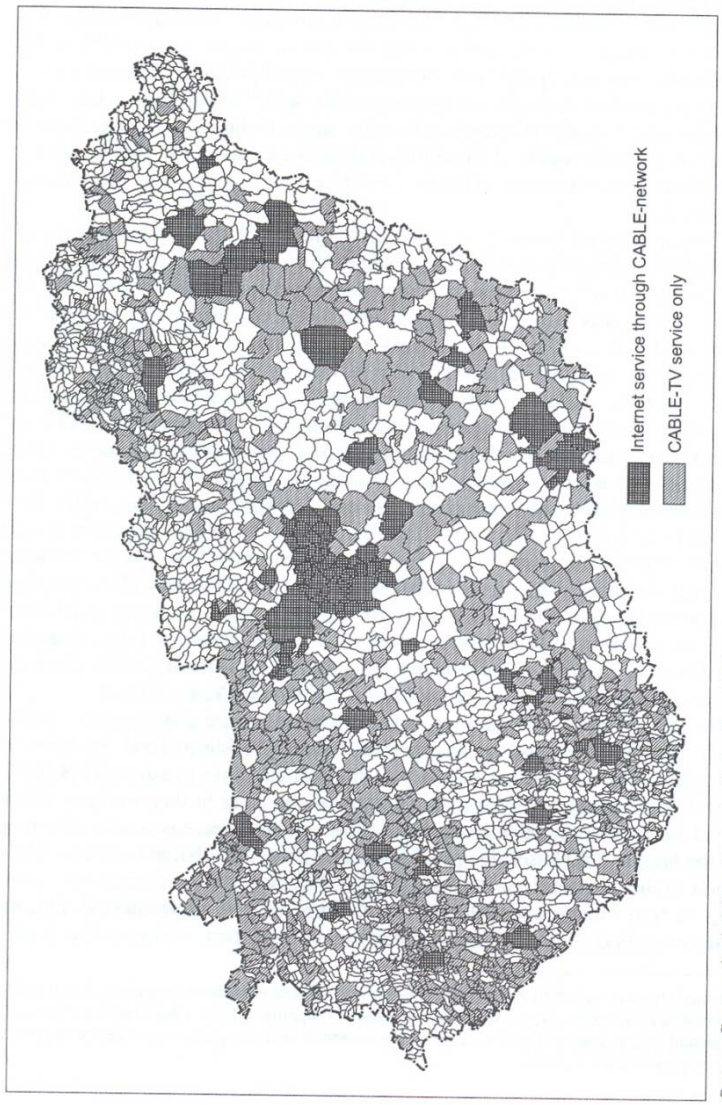

Figure 5 *Technical characteristics of CABLE TV networks, 2001*

Source: Communication Supervisory Authority, June 2001.

Figure 6

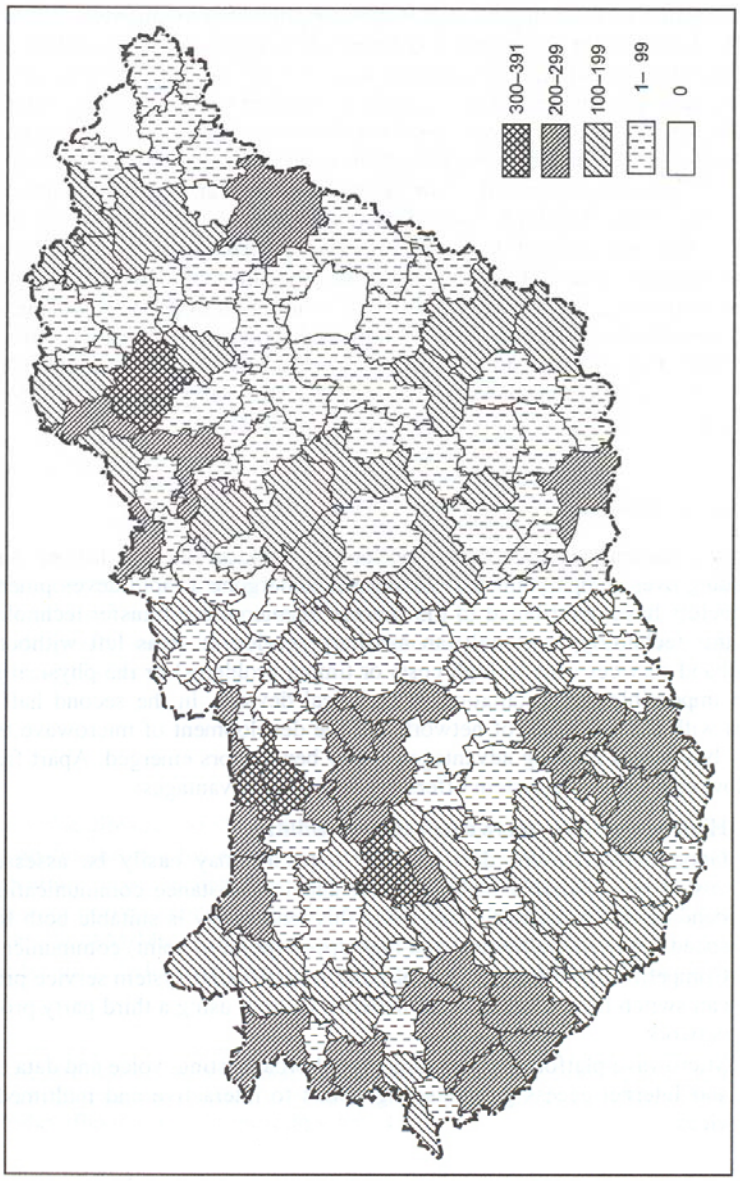

Figure 6 *Number of flats with CABLE-TV connections (per 1000 inhabitants, 2000)*

Source: Regional Statistical Yearbook, 2000.

middle-size service providers. They may expect some profit only from the establishment of some small micro-regional networks, though the operation costs on this spatial level are higher than in densely populated urban areas.

The development of network intelligence has significantly reduced the speed of new installations but after its completion (at the end of year 2003) the intensity of joining new subscribers will go up again. Compared to the European standards the present supply indicator is very good but it may further be increased, especially if the number of communication applications is producing significant growth.

CATV networks have undergone rapid quantitative and qualitative development during the 1990s. The high share of new subscribers and the improvement of network intelligence enabled these systems to act as challengers for the telecommunication network in the field of integrated data transmission. However the strong regional disparities, the aspects of network building and operation and the current development trends do not allow to reduce differences within this segment in a short time. For all that CATV networks, as information transfer agents should be taken into account in developing a micro-regional, county or regional information strategy.

Microwave networks

This data communication technology, looking back the shortest history, has been spreading over Hungary since 1992 and has undergone a rapid development. Several factors have contributed to the success of microwave transfer technology. At first this technology was only an auxiliary service in areas left without wired broadband services (due to high costs or timing problems) or the physical surface made impossible the installation of technical devices. In the second half of the 1990s with the extension of network and the development of microwave technology – besides its existing advantages – new benefactors emerged. Apart from fast and low-cost entry, the system offers the following advantages:

- High quality and secure data network facilities
- Good configuration: data network capacity may easily be assessed and customised. Suitable both for short and long-distance communication. Depending on the carrier's frequency this technology is suitable both for low-speed (point to multipoint) and high-speed (point to point) communication.
- Competitive prices as in case of point to multipoint system service providers can switch their users into the network without using a third party provider's network.
- Microwave platforms integrating digital broadcasting, voice and data transfer and Internet access good starting points to interactive and multimedia services.

From the aspect of the accessibility of these services we emphasise that several Hungarian telecommunication companies are profiled in microwave data transfer services. GTS Hungary and Antenna Hungaria have built their own national backbone system *(Figure 7 – Annex)*. GTS Hungary has built microwave stations at more than 600 points, while Antenna Hungaria has built at 51. In the same period MATÁV has built its independent microwave network. This technology is extremely valuable today because after liberalisation telecommunication companies established their services in such areas where optical or copper wired subscribers' networks had not been installed but had available backbone facilities.

Despite these advantages of microwave technology its later development largely depends on frequency management policy. The most valuable frequency range for telecommunication and data communication has already been distributed. For this reason there will be a heavy demand for those frequencies that represent high value for telecommunication and data communication. (i.e. they cover long distances) and a continuous battle will be going on for their redistribution. The increasing value of available frequencies is well illustrated by the fact that telecommunication companies – in Europe and since the 1990s in Hungary as well – are paying heavy sums for frequency licenses (e.g. cellular phone service providers for 900 Mhz, 1800 Mhz, GPRS, UMTS). In Hungary the frequency band of 3.5 Ghz has been sold out[24] and a new tender will soon be announced for the distribution of the 26 Ghz frequency band. These new frequencies will serve as a basis for companies profiled in microwave data transfer to improve their network and services (leased line, Internet access, VoIP, speech technology etc.) through which they can significantly extend their telecommunication access into less provided areas. This technology will spread mainly in urban agglomeration areas where mostly multiple-site companies will be its end-users.

Outlook

There are some already tested but not yet implemented technical applications such as data transfer through the electricity network which would make advanced data communication networks instantly available for 96–97% of the total population. We did not go into technical details in case of VoIP, the ground stationed satellite system or the AM-Micro systems, making regional-level data communication available for users. Although these technologies are the real alternatives of the ex-

[24] There were five winners in the auction for the license of 3.5 Ghz frequency band (Vivendi, MATÁV, PanTel, Antenna Hungária, GTS Hungary) who paid a sum of 2.8 billion HUF into the central budget. This is higher than originally expected.

isting forms of communication they are not analysed in this paper[25] because they would have very small impacts on the present spatial structure. At first it will be large consumers who will benefit from the advantages of competing "last mile" technologies and the liberalisation of telecommunication but we are on the opinion that technology development, the ongoing improvements will bring positive changes for small individual users within the next few years. It is a bigger problem how micro-regional/regional level, which has a larger role in the articulation of local interests and the co-ordination of resources, can follow the changing situation. Can it find the most suitable technology or an optimal combination of competing technologies and use them for better spatial organisation and integration? As a step towards direct democracy will it be possible – at least on regional level – to gather the opinion of (almost the total) population in an issue on which policymakers can make and execute their decisions on majority vote basis? Can public administration get closer to people at least on local or even on regional levels? Can new technologies help us in turning the present political power system into a serving for the people system? Does the spread of new technologies create equal chances for us all? Can we avoid the making of another social gap, which would create a dualistic society through the dimensions of information illiteracy?

2.3 The future trends of telecommunication and data communication market

Telecommunication and data communication were success stories in Hungarian economy at the end of the 20th century. Their profitability index – especially since the mid–1990s – were far above the national average. The annual increase in the net income of the Hungarian telecommunication sector was 35–40%, more than double of the West European average. All the time profitability was determined by the extremely high investment rate (it was 25% in year 1999) and this resulted in the continuity of the development of new technologies and services and in the growth of the whole telecommunication and data communication network. During the last years of the 20th century as coming closer to the liberalisation of telecommunication in 2002 there was an increasing competition among companies in the area of telecommunication and data communication in the limited-size market of Hungary. To preserve their market positions, to meet the ever changing market demands and to yield the pressure of proprietors, investors and the stock exchange the launched new and new technology development, service enhancement and net-

[25] Novacom Telecommunication Ltd. has developed a technology for the transmission of telecommunication signals to households through the electricity network system.

work development projects. These projects were aimed at increasing the number of subscribers and at providing them as a wide range of services as possible. However several companies were unable or – due to the long investment return period – were unwilling to finance the costs of investments and the Hungarian telecommunication market – following international trends – faced[26] several fusions and procurements. After liberalisation new and rich service providers will emerge on the Hungarian market and further fusions, procurements and strategic alliance formations may be expected. This process is rather more strongly motivated by economies of scale, by a more powerful cost-efficiency, by a stronger bargaining position against satellite firms and by synergic effects, which may be achieved through the formation of strategic alliances. This means that during the first years of the 21st century the major trend in Hungarian telecommunication and data communication sector besides dynamic development will be the decrease of the number of service providers.

Future trends in services

Today more and more news information and data are being transmitted through separate and independent channels. But *future* is for *integrated services*. With the improvement of living conditions (with the spread of new forms in the maintenance of contacts, in the gathering of information and new work or leisure activities) there is growing demand to be connected to communication networks. Subscribers would like to have access not only to traditional communication (voice, data, pager, video signal transfer) service facilities but would rather to have their integration.[27]

Thus, to meet the new demands within the next few years the traditional serial line services will be replaced by new – broadband – (leased line, ISDN XDSL, VTMS, cable modem, VSAT) data communication systems and new services that will be provided by network operator companies. The spread of broadband networks and the further development of information society largely depend on such a regulation, which facilitates competition, and innovation, contributes to the development of technology, to reducing the access costs and to the social adaptation of information technology.[28]

[26] These processes are clearly illustrated by Vivendi's acquisitions MATÁV's procurements and the procurement of Hungarian CTV and Internet companies by UTC and GPS Hungary.

[27] This trend seems to be verified by the fact that the demand for broadband services has increased by 10–15 fold compared to the earlier periods.

[28] To this the Single Telecommunication Act and its execution directives as the guidelines of future development trends may be good starting points.

Possible changes in transfer technology and telecommunication networks

During the past ten years the number of telephone lines increased by 340%. But the last two years show a slowdown in the dynamism of development compared to the earlier period. This is a clear mark of the saturation of fixed phone service market *(Table 8),* which can be explained by the changing communication attitudes of potential subscribers and these attitudes are closely followed by the emergence and rapid diffusion of alternative products and services (e.g. cellular phone services, microwave telecommunication services, CATV networks).

Table 8

The number of fixed phone subscribers

Year	Number of main lines (items)	Relative change to the base period (1991) (%)
1991	1,129,100	–
1992	1,292,100	114.4
1993	1,497,600	132.6
1994	1,785,400	158.1
1995	2,157,200	191.0
1996	2,651,200	234.8
1997	3,095,300	274.1
1998	3,385,100	299.8
1999	3,609,100	319.6
2000	3,687,000	326.5
June 2001	3,756,776	332.7

Source: the author's calculation on the basis of KHS (Central Statistical Office) data.

During the next few years the increase in the number of fixed telephone main lines will ultimately depend on the competitiveness of the service packages of wired telecommunication companies and the capacity and quality of the backbone and auxiliary network service providers. Thus, it is expected that after liberalisation the backbone and auxiliary network of telecommunication service providers will further be improved, primarily in cities and their agglomerations, as these areas that offer stronger solvent demand for telecommunication companies.

The present 92% digitalisation level of the telecommunication system will grow to 100% within the next two-three years and this will bring about significant changes in the quality of main lines as well. The rate of ISDN will increase from the present 10.7% to 30–35% by 2005, while the share of ADSL may reach 10–15% within the total fixed telephony network. However by the end of this period

the penetration of fixed telephone network still going to be under the European average. The number of main telephone lines per 100 head is expected to be topped somewhere between 40–45 *(Table 9)*.

Table 9

The division and density of ISDN by counties

Counties	1998	1999	2000	Population	The share of population within the country	Density (lines/1000 head)
Budapest	48,372	70,052	159,590	1,811,552	49.54	8.81
Bács-Kiskun	1,286	2,938	8,912	532,465	2.77	1.67
Baranya	2,212	3,796	13,264	400,806	4.12	3.31
Békés	61	224	1,820	391,702	0.56	0.46
Borsod-Abaúj-Zemplén	1,966	3,912	14,966	729,965	4.65	2.05
Csongrád	0	161	3,772	417,668	1.17	0.90
Fejér	1,869	3,495	9,412	423,531	2.92	2.22
Győr-Sopron-Moson	2,734	5,666	16,706	424,507	5.19	3.94
Hajdú-Bihar	1,646	4,190	11,338	541,581	3.52	2.09
Heves	648	1,242	7,704	322,629	2.39	2.39
Jász-Nagykun-Szolnok	1,069	1,552	5,878	410,694	1.82	1.43
Komárom-Esztergom	756	2,057	6,332	311,770	1.97	2.03
Nógrád	115	285	1,710	216,538	0.53	0.79
Pest	2,956	4,952	19,206	1,032,672	5.96	1.86
Somogy	0	0	7,966	330,261	2.47	2.41
Szabolcs-Szatmár-Bereg	674	1,666	7,184	569,676	2.23	1.26
Tolna	0	1,366	6,048	243,701	1.88	2.48
Vas	915	2,364	6,108	266,411	1.90	2.29
Veszprém	290	1,027	4,350	371,862	1.35	1.17
Zala	1576	2,944	9,910	293,233	3.08	3.38
Hungary total	69,145	113,889	322,176	10,043,224	100.0	3.21
Counties total	20,773	43,837	162,586	8,231,672		

Source: County Statistical Yearbooks, 1999–2000.

The regional (or rather county) level distribution of telephone main lines shows a tendency of equalisation while on local level a strong polarisation may be prognosticated. Some 60% of telephone main lines will be concentrated in cities with population above 50,000.

In *mobile telecommunication* the growth of the number of subscribers – even if its intensity will be below the 2000–2001 level – is still continuing. Decreasing growth dynamism may be explained by the narrowing of solvent demand, by the still high service fess and by the slow diffusion of modern technologies (GPRS, EDGE, UMTS) in Hungary.[29] Thus mobile communication cannot expect rapid development within the next few years. The low bandwidth (9.6–14 kbit/s) of the present GSM technology is not suitable for the simultaneous transfer of integrated data, speech and video signals. Significant development may only be expected from the introduction of GPRS[30] (a packet switched data transfer system) and from the completion of the third generation UMTS technology tender, which will introduce this technology in wider spheres.

By the end of year 2003 cellular phone penetration will increase to 70–75% from the present 50%. It is also expected that – for all the technical limitations of GSM technology – the majority of telecom service providers' incomes will be resulting rather from data communication than voice communication.[31] This rapid development of mobile communication industry is necessary both for economic and regional development, because data communication and its advanced services will be available in such territories where – due to several reasons – the building of fixed telephone networks was impossible.

In Hungary *CATV services* were available for 1.6 million households in 960settlements in 2001. 60% of the market is shared among four large CATV providers. (UPC 36.7%, MatávkábelTv 11.3%, Fibernet 6.7% EPA-HCS 3.3%). The remaining segment of the market is shared among 300 small CATV companies. There will be no significant changes in the number of subscribers within the next two years but the number of service providers – as a result of sharpening competition and its side-effecting fusions, procurements – may significantly decrease.

CATV companies, preparing for the provision of telecommunication services after the liberalisation of this sector, have significantly modernised their network. This enabled them to provide good and cheap telecommunication services, which may guarantee the quick, return of their investment costs. Their job is made difficult by the fact that even the largest CATV service provider has no national backbone system. For this reason after the termination of telecommunication concessions CATV service providers will probably form a strategic alliance with

[29] Several potential cellular phone users are postponing their purchase until the introduction of new technologies.

[30] In the first half of year 2002 WESTEL introduced its multimedia service (MMS: Multimedia Messaging Service), based on the quick packet switched data system. This is a large step towards integrated services (the simultaneous transfer of graphic, voice and text information).

[31] This seems to be verified by the fact that in the near future large media companies, transportation and travel agencies, commercial chains, several service providers and banks are planning to introduce their online service packages in the mobile market.

telecommunication companies who have it, so that they could introduce their integrated service packages in the market.

Those CATV providers who have freshly entered the telecommunication market may have competitive advantages against their counterpart telephone service providers. This advantage is based on the relative cheapness of integrated service packages, (voice, data, video, traditional and later digital programme distribution) which may be distributed through broadband (even 8 Mbit/s) CATV networks[32]. Another advantage of these services is that within a short time they will be available for 1.5–1.6 million households[33] without having to use the local telephone networks. This will urge service providers for applying a competitive price system within voice communication services as well. During the forthcoming years we can expect a growing involvement of CATV companies in local call services.

Microwave network *services* will preserve their present popularity, especially in such areas where wired services are not available or if so, their prices are too high. The demand for microwave communication services is well illustrated by the fact that the Communications Authority only in year 2000 issued 750 frequency-range marker resolutions and 578 microwave aerial tower building licenses. This shows 83% growth in comparison with the previous year's indicators. Due to easy portability, flexible customisation and the integrated service providing capabilities of this technology it is quickly spreading among multiple site companies. The great advantage of microwave technology is that – just as CATV network systems – it does not require local telephone networks, so it can offer competitive services between urban areas and their agglomeration. *Laser-beam data transfer technology* may increase its popularity among multiple-site institutions and companies in cities and agglomerations. Besides its several advantageous technical parameters (Mbit/s range of data transfer capacity, quick and cheap transportation, the operation of the equipment is simple and does not require licenses) the spread of this technology is limited by some technical reasons (suitability only for short-distance data communication, requirement of direct visual contact, dependency on weather conditions etc.) as well.

VSAT services are a special brand of microwave services. This technology is capable for covering huge even continental size areas. As this service is very expensive and it is used by a relatively small group of potential customers it has been introduced in some specific areas only – high-speed computer data exchange, credit card checking systems, electronic booking systems, disaster prevention etc. The large-scale public provision of these services in Hungarian telecommunication industry is not likely in the near future.

[32] Integrated service packages are available for a flat rate, thus they are independent from traffic and free from traffic volume charges.

[33] Today data communication services are available through the CATV system in 82 Hungarian settlements. At the end of the next 2–3 years this figure may be 5–7 fold higher.

Technical development may generate the innovation of *other technologies and systems*. Electric-energetic networks – as telecommunication signal carriers (such as PLC technology) may open up new perspectives in this area. The use of VSAT stations orbiting round the Earth for telecommunication purposes is also being tested. These systems will surely not be introduced for public services within the next 2–3 years.

3 Internet in Hungary

3.1 The evolution and development of the Internet

The formulation of the Hungarian information network started in the mid–1980s, later than the West European development. Despite several problems (COCOM embargo, political transformation, economic crisis, poor funding of the information sector) the development of the Hungarian information network was progressing well and by now three major computer network circles have been formulated. HBONE (Hungarian Backbone), the first one, has the largest data traffic volume and has the greatest importance in network applications. HBONE is the computer network of the community of R&D, higher education, library and public collection institutions. Sulinet, the second network group of secondary schools, has been developing at a changing speed since 1997. Commercial data communication networks, having produced the most dynamic development and the largest variety of technical improvement are the third group within the Hungarian computer network.

The first steps towards internetworking

The development of the Hungarian computer network started within the framework of the Information Infrastructure Development Programme (IIFP) launched by the Hungarian Academy of Sciences and the National Technical Development Board (OMFB) and was funded by Hungarian (MTA, OMFB, OTKA, MKM) and foreign (World Bank, European Communities) resources. The programme had an initiative to build a computer network infrastructure for the Hungarian "academic" (R&D, higher education, library and public collection) community and to provide advanced information technology services for Hungarian users. In the first stage of network development between 1986 and 1990 the primary elements of information infrastructure were built. The embargo imposed by the Western World on the export of high technologies, equipment and devices was slowing down the speed of

building the system but due to Hungarian technology development initiatives a packet switching data exchange system was established at the turn of the 1980s and 1990s through an X.25 network among the Hungarian research and higher education institutes. With the implementation of international data communication standards (X.25, XXX, UUCP) and with the establishment of similar computer network services to the Western European counterpart institutes (electronic mail, bulletin board system, file transfer) all the technical criteria have been met to establish direct information exchange with the international computer networks of research and higher education. This made possible for the Hungarian research and higher education community to join the EUnet network in the first months of 1990 and later on to EARN the European affiliate of the American BITNET network. After the lifting of COCOM embargo the modernisation of the Hungarian network continued by building new switch centres, microwave and optical connections in the strategic nodes of the Hungarian computer network system (*Kanalas,* 2000).

The HBONE-system

After Hungary's joining the Internet in the year 1991, the HBONE network, the IP (Internet Protocol)-based Hungarian education and research network has been established (1993) through the initiation of IIF. The foundation of HUNGARNET Association by the community of higher education, public collection and research institutes in 1992 was a great step towards the improvement of our international network connections and towards winning a membership in further international network organisations. HUNGARNET became a member of key international organisations (TERENA, DANTE, CEENET, ISOC).[34] Through international cooperation Hungary could join and participate in several European projects (e.g. TEN–34, TEN–155, Internet 2, EU 5th Framework Programme, GEANT). In the middle of the 1990s the increasing network traffic volume, the need for accessing new services, the maintenance of our information network connections (such as EuropaNET, Ebone) and the necessity of building up a modern information network urged for launching a new national development programme of information infrastructure (*NIIF, 1996*). Within the framework of the new programme new institutions of HUNGARNET could join the HBONE system. Due to this extensive development – which also generated significant technical modernisation – the number of networked institutions has quintupled during the past ten years. Today

[34] TERENA (Trans-European Research and Education Networking Association) – The most important European network organisation. DANTE (Delivery of Advanced Networking Technology to Europe): a Pan-European service centre. CEENet (Central and Eastern European Networking Association): An association for networking in Central and Eastern Europe. ISOC (Internet Society): The Internet's technical, organisational, standardisation and culture-forming international organisation.

the "academic" community has 80,000 hosts (Internet end-stations) in 1000 institutions of 47 cities, connected to HBONE through 26 regional centres. The significant growth in the number of users – 30,000 in 1994, 100,000 in 1996, 230,000 in 1999, and some 400,000 in 2001 – resulted an enormous growth in international network traffic, which raised the problem of increasing the capacity of our international connectivity. To manage this issue, first the bandwidth was increased from 64 kbit/s to 2x64 kbit/s in the early 1990s and 256 kbit/s later in 1995. Within the same year HUNGARNET got a 2 Mbit/s connection access through EuropaNET (Amsterdam) of which 1 Mbit/s was available for HBONE. Network connection among Hungarian regional centres was established through leased lines, they generally provided a bandwidth of 64 – 256 kbit/s, while the core nodes of HNONE in Budapest maintained their connections through 100 Mbit/s optical, 10 Mbit/s Ethernet cables and 2 Mbit/s microwave networks. In the second half of the 1990s the development of the Hungarian computer network further continued at an increased speed. The connection speed among HBONE regional centres was continuously increasing and the international Internet connectivity was also significantly improving, due to the ATM-based 10 Mbit/s TEN–34 (May 1997) and the 34 Mbit/s (17–34 Mbit/s EU, 17 Mbit/s USA) TEN–155 EU projects.

In 1999 a government decree was passed[35], which had strategic importance from the point of further network development. The decree changed *NIIF Programme 1999–2001 (1999*), which had so far been funded from various and uncertain sources into a target programme of the Ministry of Education to be funded directly from the central budget. Due to government funding the programme was able to pay the costs of national and international communication, to purchase new equipment and to introduce advanced IP services. The 2001 budget made possible the preparation for the GEANT (Gigabit European Academic Network Technology) project – co-financed by the European Union – in Hungary and Hungary's joining to the project in December 2001. Through GEANT Hungary – with 10 other European countries – established a 2.5 Gbit/s network connection with the European academic research network *(Table 10 – Annex).* The end-points of the Hungarian backbone system have been established at seven university HBONE centres and eight nodes in Budapest.[36] The project will not only significantly increase the connection speed to Europe but the changing demands of information will also bring about fundamental changes in Hungarian research network technology, in service quality and in the principles of network organisation (*Csatári–Kanalas,* 2002).

[35] 95/199 (VI.23.) *Government Decree on the operation of National Information Infrastructure Development Programme* (NIIFP)

[36] The end-points of HBONE system are Miskolc, Debrecen, Szeged, Pécs, Veszprém, Sopron, Gödöllő, while in Budapest BMGE, ELTE, BGF, BMF, MTA, KFKI, SZTAKI and MeH.

The "Sulinet" schoolnet-system

The "Internet for Secondary Schools" (Sulinet) Programme was launched in Hungary in September 1996 under the auspice of the Ministry of Culture and Education[37]. The building of network, having been initiated by a consortium[38], was started only in 1997 with the involvement of several concession-bound telephone companies (LTO-s). With the realisation of this project more than 1500 institutions (secondary schools, student hostels, primary schools) were connected to Sulinet in 300 settlements. Of them 1200 were schools (70% secondary schools). The structure of network is divided into two levels. The first level – *the backbone system* – is a regional hub and a gateway to international connections through the fibre optic cable network of MATÁV. The secondary level – *the auxiliary network* – connects schools to the backbone. Large schools (having more than 500 students) are connected to the network through a 64 kbit/s ISDN, small schools access the Internet through a modem. The backbone of Sulinet consists of 2 Mbit/s fibre optic system connecting central routers (switching machines for route selection) with their subregions. International connectivity is maintained through the Hungarnet network. Until the beginning of 1999 this was a 800 kbit/s connection to TEN–34 the European network and a 512 kbit/s connection to overseas areas. This capacity significantly increased with Hungary's joining to the TEN–155 project, when the international connectivity speed increased to 4.5 Mbit/s. GEANT project will further increase both backbone and international connection capacities. Due to network development Sulinet can provide Internet access for more than 500,000 students and teachers. Although Sulinet has achieved significant results it should be mentioned that the halting and modification of Sulinet programme broke the earlier dynamism of development. This means that the programme of connecting every primary school to the Internet will have been completed by years 2002–2003 only.[39]

Although several results have been achieved in the development of the information infrastructure of public education, there are still a number of problems to solve. From the point of building the information society it is very important that in Hungary still in year 2000 there were significant differences among counties in the Internet access of public schools. In *Jász-Nagykun-Szolnok, Bács-Kiskun, Borsod-*

[37] Sulinet has the following objectives: to provide support for public education by the means of Internet, to increase regional independence and create equal chances for all, to provide an access to Internet services for cultural organisations, public collections, to provide methodological support for Hungarian ethnic minorities how to access Hungarian culture through the Internet, to create standardised public access educational databases.

[38] The consortium of Elender Kft, MatávCOM and ANSware Kft is responsible for the building and continuous provision of Sulinet. This consortium assigned local concession-bound telephone organisations (LTOs) to be the subcontractors in building the Internet network.

[39] This means that until 2002 the Hungarian government must (should) connect another 3000 organisations to the Internet.

Abaúj-Zemplén, and Szabolcs-Szatmár-Bereg counties only 15–20% of public schools were connected to the Internet. *The difference among schools in computer provision* is a bigger problem. There are several schools where 7–12 computers should be divided among 300–400 students, which is not an ideal condition for teaching computer applications efficiently. *The growing number of ageing computers at the majority of schools* gives another big headache. Even if schools have greater opportunities to win support for the modernisation of their computers *they are unable to continuously replace all of their old computers with new ones*. The education of computer and information skills at school is the biggest problem of all. It is quite common that village schools *cannot find computer specialists to teach computer and information science for their students* and/or they don't have suitable teaching materials. These problems create enormous differences in information access not only among regions but on national level as well. Several specific problems of the information age (the absence of Internet access, information illiteracy, inadequate information skills etc.) are recognised in these cases.

Commercial networks

Data transmission networks were already available since the second half of the 1980s but their large-scale utilisation was hindered by the low demand of advanced services and by the absence of financial resources for their installation. The largest impulse for the development of data transmission networks were generated by the passing of Telecommunication Act in 1992 and the signing of concession agreements in 1994–1995. They were followed the increasing volume of investments of local concession-bound and alternative telecommunication companies. These investments were motivated by concession agreement conditions on the one hand, and by the improving economic situation and the increasing demand for advanced data communication services on the other hand. With the modernisation of data transfer technology (X.25, Frame Relay) having been customised to the demands of telecommunication companies and with the improvement of network capacities and qualitative parameters, the data transmission network was completed by 1995. Also this was the time when the demand for computer data network services had reached a critical mass and became a basis for the introduction of profit-oriented services. Every year telecommunication companies invented new techniques in data transmission to switch new areas and potential users into their service coverage.

Several factors hindered the intensity and homogeneity of the spatial diffusion of Internet services. One example is that in the second third of the 1990s Hungary still had primary node districts with lower than 50% of digital exchange centre ca-

pacity.[40] Telecommunication companies – hoping for the quick return of their investments – were building new networks first around large cities. Thus, villages falling off the urban agglomeration areas have been excluded from the access zone of data communication services. This further increased the regional disparities of telecommunication.

CATV networks as the alternatives of telecommunication services also had technical problems. The *modification of the Telecommunication Act in 1999* did not accelerate the spatial diffusion of CATV networks. The Act stipulates that in settlements with population over 30,000 telecommunication companies with existing telephone network are not allowed to build CATV system, and one CATV company is entitled only for maximum one sixth of the total CATV market[41]. This resulted in such a funny situation that – despite their potential chances – the development potentials of profitable companies to build a CATV network are limited by law. Small CATV companies, on the other hand, are unable to finance from their own resources such a system, which would be suitable for bi-directional (duplex) data communication.

During the mid–1990s these were the technical and legal problems that were hindering the spatial diffusion of Internet services but *the greatest barrier to the growth of Internet subscriptions were the very high – even in comparison to the European average – Internet access fees (Table 11)*. As compared on purchase power parity the costs of Internet access in Hungary are almost double of the EU average. It must be added however that during the past years (1998–2001) Internet access fees significantly dropped both for the private and business sphere *(Figure 8 – Annex)*.

Table 11

Changes in Internet access fees in Hungary (HUF/month)

Name	1998[1]	1999	2000[2]	2001[3]
Individual user 30 hrs per month Internet access in off peak period	19 115	10 800	8 500	7 500
Business user 20 hrs per month in peak period	20 162	17 733	14 385	12 500

[1] The values of year 1998 do not include the night period reduced rates of MATÁV.
[2] The values of year 2000 are the unlimited service package fees of MATÁVnet.
[3] The values of year 2001 are the unlimited service package fees of Axelero. Business user fees are based on the service package fees of IrodaNET (ISDN 64 K).
Source: Carnation Consulting, MATÁV, Axelero.

[40] On 31 December 1998 the full capacity of digital exchange centre capacity of the primary district of Szentes was 42% and of Baja was 23.
[41] LXVI/1999 Act (the modification of the LXXII/1992 Act on Telecommunication)

The falling prices of Internet access, the improvement of services, the spread of individually customised data communication techniques (ISDN, CATV, leased line etc.) and the development of computer network system have resulted as a whole in a dynamic – nearly 50% – annual growth of Internet subscriptions since the end of the 1990s.

Serial line Internet connection through a modem is still the most popular form of Internet services. They go up to 80% of total Internet subscriptions. However during the past years there is a growing demand for higher speed services than the bandwidth of telephone modems can provide *(Table 12)*. The growt0h dynamics of high-capacity data transfer methods (between 1999–2001) – which can partly be explained by the low number of subscribers – was much stronger (17 fold in ISDN, 12 fold in CATV services) than of modem-based connections.

Table 12

The number of Internet subscriptions within the categories of access method

Name	1999	2000	2001
Number of Internet subscriptions	137,929	220,395	301 828
Access method category:			
Serial line connection (through a modem)	133,672	195,733	247 948
ISDN	1,693	20,708	27 947
X.25	1	0	0
VSAT	10	12	13
AM-Micro	2	10	21
Cable TV	1,401	1,904	17 419
Leased line	1,150	1,900	2 460
Other (including ADSL since 2001)	0	128	6 020

Source: Central Statistical Office, Statistical Monthly Bulletins 2001–2002.

Within the next few years the rapidly growing CATV networks, the new xDSL (Digital Subscriber Line) and mobile communication (GPRS, EDGE, UMTS) technologies will further increase the share of high-speed data transfer services.

Recently the competition in the market of Internet services has significantly increased. This is illustrated by a growing number of service providers – authorised by the Communications Authority – in some service segments *(Table 13)* and the number of subscribers having cancelled their agreement with their previous Internet service providers.[42]

[42] Only in the year of 2000, according to the data of Communications Authority 49,000 subscribers cancelled their *agreement with their previous Internet service providers.*

Table 13

The number of information service providers sorted by service type

Data network service providers	122
Voice-based Internet Providers (VoIP)	56
Other data network service providers (ISDN, ADSL, VSAT, Frame-Flex, etc.)	21
Switching service providers	1
Integrated telecommunication service providers (e.g. leased line service)	33
Tele-conference service providers (video conferencing services)	1

Source: Communications Authority, June 2001

3.2 Internet access in Hungary from international perspectives

We can draw a real picture on the recent development of data communication in Hungary if we have something to compare it with. During the 1990s the whole world has undergone a rapid change in the telecommunication and data communication sectors. Information-telecommunication industry has produced the most dynamic growth. The annual traffic of the so-called ICT market has reached the value of 1445 billion ECU in 1998, and according to estimations it will be some 2205 billion EURO in year 2001. Its growth indicator within this period was 15%, which is much higher than the average index of any other industries (*EITO* 2001).

In Hungary the growth of IC sector was 35–40% during the last 3 years of the 1990s, exceeding even the international growth index. However it should be mentioned that this dynamic growth is explained by rather the experiment of closing up Hungary to the ICT provision level of the developed world.

Within the info-communication sector the development of data communication networks, the increase of their data transfer capacities and their qualitative improvement are the most spectacular. Due to these improvements at the end of year 2001 the 15 regional centres of the "academic" network were connected to HBONE at a data transfer speed of 2.5 Gbit/s, which is in full compliance with the performance of the West European academic networks.

As regards Internet access, Hungary's closing up to the modern world has started. Compared to the early 1990s Hungary has better indicators of domain name servers per 1000 head, especially the number of Internet end-stations (hosts) increased significantly *(Figure 9 – Annex)*. The dynamism of growth is progressing well, Hungary's fallback in this field is not more than 4–5 years.

On the other hand, the number of Internet users and their proportion within the total number of population are much lower than the European indicators *(Table 14 – Annex)*. This can be explained by several reasons. Among them the most important are as follows:

- The lower level of living standards than in developed countries;
- The high price of computer devices and accessories compared to Hungarian incomes;
- High Internet access fees (the telephone costs of modem connection are exceeding the European average);
- Shortages in the physical availability of Internet access;
- Low level of computer skills, computer illiteracy;
- Low level of social accommodation;
- Age problems (elderly people quite rarely use this technology);
- Small number of Hungarian language homepages;
- The absence of foreign language skills.

For all these problems, a significant increase in the number of users is prognosticated, on the basis of four factors.

Increasing living standards are the first of all but the reduction of telephone costs and subscription fees after the liberalisation of telecommunication may be another incentives. The continuous spread of computer skills education and alternative networks as a result of technical innovation are the next two major factors.

3.3 The future development trends of Internet in Hungary

Today Internet is a basic tool of maintaining connection and communication. The present trends (the liberalisation of telecommunication, the spread of computer education in schools, a significant reduction of Internet access fees, the qualitative improvement of services, the widening of content provision services) may serve as a good basis for its development. Due to these advantageous factors the number of Internet subscriptions increased by 120% between 1999–2001 (*Internet providers...* 2002).

It is expected that within the next two-three years Internet will mostly be accessed through telephone networks but ISDN and ADSL, providing larger speed connection, will have attract an increasing share of users. This trend seems to be verified by the launch of a project, adding a fourth network system to the existing three (HBONE, Sulinet, commercial networks), which would connect *public administration* organisations through a *fibre optical backbone system*. Some 800 institutions, offices will be connected to this network and their large-volume data

traffic will require broadband cable connection.[43] *TETRA* (Terrestrial Trunked RAdio)[44] system with its highly reliable and secure communication and information facilities to be installed for emergency service organisations (police, fire-brigade, disaster prevention etc.) is another example for the qualitative improvement of Hungarian data communication network.

With the improvement of the qualitative parameters of CATV networks and their user-friendly service packages – offering integrated services in some cases – CATV services will serve for at least 20% of total Internet subscribers. The number of microwave and mobile service subscriptions will also increase. The spread of these services will highly depend on the date of the introduction of UMTS technology in Hungary and on the price its services will be sold. This technology will surely not be available for masses within the next one and half-two years. Until the introduction of UMTS mobile Internet facilities will depend on the development of WAP technology.

In recent years the growth in the number of Internet subscribers has been followed by an intensive growth in the number of Internet end-stations (hosts). Compared to the values of year 1996 the number of Internet hosts has octupled *(Figure 10 – Annex)*.

The increase in the number of hosts will at least maintain its present dynamism until year 2003. The present 17.6% penetration will annually increase by 8–10 percentages. These optimistic forecasts are based on Hungary's good economic development chances. During the past years a number of events have happened (the launch of the *National Information Society Programme* (1999–2001), the passing of the *Electronic Signature* (2002) and *Single Telecommunication Act* (2001), the launch of e-*governance programme* (2002)), which are promoting the spread of information technology. These with future changes (e.g. the liberalisation of telecommunication, technology innovations, 26 Ghz and UMTS tenders) are creating a good basis for the further development of Internet and its social adaptation. The spread and the application of Internet in Hungary can be a success story only in case its access (I mean here both physical access and affordable use) is guaranteed for the widest range of territorial levels and social groups.

[43] The inauguration of the first phase of the governmental information network took place in April 2002.

[44] TETRA system is an open, European standard, professional group communication system having been developed for high-speed, extra reliability and secure information transfer purposes, mainly for governmental-emergency utilization.

Csatári, Bálint - Kanalas, Imre - Nagy, Gábor - Szarvák, Tibor :
Regions in Information Society – a Hungarian Case-Study.
Pécs : Centre for Regional Studies, 2004. 114. p. Discussion Papers, No. 42.

4 The competitiveness of counties within the Information Society

During the spatial research of information society it is very important to form a clear picture on the progress, spread and regional differences of information equipment supply and information activities. For this reason this chapter will discuss the features of the spatial distribution of registered domain name servers on regional level, as domain name servers are the most essential parts of content service provision.

In the second part of this chapter we will demonstrate the information development level of Hungarian counties and regions through the presentation of economic, social and info-communication indicators and also the interrelationship of their relative development, to point out their accommodation and activity levels at the brink of the new information age.

4.1 Spatial diffusion and distribution of domain name servers

Among the indicators of spatial differences in the development of information technology the volume of domain name registrations with their attached domain name servers and their spatial distribution seem to be the best for further analysis. The available database of domain name servers provides information not only on the spatial distribution of technical devices but also very useful for the determination what fields of content service (e.g. economy, public administration, education) they are used for. These are all the indicators of information culture and the Internet activity of a certain area or activity sphere.

Since Hungary's joining the Internet in 1991 there is a continuous growth in the volume of domain name registrations *(Figure 11 – Annex)*. From the databases of RIPE[45] and Hungarnet Association it is clearly seen that since 1997 the volume of domain name registrations shows a continuous growth and since March 2000 – the date of the liberalisation of domain name registrations – this growth has significantly accelerated.

The spatial diffusion of domain names – with their attached domain servers – is well illustrated by a survey having been carried out at the end of year 1998 first. At that time the total volume of domain addresses was 5264, with a spatial coverage of 260 settlements (*Kanalas,* 2000). The second survey in March 2000 produced

[45] Reseaux IP Europeens: This organisation was founded by the EUnet for the management of continental TCP/IP network, the European Internet for the registration of domain names and for providing various information services.

12,753 domain names in 473 settlements. As the latest samples having been taken in November 2001 indicate 67,715 '.hu'[46] domain name extensions have been registered at 37,600 hosts in a spatial distribution of 1092 Hungarian settlements *(Figure 12)*. As it is seen the number of domains significantly increased during a three-year period and now they are covering one-third of Hungarian settlements (*Nagy,* 2002).

For all these relatively high indicators the spatial diffusion of domain names and servers shows strong urban concentration, as 82% of the total registered domains are located in 23 cities of county rank. The presence of Internet and the demand for servicing a large number of hosts are yet not typical phenomena in rural areas.

The majority of domain name servers have been registered in Budapest. Of the Hungarian cities Szeged (1556), Budaörs (1210), Pécs (1206), Debrecen (1063) and Győr (878) have the largest volume of domains. *Domain name servers* – needed for running e-mail and Web services – *are concentrated in central cities with large population, significant administrative, cultural, educational functions and last but not least these cities are commercial and economic centres as well*. Budaörs is in a specific position from this aspect as it has neither public administrative nor educational or cultural functions but its advantageous geographical location (easy access to motorways M1, M7, the proximity of Budapest) concentrated several economic organisations there. There are many businesses in Budaörs that either by business profile (commerce, storage, logistics, freight transportation or other) motivations or for corporate structure (only the site, the manufacturing unit is located here, the company seat is in Budapest or in other Hungarian city) reasons should carry on intensive communication to which modern information equipment and wide-range information services are indispensable *(Figure 13)*.

Those 430 settlements having only one server for the provision of their local community content services (information, facilities, products) and for the maintenance of electronic data connection are the other extremes on the palette of information access. *As they are preparing for the adaptation of a new technology at such places that have hardly participated so far in the global exchange of information, they have a key role in the distribution of information culture.*

The spread of domain servers – representing both the innovation of products and activities – its rules following the patterns of economic development and the establishment of new business enterprises were analogue with the spread of the traditional elements of infrastructure (public road system, energy and telecommunication networks etc.) and were also perfectly harmonising with the resulting settlement hierarchy structure. Recently a third – a specific – diffusion pattern has

[46] This figure includes the domain names having been reserved by domain brokers. The number of domain names not registered by domain brokers was 48,192 in January 2002. In our research we were calculating with the total number of registered domains.

Figure 12

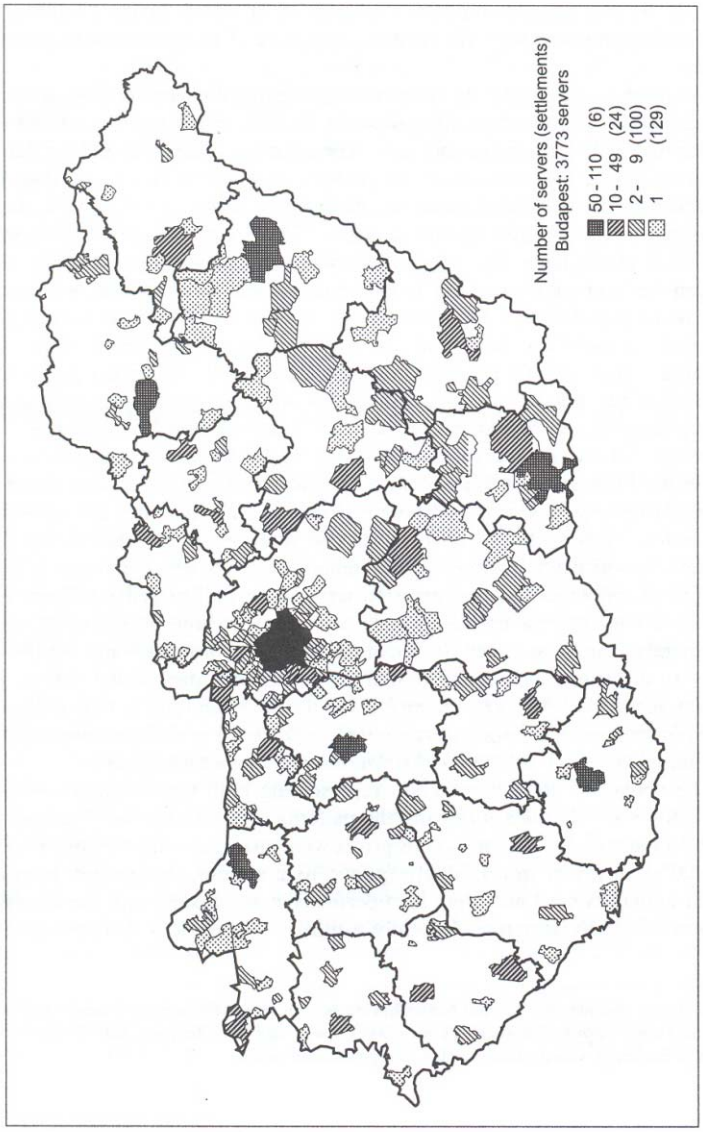

Figure 12 *Spatial diffusion of domain-name servers in Hungary (November, 1998)*

Source: www.nic.hu

Figure 13

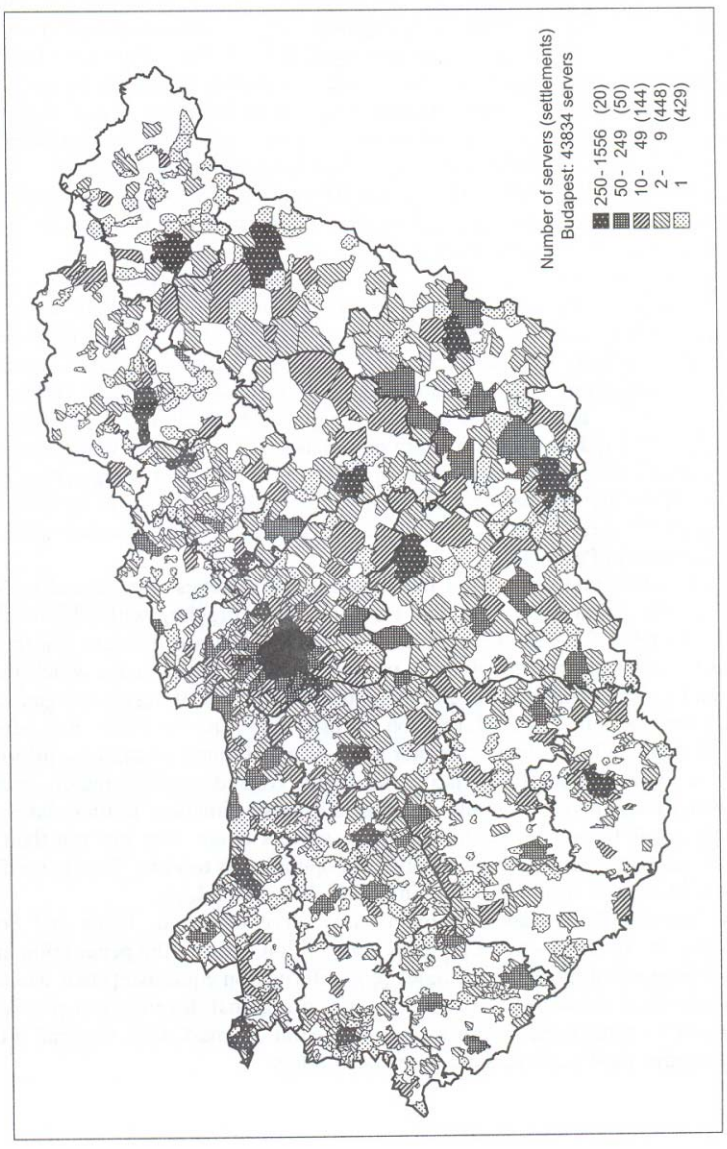

Figure 13 *Spatial diffusion of domain name servers in Hungary (November, 2001)*

Source: Hungarnet Egyesület.

been formed in which new domains are registered in apparently remote areas and different activities. In this case not the classic site selection factors (advantageous geographic location, economic development, large consumer markets) are dominating but private persons (in Hungary more than 10,000 names have been registered by individuals) with their specific ideas, attitudes and creativity are standing in the background of this phenomenon. *As it is seen behind the numbers, more and more users believe that Internet may have a significant role in the demonstration of their activities and in the distribution of their services on a wider scale*.

By taking a look at the county-level distribution of domain name registrations we can see that economically and socially the most developed counties have the largest volume of domain names *(Table 15 – Annex)*.

Both absolute and relative indicators show the dominance of Budapest (having 65% of all the Hungarian domain registrations) and Pest county. The indicators of Csongrád, Győr-Moson-Sopron and Baranya counties are also good. However even in counties of high indicators there are sharp distributional disparities within the counties themselves. In most counties the volume of domains in the county seat is exceeding 50%. This value is extremely high in Debrecen (88%), Szeged (84%) and Pécs (83%). This shows a sharp dominance of county seat within the county. The spatial distribution of domain registrations is the most homogenous in Pest county. Here the number of settlements with some 100 domain registrations is more than 10. But for all that even the best (Budaörs) of them has only 20% of the total domains in Pest county.

At the other end, the lowest number of domain names is produced in Nógrád (0.55%) and Tolna (0,55%) counties but they are struggling with additional (economic, social, infrastructure) problems. These low figures illustrate that the adaptation to information technology is progressing very slowly here, which may explained by weak economic development, the low number of business organisations, the underdevelopment of information infrastructure, the residents' low education level or even by inadequate computer skills or by a limited demand for information services. From the point of relative indicators, Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg and Békés counties are also in crisis situation. In these latter counties the absolute number of domain name servers is not very low but their share considering the relatively high number of population is too low. This is verified by the low involvement of population in information technology.

As regards the spread of domain name servers Nógrád, Tolna and Somogy counties may be the losers of regional competition because the penetration and the diffusion speed of those technologies (e.g. information equipment) that would contribute to local economic development and to regional development processes in several areas (electronic commerce, e-administration, marketing, regional information systems, public services etc.) are also too low.

Between 1998 and 2001 – due to higher initial values of provision – the increase in the number of domain names was less dynamic in Budapest than the Hungarian average, so its share from the total number of domains also lowered. Fejér, Hajdú-Bihar, Somogy, Komárom-Esztergom, Tolna and Nógrád counties had a similar tendency. During this period Pest, Szabolcs-Szatmár-Bereg and Veszprém counties produced the most dynamic growth in this field. Pest county's growing indicator is explained by the larger presence of economically prospering companies on the Internet. In case of Szabolcs-Szatmár-Bereg county regional development grants and tender funds provided by the Hungarian government had key role in domain server funding for electronic mail and Web services in public administration and in some business organisations. In Veszprém county Internet services are mostly utilised for public administration, educational, commercial and tourist service purposes, these are the areas where the number of domain name registrations and servers has increased most of all.

The results of research also verify that with the exception of the Central Hungarian Region the share of regions in the total volume of domain servers has increased since 1998. The largest growth has been produced by the West Transdanubia, the most advanced region, and – due to the good results of Szabolcs-Szatmár-Bereg county – the North Hungarian region (0.69) and also the Southern Hungarian Plain (0.48). It should also be mentioned that *these latter two regions of the Hungarian Plain that are facing serious regional development structural problems initiated several new information technology development proposals and programmes* (such as the Intelligent Region Operative Programme of the Southern Hungarian Plain). On this basis we can conclude that *information technology and applications will have greater role in increasing the efficiency of economic and regional development in the future*.

In our survey we analysed not only regional aspects but also the activity scope of domain name proprietors and the distribution of domain registrations by types of activity. The results are as follows; more than 95% of domain registrations from the aspects of building the information society fall into one of seven basic categories: (public administration, economy, R&D, individuals, civil organisations, culture, education) *(Table 16)*.

Nearly three quarters of the total registrations are involved in *economy and business*. This is not surprising as here the profits of computer technology investments are the most measurable and this is where the expenses may return (e.g. e-commerce, advertisements, payment charge services).

The largest number of domains in the field of economy is registered in Budapest and Pest, Győr-Moson-Sopron, Csongrád and Fejér counties, while the smallest number is in Nógrád, Tolna and Jász-Nagykun-Szolnok counties (*Table 17 – Annex*). *More than 50% of domain name proprietors are involved in computer and information technology business*. The potentials and development dynamics of this

sector is well illustrated by the fact that more than 70% of the total registrations within this sector have been made within the last two years.

Table 16

The division of domain name proprietors by their basic function

Activity scope	Percentage of the total registrations (%)
Public administration, municipalities, offices	2.34
Civil organisations, businesses	3.64
Economic organisations, businesses	74.90
General education, culture	0.37
Education, training	0.94
Individuals	14.03
Other	3.40
Total	100.00

Source: Kanalas's calculation on the basis of data provided by Hungarnet Association.

14% of domain proprietors are *individuals*. This relatively high proportion is partly explained by the high number of private entrepreneurs (432,000) partly by the fact that relatively small capital is needed to start such a business in computer and information technology industry (website preparation, information service, network operation and maintenance, domain name purchase and selling) which needs domain registration and server use.

The first domain name for private use was registered in 1997 but the spread of domain name registration accelerated only after March 2000 (99% of the total private domains have been registered since that time). The majority of private domains were registered in *cities with university campus* (Budapest, Pécs, Szeged, Debrecen) *and* the remaining part *was also registered in cities*. Thus, county indicators are practically the cumulated indicators of cities within the county *(Table 17 – Annex)*.

Civil organisations and foundations attribute a growing importance to their presence on the Internet. This is verified by nearly 4% of their share within the total registrations. The number of domain names and websites of civil organisations has significantly increased since 1998. The presence of the "civil sector" was significantly promoted by the CXXVI/1996 Act[47], which regulated the utilisation of 1+1% of personal income tax revenues. The Act authorised legally licensed[48] pub-

[47] Act on the Utilisation of a Certain Share of Personal Income Tax Revenues by the Taxpayer's Will
[48] CLVI/1997 Act on Public Organisations

lic organisations and foundations for raising a fund from 1% of personal income taxes in case it is nominated for them. This was such a financial incentive, which urged them to introduce their activities in the widest sphere. *The spatial distribution of domain registered civil organisations shows urban concentration*. Among them Budapest has 71% of the total civil domain names. The dominance of Pest county is seen in the remaining parts of Hungary. They are followed by – due to the traditionally high values of civil society in Szeged and Székesfehérvár – Csongrád and Fejér counties *(Table 17 – Annex)*.

It is remarkable that during the past two years several local governments and offices have registered a domain name. As a result, today almost 900 governmental, public administrational authority and municipal organisations have their own domain names and websites, which will be suitable in several cases for the electronic management of several public and official affairs (tenders, requests, registrations, document administration, information etc.) In the future these services will promote electronic administration and will introduce e-government. Of the seven sectors involved in our research this is the only one that shows the largest spatial homogeneity of registered domain names *(Table 17 – Annex)*. The development – which is rather showing a tendency of spatial equalisation – is bringing equal chances for Hungarians living anywhere in the country to manage their affairs electronically and to access e-government services easily.

The institutes of education are also very active users of information technology. 353 institutes of education and training have already registered their domain name. Due to the growing need for higher education and the increasing demand for certain faculties and departments, several universities and colleges provide tuition-fee based education services. To introduce their services to the public, to increase their prestige and to serve their high-number Internet domain terminals they have registered 200 new domain name servers during the past 5 years. Sulinet programme, having been launched in 1997, also contributed to this by tens of servers providing help in this way to several secondary and primary schools to start their electronic content service provision.

The spatial distribution of schools with domain name shows a relative homogeneity (Table 17 – Annex). The domain registration indicator is extremely high in counties with cities of university campus. The number of new registrations will increase but their ratio will practically remain the same.

The presence of cultural and R&D institutions on the Internet is still very low. This is well illustrated by the fact that only 140 *institutes of culture* (museums, culture centres, theatres) have registered 149 domain names so far, and 40% of them are located in Budapest *(Table 17 – Annex)*. *These low figures* are clear indicators of the poor economic situation of Hungarian culture (most institutes have no financial resources for the maintenance of domain name servers, for the electronic processing and presentation of their collection and for paying all the other expenses

that have incurred by these activities) and *the deficit of all the efforts to demonstrate Hungarian culture on the Internet.*

Hungarian R&D sector is facing a similar situation. *The Budapest-bound organisational model of the R&D sector is reflected in its presence on the Internet* (78% of the total R&D domains are located in Budapest). What makes these spatial disparities worse, is that there are no domain registrations from the R&D sector in four counties (Komárom-Esztergom, Nógrád, Somogy and Tolna) and in additional seven (Békés, Borsod-Abaúj-Zemplén, Szabolcs-Szatmár-Bereg, Zala) there is only one in each *(Table 17 – Annex)*. The present situation does not favour for the social and professional prestige of research institutions as (they are not visible on the Internet, the most public forum for all, they do not make their research results available for others, which things today are essential to create publicity and prestige for a science) their research results and activities – as they are unavailable on the Internet – will be accessible only for a small community. A significant change in these attitudes would be necessary, so that anyone interested in the results and the intellectual heritage of Hungarian science – in compliance with the demands of our present information age – whether be inside or outside Hungary, could have an access to them through the Internet.

As a conclusion we can declare that domain server provision has significantly increased during the past few years in Hungary. The end of the 1990s can be characterised by a dynamic but at the same time a very concentrated development of information technology and services but this tendency – on regional level – has moved towards the equalisation of regional disparities. *However we also would like to point out that the majority of information technology investments and 94% of the total domain name registrations have been concentrated in urban or peri-urban (agglomeration) areas*. These phenomena call the attention for a very important problem from the point of spatial structure and regional development. In the present situation Hungarian rural areas beyond their existing development problems (insufficient infrastructure supply, economic backwardness, unemployment) will face a series of new problems. The differences in the accessibility (both in physical and affordability sense) of information networks and equipment may further increase regional development disparities between urban and rural areas. The low social accommodation of the utilisation of information technology may further widen – on the level of social career and self-assertion chances – the gap between villages and cities and this may bring negative impacts for us all. To overcome these disadvantageous tendencies such short-term objectives should be set up as raising the general level of information technology culture, the improvement of the general circumstances of accessibility to information sources, creating the preconditions of social involvement for the building of a better information society.

4.2 The relative position of counties in the rising information society

The spatial diffusion of domain name registrations in Hungarian counties is not/ cannot stand as an explanation alone for the information and telematic development of counties and their indirect or direct impacts on regional development processes. To give a deeper analysis for these impacts, to assess their potentials from the aspects of the future development of the information society a complex system of indicators was applied, which – within the limitations of this methodology – made general development indices comparable with telecommunication, information technology, social and economic indices. In our research 30 indices are grouped into 6 main index categories. These categories are as follows:

I Population – Housing stock
II Economic development
III The overall development of infrastructure
IV Telecommunication and information infrastructure development
V Research-development and the development of higher education
VI The development of culture and media

The general development of counties by indices and index categories were determined by rank analysis[49] (*Csatári–Kanalas,* 2002).

With the "traditional" (population-housing stock, economic development, overall development of infrastructure) and "new" – information activity, innovativeness, accommodation indicators – indices (telecommunication and information infrastructure development, the development of R&D and higher education, the development of culture and media) we tried to outline the current trends in space and to reveal tendencies behind phenomena. It is very important to analyse the county-level "presence" of the key factors of future economic development and to rank and categorise counties by each of the categories and by the overall six.

The results of this method are providing information on the position of counties within their national-level ranking by index groups and by overall development, on the geographical location of developed or underdeveloped areas and on the presence and relative development of new development-generating factors (R&D, higher education, media development, information technology provision etc.).

On the basis of rank analysis it is clearly seen that there are significant differences in the "overall" development of counties. Some of these differences are not

[49] In all cases the best county in the rank is marked by the figure of 1, while the worst is marked by the figure of 20.

new, they are the legacy of the past, having been resulted from the different spatial impacts of the economic depression of the early 1990s. The other, new group of differences has originated not from the underdevelopment of certain regions but rather from the differences in the intensity of development projects having been scheduled for different time-scales.

It should be emphasised that our indices did not show a homogenous "growth" of spatial disparities in all aspects, in some cases differences are decreasing on regional level. In case of the provision indices of the traditional elements of infrastructure for example (water, waste-water, gas, energy, fixed phone supply systems) even the traditionally underdeveloped areas (on the basis of their overall development indicators) areas are closing up to the national average (*Table 18a–d – Annex*).

In all areas the quality of housing stock, the provision of primary services have generally improved and the same applies to general economic performance. In every county the number of businesses or the value of gross domestic product (GDP) have increased. But *there are huge differences* among territorial units in the dynamism of economic development, in the profitability of economy and *in the diffusion and development of the primary elements of information society (Table 18a–d – Annex)*.

The results of our survey clearly show that county-level *differences in the provision and development stage of those* new *areas stimulating regional development* (higher education, research-development, information infrastructure and application, advanced business services, ICT businesses) *are the largest in those areas that have the greatest impact on their region's long term regional competitiveness* both in Hungary and in international environment (*Table 18a–d – Annex*).

On the basis of economic development and the preparedness for the information age and information activities counties may fall into one of the following groups: *(Figure 14–15)*.

1 The shaping *"core areas"* of information society (Baranya, Budapest, Csongrád, Győr-Moson-Sopron, Pest)
2 Areas *"closing up"* to information society (Bács-Kiskun, Fejér, Hajdú-Bihar, Veszprém, Zala)
3 Areas *"lagging behind"* in the development of information technology (Békés, Borsod-Abaúj-Zemplén, Heves, Komárom-Esztergom, Vas)
4 Areas of information *"backwardness"* (Jász-Nagykun-Szolnok, Nógrád, Somogy, Szabolcs-Szatmár-Bereg, Tolna)

Figure 14

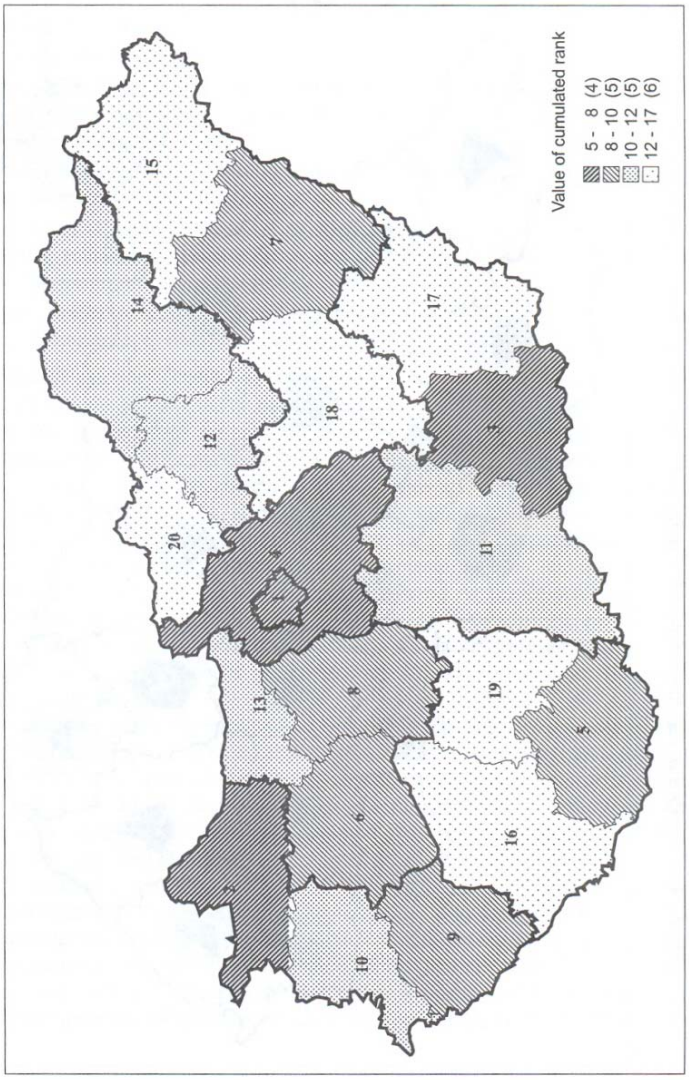

Figure 14.
Cumulated rank of counties in the spaces of "traditional" and "information" potential (2000)

Source: Calculation of B.Csatári and I. Kanalas, 2002.

Figure 15

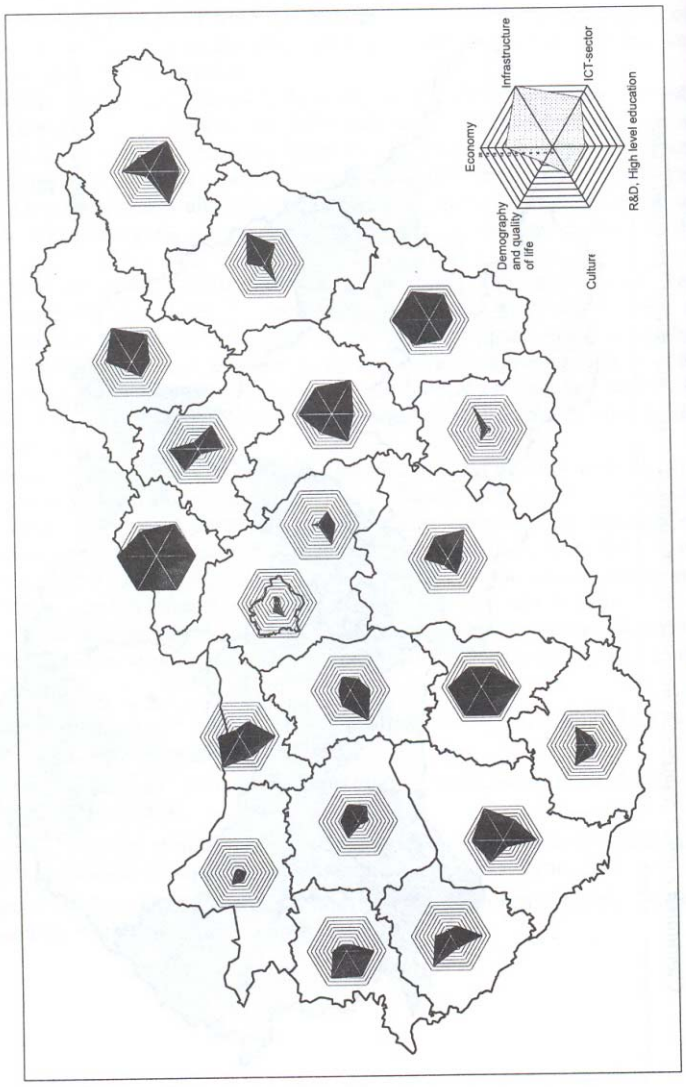

Figure 15
The rank of counties in the dimensions of "traditional" and "information" potential (2000)

Source: Calculation of B.Csatári and I. Kanalas, 2002.

The first category is listing those counties that have

a) a perfect supply and quality of telecommunication and information infrastructure,
b) high number of businesses,
c) large higher education and research capacities enabling them to produce higher innovativeness and accommodation of new technologies than the national average,
d) county organisations, institutes and businesses with relatively advanced content service provision facilities,
e) cities and villages with several existing specific functions (such as ICT businesses, tourism, distance education etc.) which may generate further information-communication activities,
f) high number of information applications (banking services, distance education, e-commerce) that are operating fairly successfully.

The second category is listing those counties that have not yet met one or two items of the above-listed criteria but their available financial, economic, institutional and human capacities are enabling them for quick development.

The third category is listing those counties, which have not met several items of the above-listed criteria. The absence of universities and research institutes is the most striking in Békés, Heves, Komárom-Esztergom and Vas counties but the information and communication network of these areas is also incomplete. The adaptation of new information technologies is progressing slowly and the number of ICT businesses is still low. In some areas of Borsod-Abaúj-Zemplén and Békés counties relatively high unemployment and low living conditions are additional problem sources. *Significant results in these areas may be achieved only by a well-prepared strategic development policy and by launching complex information technology programmes*.

The fourth category concentrates counties that are facing several phenomena of social and economic crisis (low economic performance, unemployment, ethnic minority problems, poor education). The management of these problems is essential for the launch of information-communication development programmes. These counties need significant financial assistance from the central government for launching their regional development projects.

On the basis of the present intensity of building information and telecommunication infrastructure we have good reasons to assume that within the next few years Hungarian telecommunication service providers will ensure good technical background and services for their customers in all primary districts of Hungary. For this reason it is not technical infrastructure but rather the adaptability of human factors

that will determine future development perspectives. Thus, a region's development chances will depend on such factors as the education of its population, their special skills and their receptivity for the new.

Hungary is following international trends *as the government and local policy-makers will have higher responsibilities in the active distribution of information technology applications* (they are increasing receptivity through this way) and *in working out a system of incentives for lifespan education*. *The building and development of the information society cannot be successful without broad social participation*. Large efforts should be made to increase the educational, cultural level and living conditions of socially handicapped groups. Without this not only the chances of regional equalisation will fade away but *also new social conflicts may arise between the information-equipped social elite and the "information deprived*".

As it is seen from research results the "spatial diffusion" of information technology innovations and applications – having gone through an urban concentration, a typical phenomenon of the 1990s is getting more and more differentiated, which – has become a significant process even in socially and economically handicapped areas. From this we can conclude that these regions have recognised the importance of the potentials of the new information-communication technologies and they actively use them to increase their economic performance and regional competitiveness.

5 Regional IT strategies

Since the mid–1980s more and more papers have been published on the development chances of such regions, cities, micro-areas that had based their competitiveness[50] on the spread of new devices, technologies and economic restructuring. Soon it cleared out that purely the implementation of new technologies is not a remedy for all regional problems as its powerful application has socials, sociological and cultural prerequisites. If they are disregarded any high technologies are no more than just *"cathedrals in the desert"*.

The "information bing-bang", the simultaneous "revolution of digitalisation" and their practical utilisation were such available instruments for regional policy, which could easily deliver information, skills and knowledge to the target areas. They seemed suitable for the elimination of those problems that were standing in the way of closing up areas being located outside core regions. As it is illustrated

[50] Several years ago ITTs had already been included in the strategies of some sectors, one example is the pioneering applications of the financial sector!

by concrete examples the application of ITTs is not self-motivated, its impacts on regional and local development is relatively weak but its integration into a complex system may bring such a multiplier effect into all sectors of economy, which can stand as a more environment-friendly development alternative (*Bruntland Report,* 1989).

The ITT initiated spatial organisation will change the meaning of *core and periphery*. The use of terms *node and inter-node area* would be more adequate, as the majority of disadvantages associated with peripheries will disappear. ITTs have a specific role in regional development because they are not bringing peripheries closer to the core area but rather make the advantages of core areas available for peripheries. The big question now is *whether an area can* access information networks and through this it can *participate in or it is excluded from the ongoing global processes*. An area without primary infrastructure will soon produce the symptoms of running down: the decreasing number of intelligence jobs, the increasing number of low salary jobs, the growth of dependency, the increase of external supervision, out-migration (*Mészáros,* 2003; *Cas,* 1995).

In the literature of regional policy three relevant theories can be differentiated:

1 The *theory of deconcentration* – the nearly homogenous spatial development of ITTs is a prerequisite here. In this case with the fading competitive advantages of traditional industrial areas the development chances of peripheries are increasing and this will result in a more homogenous spatial distribution of dwelling and workplaces and in a more optimal utilisation of available resources.
2 The *theory of concentration* – it is based on the assumption that ITTS are preserving only the existing spatial structures. Large settlement concentrations are the winners of the adoption and implementation of technical innovations. The centralisation of management favours for settlements hosting large company seats. The polarisation of settlement structures gives larger power to the formation of new hierarchical structures.
3 *The theory of non-determinism* – assumes that ITTs themselves have no impacts on innovation, they are merely intensifying the existing trends. The innovation features attached to them are exaggerated, the impacts of technical and technological innovations on society are experienced only indirectly or after a long time delay.

It is generally true that in the first phase of expansion a strong concentration process is taking place on regional level (*Tesauro–Papa,* 1995*)*. In the subsequent stages of expansion deconcentration processes are already measurable.[51] In the

[51] The real winners of the spatial diffusion of ITTs are the satellite small and medium-sized enterprises that can cooperate with innovative, large organisations!

mature stage of expansion deconcentration may continue outside the agglomeration areas, where ITTs are considered as preconditions (alternative technologies) but their adoption requires servicing and social background as well.[52]

Closing-up type developing countries may draw great advantages from this process because after the building of their ITT infrastructure they can minimise their disadvantageous site location on micro-regional and regional levels[53] (*Farkas,* 1999). The success of the utilisation of opportunities that applications provide depends partly on strategic regional development, partly on the regional-level adoption of new technologies and organisation, and partly on social accommodation and skills (*Tamás, in: About...,* 1996). Again the role of social and psychological factors should be emphasised here because they are essential for a successful close-up process. Those approaches that are concentrating only on technical supply issues, disregarding those factors that motivate the recipients' demands[54], are all false. (*Magyar–Karvalics,* 2000).

5.1 Core regions[55]

Within the information sector value-increasing, creative applications that create new jobs in several cases are the most typical phenomena. Regions can improve their services, transform their product structure and quickly adopt new corporate and management structures with the assistance of ITTs (*Cities and new technologies,* 1992). The resulting better performance can enable regions to expand their markets and improve their economic and market positions. Modern ITT centres (in most cases teleports) servicing for the whole region have a very important role in the strategy of core regions. High-speed transport networks (motorways, high-speed train services) and new information connections (ISDN, xDSL, Internet) are

[52] In this model *Hoberg* (1987) pointed out that in the early stage of expansion decentralisation cannot take place, the advantages of densely populated areas are increasing. On peripheries applications may start only with time-delay, for this reason the attainable profit will be smaller than in core areas. ITTs do not change the migration and spatial distribution of population in short term. Later empirical researches pointed out that in the early stage of expansion larger regional differences may occur in developing countries than in developed ones.

[53] An interesting paradox is that the enthusiasm for ITTs is the highest always in the core and in the peripheries. In core areas the attainable advantages are realised day by day but in peripheries the diffusion of ITTs is only a symbol of belonging to the core, a symbol getting closer to the core. (See: *Info* 2000, 1996)

[54] Here the subvention of technical devices as an instrument of the acceleration of diffusion and the promotion of training and consulting services to facilitate the adoption of new technologies may come into sight.

[55] Core regions are defined as dynamic areas of the European 'high-plain', having been in the leading edge of economic development and innovation since the industrial revolution.

increasing the value of metropolitan regions because they offer concentrated markets but at the same time they are lowering the value of inter-node areas (*Engel,* 1992; *Lahti,* 1990).

5.2 Traditional industrial areas – Strategies for regeneration

ITTs are effective devices of industrial restructuring. Crisis is a spiral of depression, resulting in an increased functional dependency, economic polarisation, the absence of human capital and reduced entrepreneurial ambitions. It is also breaking up vertical and horizontal integrations. This may result in a kind of "creaming off tendency" in which the profits of diminishing internal value production are exploited by external agents. The way out of this trap may be the total reorganisation of the structural, institutional and management schemes in which ITTs may provide help for every partial segments. They can fully be utilised in the reintegration of corporate activities and in the regeneration of manufacturing-oriented management functions. They are reducing vertical integration but at the same time they are facilitating horizontal connections, the division of huge factories, they are reducing the costs of small-scale manufacturing, creating stronger export orientation and expanding the region's SME base (*Graute,* 1995; *Tiner,* 1992).

At the same time negative regional image should turn into a positive one, as policymakers do not like depression areas they are rather migrating into prosperous ones. Profit oriented technology transfer organisations and information centres are important instruments in this process. According to *Gertler's* survey (1993) several firms face difficulties in the adoption and implementation of ITTs in traditional urban areas.[56] His researches have cleared the role of social environment and social coherence in the success of adaptation. However the fact that national, regional and local specific features have created several varieties of the basic situation is working against issuing a universal know-how to manage all these issues by the same pattern. In *Charreyron-Perchet's* opinion (1990) selecting those elements that work unsatisfactorily and changing them with the full agreement of those who are involved in decision is the best strategy.

During the preparation of industrial regeneration programmes depression sectors with the depth of their structural problems should be assessed. The traditional crisis phenomena may require two different crisis management strategies. The first

[56] Gertler is differentiating extensive and intensive adaptation. In the first case the implementation of new technologies will not increase the system's efficiency and for this reason – mainly SMEs – returned to the traditional production systems. The latter case is a planned, well-prepared adoption process, in which the application of ITTs was followed by corporate changes. In most cases success indicators were high.

is oriented towards the achievement of success in short-term. In this case the establishment and operation of new businesses should be promoted as they are bringing new economic impulses into the region by creating new jobs and by easing the one-sided dominance of old economic branches. The drawback of this strategy is that it does not generate real industrial restructuring and within the a few years the same problems may come back again (*Stöhr,* 1990).

In case of long-term regeneration priority should be given to qualitative elements, crisis management should be followed by real restructuring. This covers the modernisation of dominating industrial sectors and the introduction of new industrial branches. In both cases this means the expansion of services – mostly business services – that are pushing out old industrial sectors. The demand of the "actors" of regional economy for information can be satisfied only through an extensive development of communication networks. Existing networks are bringing new economic opportunities, knowledge and connections for regional economy (*Gertler,* 1993).

5.3 The spatial organisation models of new industrial areas

Since the 1970s a new development zone has formed outside the traditional "high-plain areas" of Europe. In these areas different key sectors and partly different corporate organisation schemes have been developed from those in core regions. We are going to introduce two examples of this model in details. The first is in South-Germany (Baden-Württemberg) and the second is in Middle-Italy (Emilia-Romagna).

The restructuring of the regional and corporate scheme of car industry in Baden-Württemberg may serve as a prototype model. Increasing competition and the individualisation of customers' demand have enforced the rationalisation of production, the increase of flexibility and the reconsidering of seller-customer relations. The vertical integration of production weakened and strategic partners were selected. Just in time and TQM were introduced in satellite firms, the development lifespan was reduced, greater efficiency was required from the organisation of production even on the costs of outsourcing some potential tasks. Belonging to one firm was a requirement. The complexity of corporate units has increased (modular structure), innovation and development potentials increased and resulted faster reactions, reducing logistic and scheduling costs, increasing flexibility and rationalising production (*Funck–Kovalski,* 1993).

The province is facilitating information flow and network organisation. DCO, the central data network, has been established connecting 90% of district administrative units. In 1988 165 cities were connected to the network having seven re-

gional centres (*Hauser, 1992*). The network operator produces services customised to the individual needs of cities from its recommended and continuously expanding service packages. In 1990 car registration, personnel data management, motorway toll payment and voters' registration services were available on the network but the environmental information system, GIS-based maps, geographical data processing and a real estate proprietorship registry system have also been modernised. Data collection and processing will gradually be transferred to regional centres (*Rieder–Maier,* 1994).

The institutes of technology transfer have been in operation since 1971. In 1990 114 centres with a staff of 2550 were facilitating the innovation process. Chambers are providing services to firms from marketing promotion, technical assistance to training and innovation-based facilities. The two networks have fundamental role in maintaining a high number of businesses. The Frauhofer Company and the Max Planck Institute are providing research background facilities all to this. This latter institute has 11 research institutes and 13 applied research laboratories (*Funck–Kowalski,* 1993).

The role of regional policy is concentrated on the establishment of trilateral – governmental, industrial, scientific – relations (*Graute,* 1995). Besides large companies regional government has an active role in the establishment of further relations. The region is participating in the ARGE-ALPES co-operation, it is a member of the Europe's Four Engines Association and also has become a part of the Upper-Rhein Euroregion (Basel, Mulhouse, Strasbourg, Colmar, Freiburg, Karlsruhe). Within this latter region higher education networks have been built and several co-operation projects are running in such fields as computer science, software development, robotics, biology and pharmaceutical industry. Chambers are providing detailed information on current programmes, researches and their available resources within their territories (*Graute,* 1995). The building of information networks has significantly increased the innovation activity of SMEs and was a great step towards a more rationalised utilisation of available resources. The network provides direct co-operation facilities for 250 research organisations and their daily interactions are growing into a formal, institutionalised co-operation. (IAR = Institute of Automation and Robotics French-German branches).

The first co-operation projects were established within non-informational sectors as well, following the community's PAMINA project, which made chamber databases available for neighbour regions and provided continuous information services for partners, satellite firms, subcontractors to assist them in finding resources, components or sales markets. When building a network, maintaining continuous contacts with satellite firms and markets has the utmost importance. Partners are selected only from areas with advanced network services. "No EDI, no deal" – as the slogan says.

Just in time specialisation, the SME-based economic organisation model got a greater publicity through the case of the Third Italy (*Brusco,* 1982). The intensive connections on all levels and in all dimensions are forming a new horizontal model of economic activities, which may be defined as industrial cluster or networked economy. Cooperation's are the most successful traditional sectors, in which the adaptation of ITTs, just in time production systems and new marketing strategies has already taken places. All these sectors (such as shoe, clothing and furniture industries) have strong consumer orientation and they are producing goods in small series adapting themselves flexibly to the changing demands of the market (*Conti,* 1993).

Just in time production systems were first introduced in fordist style large companies but the cheaper and simplified variations of these systems were soon implemented in small businesses as well. At first they were applied in demand-oriented sectors but later on in other economic sectors as well. They are the most successful in the following areas: labour-intensive, design-intensive sectors, output production sectors, high-tech industries and various business services.

Piore and Sabel (1984) called the Third Italian variation of just in time specialisation as Benetton model. In clothing industry the servicing of consumers' taste and the flexible specialisation of manufacturing have crucial importance. The quick reaction (QR) market strategy for Benetton was realised by linking strategic markets and production into a single chain in which production strategy is determined by the current trends of sale *Brusco* (1982) considers ceramics industry (Sassoulo) textile industry (Carpi) and North-Italian car industry (Torino) as the living examples of network economy.

Flexibility, manifested in the quality of manpower and in manufacturing process, is the most characteristic feature of this model. This process is strongly determined by the impact of ITT-based technologies, which significantly reduced the price difference between specific and standardised products in favour of the specific ones (*Graham,* 1994). Local production may develop only through its integration to the international market, which process will reduce the share of home markets and will increase the orientation of production towards national and international markets.

The Third Italy example questions the traditional models of regional development, which were excluding the possibilities of internal resource based development. This development model is setting up a hierarchical regional structure and terminates the privilege of large companies and growth poles in the generating dynamic development processes within a region. The regional strategy is innovation oriented but based on "bottom to top" innovation models instead of diffusion-based adaptation theories. The new industrial system on basis of small-scale production technologies, specialisation and the new philosophy of organisation has radically changed the relationship between size and portability. The behaviour of local pol-

icy-makers, the practically free flow of information (sometimes through informal channels) and the outstanding co-operative attitude are the most important endogenous factors. In regional network systems the spatial diffusion of innovation is also following new models, which are different from hierarchical or epidemic diffusion patterns (*Conti,* 1993).

The weak elements of development are basic and applied researches and business services but the development of telematics and information technology may eliminate their backwardness through the concentration of services and research in medium-size and large cities. On the basis of their experiences in unique or small series product manufacturing networked production systems may have powerful positions in fragmented markets that are based on the variety of demands. Flexibility, large companies and high technology may guarantee competitive advantages against the cheap commodities of the developing world (*Fuá,* 1993). Another weak point of this system is that external resources are not involved in development, which may slow down technology innovation and adaptation to market trends. It has several temporary technical solutions and the quality of devices and applications is unstable. Delivery and transportation services with telematic networks offer the largest development potentials because the flow of communication and information on networks is a very important constituent of the Third Italy model (*Conti,* 1993).

5.4 The programmes of rural areas[57]

Several authors are criticising the argument of *Bangemann Report* saying that the integration of SMEs into a wide area network will bring development chances for rural areas. Wide area networks alone will not increase entrepreneurship activities or innovativeness. They re calling for local-source based regional policy recognising the potential links to global and national trends and regarding ITTs as very important instruments of necessary changes. *Sweeney* (in: *de Castro* et al. 1995) defines three different political philosophies:

- The building of technology culture environment
- Providing direct assistance to entrepreneurs
- Lifting all the barriers to the foundation and operation of businesses

What is common in all the three elements is that they do not stand exclusively on market elements but they demand active intervention of the state with varying intensity.

[57] The term rural defines such areas that have been left without large central cities and have far lower urban population than the national average (70% in the EU, 63% in Hungary).

According to *Grimes* (1992), beyond theoretical issues very few researches have been carried out on the impact of ITTs on rural areas. Theoretical implications cover such a wide range of issues, which is questioning their relevance. Technologies themselves can do nothing, development should stand on a wide social and economic basis[58]. The building of physical infrastructure is only the first step as ITTs are permissive technologies and the major problem is the slow diffusion of their applications. When analysing impacts, more attention should be paid for demand-oriented approach. The objective is not merely the building of information networks but regional level production utilisation, the transformation of information and the implantation of technologies into economic development.

The delivery of ITTS to local entrepreneurs is the most acute problem. This problem requires the quick building of networks. *Tele-colonisation* (*Dillmann* et al. 1988) is a major threat here, as external agents simply may utilise and exploit the local resources for their own purposes. The mere adoption of ITTs guarantees neither economic nor the intensification of social cohesion but may generate several adverse complementary effects (the out-migration of intelligence jobs, slowly declining professional culture and competence) (*Warf–Grimes,* 1997). The development of rural areas is hindered by their remoteness from markets, policy-makers and information sources, which cannot fully be eliminated by the application of ITTs. The question how to create and maintain such advanced services that can utilise the potential advantages of new technologies in a relatively small area of market[59] seems to be the key problem here (*Graham,* 1991).

Setting up and maintaining various links to large entrepreneurial networks seems to be one alternative for the integration of small-scale businesses. This formation is locking small business organisations into a large corporation and exclusion from this organisation is automatically coupled with isolation from potential markets (*Morgan,* 1997). The use of greater autonomy, the establishment of local-oriented SME networks on regional level, in which various supporting facilities are provided for local entrepreneurs, is another alternative solution. ITTs – though indirectly – may eliminate the disadvantages of remoteness but the return of network building and operation costs takes very long time. Especially the early period of ITT investments needs an active government investment and assistance policy.

Future scenarios expect that fewer areas will be utilised on greater intensity or the same areas will be utilised with lessening efficiency. In both cases the value of natural biosphere and recreation areas will increase but the first results are seen in core regions, the level of decentralisation potential is high! Rural areas are badly in

[58] One of the key problems here is the representation of the periphery's interests in decision-making!

[59] The disadvantages of rural areas are defined by *Grimes* (*1992*) as follows: geographical, social, cultural distance from the core, difficulties in the access to information resources, poor public services, small number of re-training programmes, the absence of professional training facilities and of institutional relations.

need of new economic sectors for counterbalancing the lessening weight of agriculture. From the potential sectors of rural economy recreation, cultural facilities, social cohesion, the traditions of folk and handicraft industries or other business activities may be mentioned but in all cases the degree of diversification is depending on the attractive force of local economy (*Turnock–Nagy,* 1998).

5.5 Peripheral[60] areas

The difference between potentials and realities is the most perceivable on the level of peripheries. New technologies are providing greater chances for joining the global information economy, they are urging for the development of information intensive activities and for a more optimal utilisation of regional resources and competitive advantages. In several cases the spectacular practical results are accompanied by such negative tendencies as the region's quickly growing external dependency, the death of weak local economy, the lost chances of endogen resource-based development, the disintegration of local information channels, the weakening of social cohesion and the erosion of local society.

*Müdersprache*r (1990), in his research on the application of ITTs in peripheries, has pointed out that in the majority of cases they were characterised by the rationalisation of workplaces, cost reduction and by the decreasing volume of investments. Peripheries are already in time-delay ("time-lag") in the building of their networks and for this reason information behaviours show a follow-up pattern both on individual and community levels. In developing or underdeveloped countries this time-lag may even be greater and this weakens the impacts of decentralisation. The reasons of time-lag are explained by the very rigid socio-economic conditions and by political power structures. In extreme cases this process may result in economic dependency and the loss of management and directive functions. Disadvantageous economic structures do not favour for reaching a critical mass necessary for achieving success in the market. The low level of co-operation skills, the absence of integration opportunities, low accommodation, poor human resources, national and ethnic features, social traditions and value system are all resulting an ultimately handicapped situation.

The potentials that ITTs offer in opening new markets, economic prospects and in easing the site location disadvantages are being utilised only at a moderate level now as the home – so far protected – markets will be opened for external competitions and with the help of ITT networks it will be easier to find those regions that offer the greatest site location advantages (*Rieper,* 1990). The dependency from

[60] The term periphery defines such areas that are located at least at a distance of 150 km from major decision centres.

core areas and decision centres will increase.[61] In the absence of a strategic development policy time-delay will increase and peripheries will lose all of their chances to join such integrations that will bring success for them. Government policy should not be restricted only to the building of networks. Assistance should be given to their utilisation as well. The instruments of assistance may be as follows: the distribution of end-user devices, payment advantages, leasing constructions, the general reform of the training system, the introduction of a degressive or at least neutral user tariff system.[62] The receptivity of rural areas should increase, the information flow between core areas and peripheries should become bi-directional (*Nahrada,* 1995).

Local governments and regional authorities have key role in tackling down the acute shortages of data. On the one hand decentralised data collection, recording and processing are cheaper than centralised, on the other hand regional, local information demands will be satisfied on local level and local governments also may come to the market as information service providers. Through the utilisation of the logistic potential of ITTs the costs of some public services may be reduced (by running municipal associations, by providing services for sporadic settlement districts) (see: *Cities and new technologies,* 1992).

Among regional development organisations those non-profit institutions that are specialised for the distribution of telematic culture (telerooms, telecottages, telecentres, small teleports) may initiate several positive changes (*Maskell* et al. 1998):

- In weak regions they can facilitate economic restructuring e.g. by starting modern services
- For telecommunication companies they provide good technical facilities and create the image of high-tech company site
- For outer world they show the image of a self-conscious regional government, which is an active initiative of economic and technical development
- They can create a good atmosphere for investors.

The positive impacts of this process can most easily be assessed by the situation of businesses, as for them ITTs create chances for restructuring, building partnership and reaching a critical mass position in the market. The reinforcement of local producers' basis and the increase of adaptation potentials are the keys to success to successful adaptation. Adaptation and closing-up are starting with the introduction of advanced but not top-level technologies because a too fast step in technological modernisation may hinder the manifestation of additional synergic effects. Man-

[61] In other words the periphery's economy functionally depends on the core area's economy.

[62] Even a neutral tariff system may increase polarisation. While in Great Britain one-third of business organisations are available by phone from London on local call rates, only 2% are them available from North England ! (*Harrison,* 1990).

agement competence, the motivation of actors, the easy to follow innovation behaviour model and regional policy are very important in this process (*Harrison,* 1990). ITTs are open structures and knowledge is spreading very fast through the existing networks. They bring real chances to improve the lagging-behind position of closing-up territories. The functional division and spatial separation big companies may further improve the chances of peripheries. One industrial producer with some business service companies may have an enormous impact on its region's economic prosperity.

The extension of the core region's communication zone is increasing the core settlement's economic prosperity and sucking out the periphery's resources ("*information drain" or "information colonisation"*). If a periphery is attached to a strong information centre it will give up its own information relation system, which created the periphery's individual image, its less developed but intact structure. By directing the information flow towards itself, the centre may break up the traditional channels of communication and may stop the periphery's natural development process.

The incoming large amount of information will generate spectacular economic development but this will quickly be over and the region's economy will soon be dependant on external forces (*trapped in effect*). Since that point the periphery will be interested in the long-term prosperity and dynamic development of the core region because it is the periphery that will primarily be affected by a crisis situation. The exploration of the periphery may be a serious threat because the so far specific for the region knowledge and skills (traditional handicraft technologies) would be "exported" into a different region, which later on would turn out as a competitor against the region's internal production (*Tiner,* 1992).

According to *Müdespacher* (1990) the spatial diffusion of telematics within a closed region may be outlined by the following pattern:

1 The preparation of technology accommodation (labour market training, corporate structure) projects;
2 The establishment of a telematic centre (the involvement of professional consulting firms, regional data bank, videotext services, hardware and software development centres, telework centres, tourist information systems, economic sector information centres etc.);
3 The promotion of innovation and the accommodation of innovation (know-how accessibility, partnerships inter-firm networks);
4 Technology transfer centre;
5 The improvement of adaptation skills and capabilities within business organisations.

Final remarks

Apart from the results having been discussed in chapters dealing with the correlation between the development of information infrastructure and society and regional development it can be concluded that regional and local development with regional policy, as a whole, should have greater role in the overall development of the information sector. A greater compatibility with the basic principles of European regional policy (subsidiarity, publicity, transparency, partnership) could be achieved if the professional competence, the development policy, the planning and research policy of regional development – like in the majority of European countries – would be "equipped" with a wide-spread, well-co-ordinated information network. The present programmes of e-Europe as well as e-Hungary[10] so far have been quite "intact" from spatial issues, and from their impacts they are disregarding such elements of this sector that may ignite completely different processes from the traditional trend of development.

Regional development as a complex economic, social and planning system highly deserves to have a more important role within the programmes of e-Hungary (*NIIF Program*, 1999). There is a large necessity for regional portals, and through the activity of Regional Development Boards high priority should be attached to the issues of regional development within Intelligent Region, county and micro-regional development programmes (*Varga,* 2000a). Without this not only regional development as a discipline with handicapped areas would be "excluded" from ICT-initiated development processes but also "locality standing partly against globality" would be marginalized and this trend of regional development would not comply with the practice of the West European regions.

On the basis of the present intensity of building information and telecommunication infrastructure we have good reasons to assume that within the next few years Hungarian telecommunication service providers will ensure good technical background and services for their customers in all primary districts of Hungary. For this reason it is not technical infrastructure but rather the adaptability of human factors that will determine future development perspectives (*Fehér–Varga,* 2002). Thus, a region's development chances will depend on such factors as the education of its population, their special skills and their receptivity for the new. (*Rechnitzer,* 2003; *What is future?* 2001).

As it is seen, the potential spatial development level of the ICT sector may be a smaller problem factor of future development than we have seen it in case of traditional factors. It is clear, from research results that "spatial diffusion" of information technology innovations and applications – having gone through an urban concentration, a typical phenomenon of the 1990s is getting more and more differenti-

[10] Europe's road..., 1995; e-Europe, 1999, or in Hungary NIIF, 1996; NIIF Program, 1999; NIS, 1999.

ated, which – has become a significant process even in socially and economically handicapped areas. From this we can conclude that these regions have recognised the importance of the potentials of the new information-communication technologies and they actively use them to increase their economic performance and regional competitiveness.

Local governments and regional authorities have key role in tackling down the acute shortages of data. On the one hand decentralised data collection, recording and processing are cheaper than centralised, on the other hand regional, local information demands will be satisfied on local level and local governments also may come to the market as information service providers. Through the utilisation of the logistic potential of ITTs the costs of some public services may be reduced (by running municipal associations, by providing services for sporadic settlement districts).

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The great challenge now is whether partnership members will get ready within a short time for the age of the information society (*Tiner,* 1998). From socio-economic aspects we consider that greater assistance should be given to civil organisations, SMEs and municipalities (being at present potential sub-governmental elements). (See: *Szarvák,* 2000; *Szarvák–Szoboszlai,* 2002). Regional development programmes with elements that can directly be linked to documents of intelligent regional development should not only be prepared for macro (regional, state) levels but also for micro (micro-regional, local) levels. The common elements of intelligent regional development programmes are as follows (*Fehér–Varga,* 2002):

1 Virtual county programme the central embedded element of Intelligent Region projects
2 E-administration programme
3 Technology development zone programme
4 E-content projects

5 E-economy projects
   - The establishment of virtual companies. E-commerce project.
   - The integration of a micro-region or county into e-commerce and e-business has key importance.
   - Distance health service projects
   - The preparation of projects associated with health information systems, health service networks and distance therapy
   - The organisation of electronic markets
   - Running an e-economic portal as a part of a commercial portal within the framework of the planned portal system.
   - County-level e-economic non-profit company.
   - Digital cottages, digital flats programme.
6 House of intelligence, telecottage programmes
7 Intelligent micro-regions
8 Public education projects
9 Distance education centres
10 Internet-based TV and radio channels (regional information and media system)

In the early 1990s significant quantitative and qualitative development started in Hungarian *telecommunication and information infrastructure*. The establishment of telecommunication concessions accelerated this process. Today there are no significant differences between Hungary and Western Europe in the digitalisation of network, in data transfer capacities and technologies. However we cannot tell the same thing about service quality and general provision indicators. Telecommunication and information companies started the building of their networks in areas offering solvent demand and higher than the national average number of business organisations. This resulted serious regional disparities in the provision of telecommunication and information services.

It is also worth mentioning that the building of the infrastructure of this sector requires less financial resources than any other types of linear infrastructure (motorway, railway, pipeline, electricity systems). Thus, it may spread more quickly and the return of investment costs is also faster. In several counties of Hungary (Baranya, Csongrád, Somogy, Borsod-Abaúj-Zemplén etc.) the building of telecommunication and information systems and equipment – in comparison to other elements (or to the overall development of infrastructure) is faster or has more dominance within the general development of the whole infrastructure system *(Figure 14–15)*. It is expected and at the same time it is very important that these counties both from economic and local-regional development reasons will attach higher priority to their information technology issues in their future development concepts. But for all that, the regions of Central Hungary and Transdanubia have

better provision indicators than those on the eastern side of river Danube (*Table 18a–d – Annex*). As it is seen, *with the exception of Csongrád, all the East-Hungarian counties are unable to mobilise such economic and social forces that would increase communication activities and generate larger development projects than the national average*. Qualitative development in the service provision of the eastern part of Hungary can only be achieved when the region's "general" economic and social problems have been tackled.

The improvement of the accessibility of East-Hungary (in the dimensions of transportation, telecommunication and information) would build several economic relations, which would also facilitate the intensification of communication. More attention should be paid for local-regional and cross-border cooperation and heavy investments are needed for culture and education because these sectors will provide the human capital for investments and for the region's general economic development.

The present volume and quality of R&D and higher education are one of the most critical issues in the building of information society. R&D organisations are necessary not only for innovation but in several cases new products and applications come out from innovation oriented environment, they are tested, improved there and some learning process is also associated with these institutions.

The political and economic changes of the early 1990s put the Hungarian *research-development sector* into a difficult situation. Several – mostly technical profiled – research organisations were closed down and the number of researches also reduced drastically. It was the research units of companies that were mostly affected by rationalisation: between 1988 and 1994 the staff of R&D companies decreased by more than 60%.

The funding resources of R&D had gone through a similar process. In year 1994 the total running expenses of the R&D sector were by 3.5% less of the values of year 1988. Due to poor economic conditions, the share of R&D within the GDP was continuously decreasing (from the 2.4% average between the years of 1983-87 it was going down at first to the value of 1.6% (1992) then to an average of 1.03% between 1992–1994).

Although after 1995 the economy was in a recovery period, the share of R&D resources still remained on low values (an average of 0.7% between 1995–1999). By this the government's financial assistance to the Hungarian R&D sector was lagging behind the average European 2–3%, not only in quantitative but also in proportional aspects. This trend changed in 2000 and 2001 and the volume of R&D funding resources, compared to the previous years, significantly increased, approaching 1% of the GDP, the first time since 1994.

Considering that in the period of building an information and knowledge-based society, the share of human capital in the value of products and services, we are on

the opinion that a further increase of R&D funding resources is essential to maintain the present level of innovative potentials and economic competitiveness.

Greater attention should be paid for reducing the extremely high spatial concentration of R&D activities (46% of the total research organisations, 56% of total researchers and 65% of the total research funding resources are located in Budapest) and to the development and support of such research organisations – their number and dispersion is very low today – that are operating outside the organisational framework of university campuses.

As it is shown by statistical data (*KSH, Kutatás-Fejlesztés,* 2000), differences in R&D potentials and R&D development resources between counties with and without significant university campuses (Tolna, Nógrád, Komárom-Esztergom) are great – in some cases higher than 100-fold. In such a situation it can be prognosticated that that these territories will be excluded from "information-generated development" and the application of new results and services because their lower adaptation skills may prevent them from the successful application of competitiveness-oriented innovations.

The *spatial distribution of the institutes of higher education* is showing less dramatic extremes than the research-development sector. Fundamental changes have been carried out within the higher education system since the change of the regime. The number of students, institutes and departments increased the most significantly *(Table 18a–d – Annex)*. However most cities have no universities or colleges or if have they are just a faculty, which cannot cover all the higher education demands of the city with its environment. Limited chances for finding a job and low salaries at the their permanent residential area make students look for a job in education centres or in other, economically prospering regions. This phenomenon is an additional source of backwardness for areas (Nógrád, Borsod-Abaúj-Zemplén, Békés and Tolna counties) being involved in a continuous battle against their existing economic and social problems.

Losing a part of the young and ambitious intelligence may have serious impacts on the building of information society. The area, involved in this problem, will lose those well-educated intelligence who – through their knowledge and personal relations – would be the most intensive users of advanced information technology and applications and through their work and business activities would the most actively contribute to changing the region's economy into a prosperous one (*qualitative migration deficit)*.

What is making this problem worse is that technical universities and colleges are almost totally missing from several regions. (Southern Hungarian Plain, North Hungarian Plain). Without them it seems to be impossible to guarantee a successful industrial and economic development for a long-term perspective.

ANNEX

Csatári, Bálint - Kanalas, Imre - Nagy, Gábor - Szarvák, Tibor :
Regions in Information Society – a Hungarian Case-Study.
Pécs : Centre for Regional Studies, 2004. 114. p. Discussion Papers, No. 42.

Figure 2

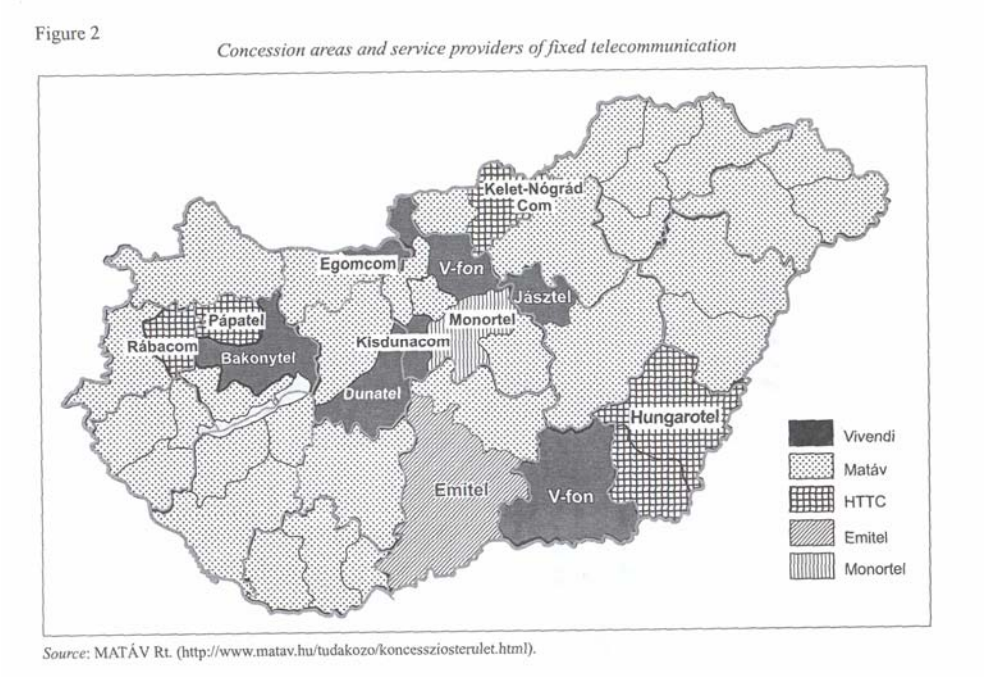


Figure 7

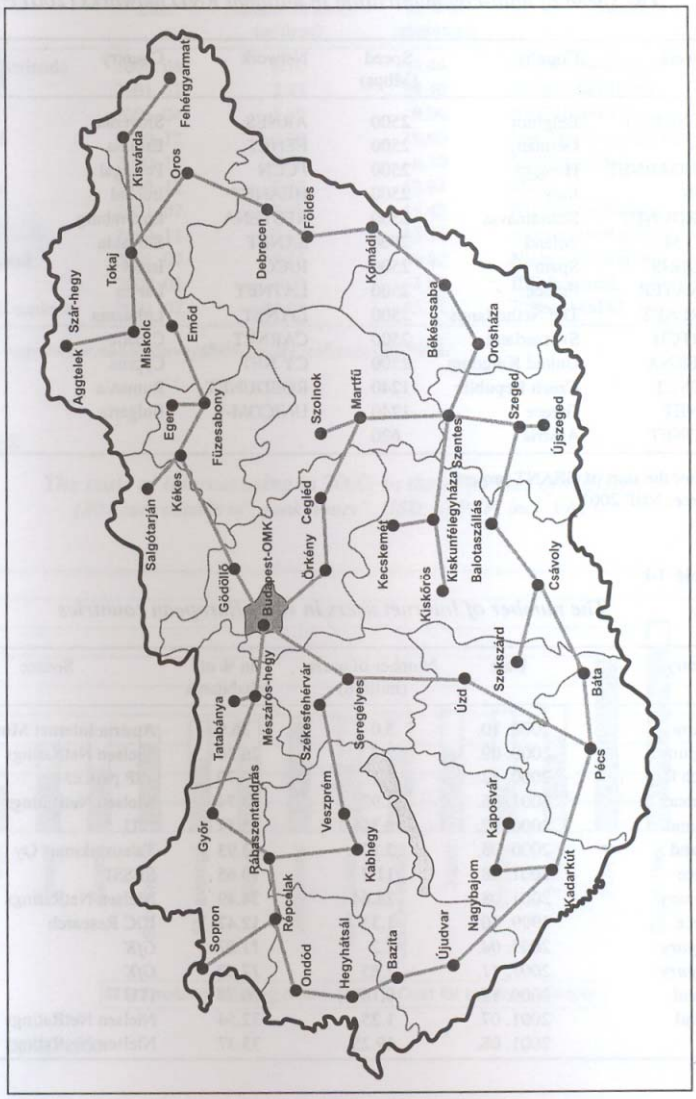


Figure 7 *Microwave-based communication network of Antenna Hungária Co.*

Source: Antenna Hungária Rt. (http://www.ahrt.hu/adoterkep.html).

Table 10

*The speed of data-communication in national R&D networks (2001)**

Network	Country	Speed (Mbps)	Network	Country	Speed (Mbps)
BELNET	Belgium	2500	ARNES	Slovenia	310
DFN	Germany	2500	EENET	Estonia	155
HUNGARNET	Hungary	2500	FCCN	Portugal	155
INFN	Italy	2500	HEANET	Ireland	155
NORDUNET	Scandinavia	2500	RESTENA	Luxemburg	155
POL-34	Poland	2500	SANET	Slovakia	155
REDIRIS	Spain	2500	IUCC	Israel	45
RENATER	France	2500	LATNET	Latvia	45
SURFNET	The Netherlands	2500	LITNET	Lithuania	45
SWITCH	Switzerland	2500	CARNET	Croatia	34
UKERNA	United Kingdom	2500	CY NET	Cyprus	34
CESNET	Czech Republic	1240	ROEDUNET	Rumania	34
GRNET	Greece	1240	UNICOM-B	Bulgaria	34
ACONET	Austria	620			

* After the start of GEANT project.
Source: NIIF 2001.

Table 14

The number of Internet users in some European countries

Country	Date	Number of users (million)	In % of inhabitants	Source
Austria	2000. 10.	3.0	36.9	Austria Internet Monitor
Belgium	2000. 09.	2.7	26.36	Nielsen NetRatings
Czech Rep.	2000. 12.	1.1	10.70	VIP park.cz
Denmark	2001. 06.	2.93	54.74	Nielsen NetRatings
Estonia	2000. 12.	0,366	25.57	ITU
Finland	2000. 08.	2.27	43.93	Talaustukimus Oy
France	2001. 08.	11.7	19.65	SESSI
Germany	2001. 08.	28.64	34.49	Nielsen NetRatings
Greece	1999. 10.	1.33	12.42	IDC Research
Hungary	*2001. 04.*	*1.2*	*11.87*	*GfK*
Hungary	*2001. 11.*	*1.85*	*17.62*	*GfK*
Iceland	2000. 12.	0,168	60.79	ITU
Ireland	2001. 07.	1.25	32.54	Nielsen NetRatings
Italy	2001. 08.	19.25	33.37	Nielsen NetRatings

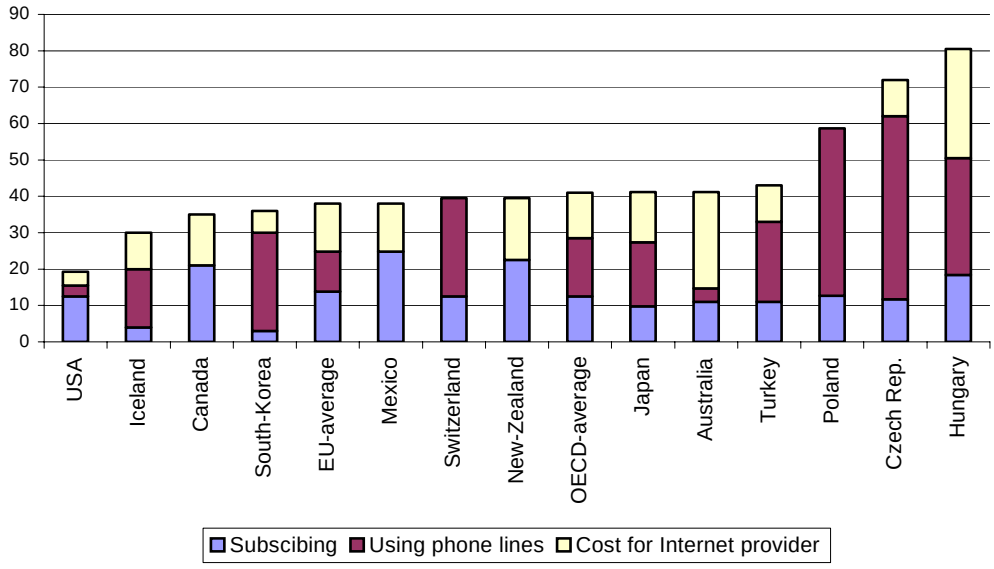
Continued form Table 14

Country	Date	Number of users (million)	In % of inhabitants	Source
The Netherlands	2000. 08.	8.70	54.44	Nielsen NetRatings
Norway	2001. 07.	2.45	54.40	Nielsen NetRatings
Poland	2001. 04.	3.50	9.06	ARC Rynek Opinia
Portugal	2000. 12.	2.00	19.90	Inst. Das Com. De Portugal
Russia	2000. 12.	9.20	6.30	Monitoring.ru
Slovakia	1999. 12.	0.70	12.94	ITU
Spain	2001. 07.	7.38	18.43	Nielsen NetRatings
Sweden	2000. 11.	5.64	63.55	Nielsen NetRatings
Switzerland	2001. 07.	3.41	46.82	Nielsen NetRatings
Turkey	2000. 05.	2.00	3.05	IBS Research
United Kingdom	2001. 07.	33.00	55.32	Jupiter MMXI

Source: http://www.nua.ie/surveys/how_many_online/index.html.

Figure 8

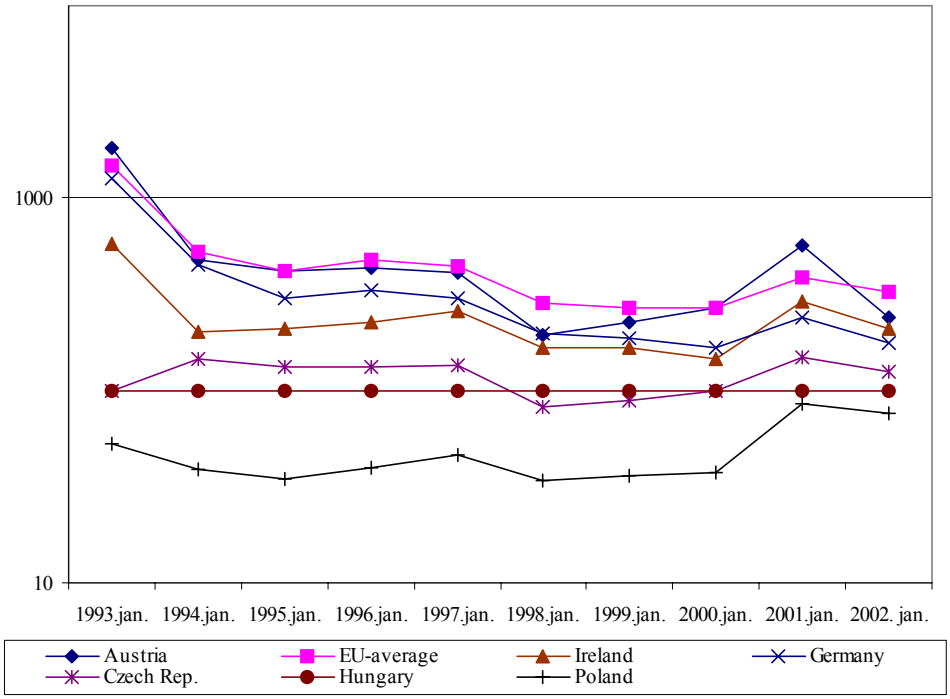
The costs of Internet using in 2000, in the countries of OECD
(30 hours outside of „peak-hours", USD, in PPP, incl. VAT)



Source: OECD 2000.

Figure 9

Changing rate in number of Internet-hosts per 1000 inhabitants in some European countries (Hungary = 100%)

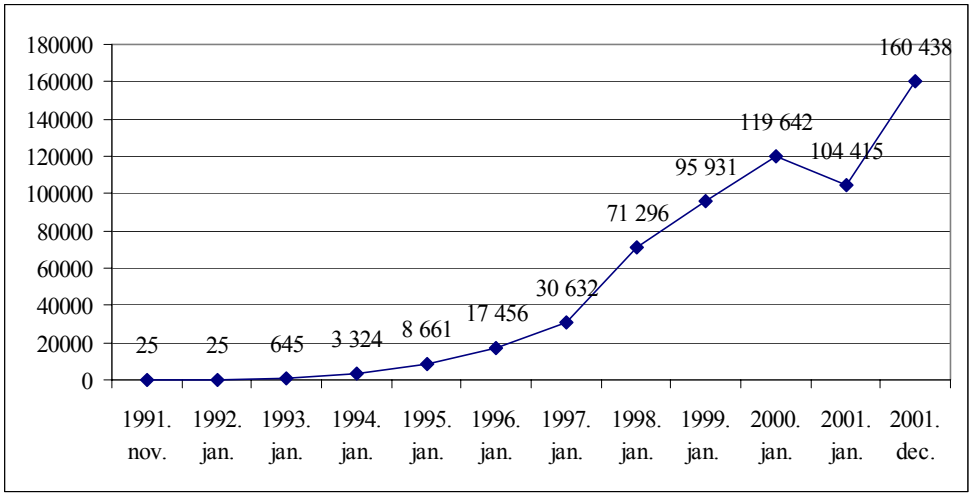


	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Hungary	0,06	0,33	0,85	1,72	3,02	7,02	9,45	11,88	10,36	16,64

Source: Imre Kanalas calculation in the base of RIPE NCC data.

Figure 10

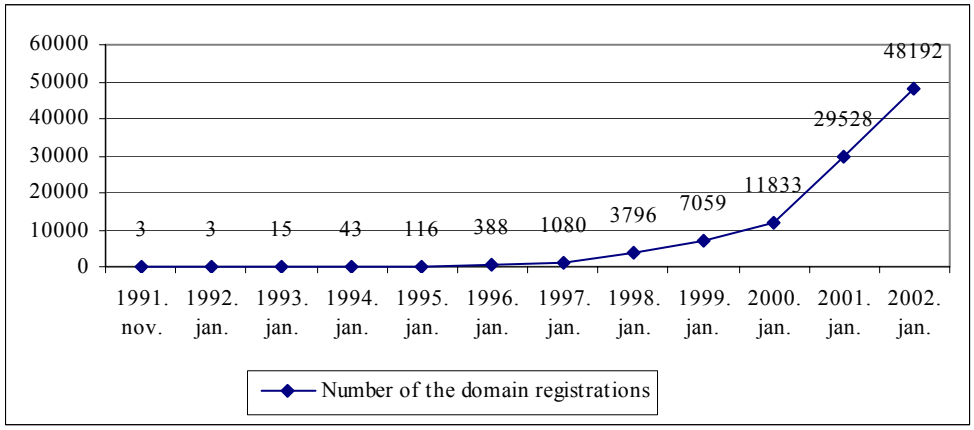
Number of Internet-hosts in Hungary (1991–2001)



Source: RIPE NCC.

Figure 11

Changing number of domain-name registrations (1991–2002)



Source: http://www.ripe.net/ripencc/pub-services/stats/hostcount/index.html

Table 15

Registered domain-name servers by counties and regions

County/Region	Number of servers (db)		In percent of all Hungarian servers (%)		Change of rates between 1998–2000 (in %)
	1998	2001	1998	2001	
Bács-Kiskun	77	1,216	1.47	1.82	0.35
Békés	49	,664	0.93	0.99	0.06
Csongrád	141	1,852	2.68	2.75	0.07
South Great Plain	267	3,732	5.08	5.56	0.48
Baranya	95	1,455	1.81	2.17	0.36
Somogy	59	697	1.13	1.04	–0.09
Tolna	31	366	0.58	0.55	–0.03
South Transdanubia	185	2,518	3.52	3.76	0.24
Hajdú-Bihar	103	1,203	1.95	1.79	–0.16
Jász-Nagykun-Szolnok	53	798	1.00	1.19	0.19
Szabolcs-Szatmár-Bereg	42	969	0.79	1.45	0.66
North Great Plain	198	2,970	3.74	4.43	0.69
Fejér	115	1,265	2.19	1.88	–0.31
Komárom-Esztergom	62	768	1.17	1.14	–0.03
Veszprém	68	1,162	1.29	1.74	0.45
Central Transdanubia	245	3,195	4.65	4.76	0.11
Borsod-Abaúj-Zemplén	79	1,015	1.51	1.52	0.01
Heves	53	841	1.00	1.25	0.25
Nógrád	29	373	0.56	0.55	–0.01
North Hungary	161	2,229	3.07	3.32	0.25
Budapest	3,773	43,834	71.67	65.25	–6.42
Pest	232	5,612	4.40	8.35	3.95
Central Hungary	4,005	49,446	76.07	73.60	–2.47
Győr-Moson-Sopron	117	1,609	2.23	2.39	0.16
Vas	37	738	0.71	1.09	0.38
Zala	49	738	0.93	1.09	0.16
West Transdanubia	203	3,085	3.87	4.57	0.70
Hungary	*5,264*	*67,175*	*100.00*	*100.00*	*0.00*

Source: Hungarnet Egyesület, 2001.

Table 17

Table 17

Main categories of domain-name owners by counties (2001)

Counties	Administration (central, regional, local)	NGOs	Other	Enterprises	Cultural institutions	R&D institutions	Individual owners	Educational institutions
Bács-Kiskun	37	19	83	807	9	3	250	8
Békés	35	14	9	477	9	1	111	8
Csongrád	29	45	58	1,130	4	11	558	17
Baranya	34	28	28	1,049	6	3	296	11
Somogy	28	16	54	412	6	0	175	6
Tolna	16	11	18	254	3	0	61	3
Hajdú-Bihar	28	26	21	894	2	1	214	17
Jász-Nagykun-Szolnok	24	8	19	582	5	2	150	8
Szabolcs-Szatmár-Bereg	18	21	10	775	1	1	132	11
Fejér	30	39	46	925	6	2	205	12
Komárom-Esztergom	33	14	11	586	2	0	114	8
Veszprém	52	29	65	743	8	3	254	8
Borsod-Abaúj-Zemplén	32	28	33	728	7	1	176	10
Heves	23	303	11	382	2	1	107	12
Nógrád	11	14	5	177	5	0	156	5
Budapest	577	1,258	967	34,837	55	137	5,821	182
Pest	73	67	209	4,275	8	5	953	22
Győr-Moson-Sopron	27	21	50	1,252	4	1	234	20
Vas	56	17	23	518	5	2	109	8
Zala	45	10	20	498	2	1	155	7
Hungary altogether	*1,208*	*1,988*	*1,740*	*51,301*	*149*	*175*	*10,231*	*383*

Source: Hungarnet Egyesület, 2001.

Table 18a

Table 18a

Rank of counties I. – Demography, Employment, Housing

Region	County	Number of inhabitants		Change in number of inhabitants	Number of employees	Rate of service sector in employment	People per one flat	Rate of newly built houses
		1990	2001	1990–2001	1999	1999	1999	1990–1999
Central Hungary	Budapest	1	1	20	1	1	1	18
Central Hungary	Pest	2	2	1	2	6	20	2
Central Transdanubia	Fejér	10	8	2	6	18	18	9
Central Transdanubia	Komárom-Esztergom	16	16	6	15	19	16	19
Central Transdanubia	Veszprém	13	13	8	11	15	13	5
West Transdanubia	Győr-Sopron-Moson	8	7	4	4	17	17	6
West Transdanubia	Vas	18	18	15	14	20	15	7
West Transdanubia	Zala	17	17	17	16	8	10	4
South Transdanubia	Baranya	11	11	12	10	5	11	14
South Transdanubia	Somogy	14	14	16	17	11	8	8
South Transdanubia	Tolna	19	19	10	19	16	9	13
North Hungary	Borsod-Abaúj-Zemplén	3	3	11	3	3	14	10
North Hungary	Heves	15	15	14	18	13	5	11
North Hungary	Nógrád	20	20	18	20	14	6	20
North Great Plain	Hajdú-Bihar	5	5	5	5	9	12	3
North Great Plain	Jász-Nagykun-Szolnok	9	10	13	12	12	7	16
North Great Plain	Szabolcs-Szatmár-Bereg	4	4	3	9	2	19	1
South Great Plain	Bács-Kiskun	6	6	7	7	10	3	12
South Great Plain	Békés	12	12	19	13	7	4	17
South Great Plain	Csongrád	7	9	9	8	4	2	15

Source: National Census 1990, 2001; Statistical Yearbook, Central Statistical Office, 1999.

Table 18b

Table 18b

Rank of counties II. – Economy, Enterprises

Region	County	GDP/capita		Change of GDP	Volume of investments	Rate of investments in service sector	Number of entrepreneurs (per 1000 inhabitants)	Number of companies (per 1000 inhabitants)
		1994	1998	1994–1998	1999	1999	2000	2000
Central Hungary	Budapest	1	1	5	1	1	1	1
Central Hungary	Pest	16	11	6	2	14	10	2
Central Transdanubia	Fejér	4	2	1	5	18	14	8
Central Transdanubia	Komárom-Esztergom	10	8	4	8	19	7	6
Central Transdanubia	Veszprém	11	9	7	12	11	5	11
West Transdanubia	Győr-Sopron-Moson	2	3	2	4	17	2	4
West Transdanubia	Vas	3	4	3	9	13	9	13
West Transdanubia	Zala	6	5	10	13	12	3	5
South Transdanubia	Baranya	8	10	12	11	3	12	3
South Transdanubia	Somogy	15	18	19	18	5	6	12
South Transdanubia	Tolna	6	7	17	17	20	8	14
North Hungary	Borsod-Abaúj-Zemplén	18	17	9	3	16	20	15
North Hungary	Heves	17	13	8	7	15	13	16
North Hungary	Nógrád	19	20	16	20	4	19	19
North Great Plain	Hajdú-Bihar	9	12	18	6	7	16	10
North Great Plain	Jász-Nagykun-Szolnok	13	14	15	15	9	17	17
North Great Plain	Szabolcs-Szatmár-Bereg	20	19	14	10	2	18	18
South Great Plain	Bács-Kiskun	14	15	13	14	10	11	9
South Great Plain	Békés	12	16	20	19	8	15	20
South Great Plain	Csongrád	5	6	11	16	6	4	7

Source: Statictical Yearbook, Central Statistical Office, 1996, 1999, 2000.

18c

Table 18c

Rank of counties III. – Infrastructure, Higher education, R&D sector

Region	County	Number of cars (per 1000 inhabitants)	Main road network (per 100 sq.km)	Energy consumption of individuals	Length of sewage network (in % of water system)	Rate of flats with gas-heating system	Number of students in higher education (per 10000 inhabitants)
		2000	1999	1999	1999	1999	1999
Central Hungary	Budapest	1	20	9	1	8	3
Central Hungary	Pest	3	4	3	4	1	19
Central Transdanubia	Fejér	8	12	12	6	5	8
Central Transdanubia	Komárom-Esztergom	9	5	4	2	19	17
Central Transdanubia	Veszprém	7	8	10	14	16	9
West Transdanubia	Győr-Sopron-Moson	2	3	2	3	17	5
West Transdanubia	Vas	6	1	6	8	13	7
West Transdanubia	Zala	4	2	19	5	9	16
South Transdanubia	Baranya	12	7	7	11	20	4
South Transdanubia	Somogy	11	15	18	18	12	15
South Transdanubia	Tolna	10	14	1	16	18	18
North Hungary	Borsod-Abaúj-Zemplén	20	10	17	15	15	10
North Hungary	Heves	14	11	5	7	2	1
North Hungary	Nógrád	15	6	11	20	14	20
North Great Plain	Hajdú-Bihar	18	18	14	12	10	6
North Great Plain	Jász-Nagykun-Szolnok	19	19	15	10	4	11
North Great Plain	Szabolcs-Szatmár-Bereg	17	9	8	9	11	12
South Great Plain	Bács-Kiskun	5	16	13	19	7	13
South Great Plain	Békés	16	17	16	17	3	14
South Great Plain	Csongrád	13	13	20	13	6	2

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18c-2

Region	County	R&D expenditures	Investments in R&D sector	R&D investments per capita	Number of employees in R&D sector	R&D employees (in % of inhabitants)
		2000	1999	1999	1999	1999
Central Hungary	Budapest	1	1	5	1	1
Central Hungary	Pest	4	7	11	5	8
Central Transdanubia	Fejér	8	12	16	11	10
Central Transdanubia	Komárom-Esztergom	18	17	6	16	16
Central Transdanubia	Veszprém	6	8	7	8	6
West Transdanubia	Győr-Sopron-Moson	7	3	3	7	5
West Transdanubia	Vas	17	18	19	14	12
West Transdanubia	Zala	12	13	13	12	9
South Transdanubia	Baranya	5	10	17	4	4
South Transdanubia	Somogy	16	15	9	17	17
South Transdanubia	Tolna	20	19	8	20	20
North Hungary	Borsod-Abaúj-Zemplén	9	11	15	6	7
North Hungary	Heves	15	16	14	13	14
North Hungary	Nógrád	19	20	20	19	19
North Great Plain	Hajdú-Bihar	3	4	10	3	3
North Great Plain	Jász-Nagykun-Szolnok	13	6	2	18	18
North Great Plain	Szabolcs-Szatmár-Bereg	11	14	18	10	13
South Great Plain	Bács-Kiskun	10	2	1	9	11
South Great Plain	Békés	0	9	4	15	15
South Great Plain	Csongrád	2	5	12	2	2

Source: Statistical Yearbook, Central Statistical Office, 1999, 2000; Statistical Yearbook of R&D Sector, Central Statistical Office, 1999, 2000.

18d

Table 18d

Rank of counties IV. – Culture, ICT-sector, Media

Region	County	Rented books from libraries (per 1000 inhabitants)	Member of art-groups (per 1000 inhabitants)	Visitors in museums (per 1000 inhabitants)	Number of flats connected to CABLE-TV networks	Penetration of main phone lines
		1999	1999	1999	1999	2000
Central Hungary	Budapest	13	20	5	9	1
Central Hungary	Pest	17	17	10	20	6
Central Transdanubia	Fejér	12	16	18	4	11
Central Transdanubia	Komárom-Esztergom	16	11	6	1	9
Central Transdanubia	Veszprém	7	10	2	7	3
West Transdanubia	Győr-Sopron-Moson	18	1	4	6	2
West Transdanubia	Vas	5	7	8	8	4
West Transdanubia	Zala	8	15	7	2	7
South Transdanubia	Baranya	15	9	3	3	12
South Transdanubia	Somogy	3	4	13	12	5
South Transdanubia	Tolna	20	3	12	11	13
North Hungary	Borsod-Abaúj-Zemplén	9	18	11	5	19
North Hungary	Heves	6	2	1	14	10
North Hungary	Nógrád	19	13	14	15	14
North Great Plain	Hajdú-Bihar	4	14	15	13	17
North Great Plain	Jász-Nagykun-Szolnok	1	12	20	18	16
North Great Plain	Szabolcs-Szatmár-Bereg	14	19	17	19	20
South Great Plain	Bács-Kiskun	11	8	16	17	15
South Great Plain	Békés	10	6	19	16	18
South Great Plain	Csongrád	2	5	9	10	8

18d-2

Region	County	Rate of primary schools connected to SchoolNET-network	Rate of secondary schools connected to SchoolNET-network	Number of telecottages (per 1000 inhabitants)	Number of domain-name servers (per 1000 inhabitants)	Number of Internet providers	Rank of county in the media-sector
		2001	2001	2001	2001	2001	2000
Central Hungary	Budapest	1	10	20	1	1	1
Central Hungary	Pest	3	17	14	2	2	2
Central Transdanubia	Fejér	7	14	15	7	4	7
Central Transdanubia	Komárom-Esztergom	9	13	16	11	9	13
Central Transdanubia	Veszprém	19	16	12	6	5	4
West Transdanubia	Győr-Sopron-Moson	11	5	11	4	3	10
West Transdanubia	Vas	20	6	8	8	7	17
West Transdanubia	Zala	12	1	1	10	11	17
South Transdanubia	Baranya	18	8	2	5	11	8
South Transdanubia	Somogy	10	20	3	14	11	11
South Transdanubia	Tolna	8	3	4	19	17	16
North Hungary	Borsod-Abaúj-Zemplén	17	15	10	20	11	3
North Hungary	Heves	5	4	19	9	18	15
North Hungary	Nógrád	13	18	9	16	20	20
North Great Plain	Hajdú-Bihar	4	7	7	13	9	9
North Great Plain	Jász-Nagykun-Szolnok	14	9	18	15	18	17
North Great Plain	Szabolcs-Szatmár-Bereg	15	12	6	18	11	14
South Great Plain	Bács-Kiskun	16	19	13	12	7	6
South Great Plain	Békés	6	11	17	17	5	11
South Great Plain	Csongrád	2	2	5	3	11	5

Source: Statistical Yearbook, Central Statistical Office, 1999, 2000; Ministry of Education, 2002; Telecottage Association, 2002; Hungarnet Association, 2001; Média Ász 14. (2002).

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Table 17

Main categories of domain-name owners by counties (2001)

Counties	Administration (central, regional, local)	NGOs	Other	Enterprises	Cultural institutions	R&D institutions	Individual owners	Educational institutions
Bács-Kiskun	37	19	83	807	9	3	250	8
Békés	35	14	9	477	9	1	111	8
Csongrád	29	45	58	1,130	4	11	558	17
Baranya	34	28	28	1,049	6	3	296	11
Somogy	28	16	54	412	6	0	175	6
Tolna	16	11	18	254	3	0	61	3
Hajdú-Bihar	28	26	21	894	2	1	214	17
Jász-Nagykun-Szolnok	24	8	19	582	5	2	150	8
Szabolcs-Szatmár-Bereg	18	21	10	775	1	1	132	11
Fejér	30	39	46	925	6	2	205	12
Komárom-Esztergom	33	14	11	586	2	0	114	8
Veszprém	52	29	65	743	8	3	254	8
Borsod-Abaúj-Zemplén	32	28	33	728	7	1	176	10
Heves	23	303	11	382	2	1	107	12
Nógrád	11	14	5	177	5	0	156	5
Budapest	577	1,258	967	34,837	55	137	5,821	182
Pest	73	67	209	4,275	8	5	953	22
Győr-Moson-Sopron	27	21	50	1,252	4	1	234	20
Vas	56	17	23	518	5	2	109	8
Zala	45	10	20	498	2	1	155	7
Hungary altogether	*1,208*	*1,988*	*1,740*	*51,301*	*149*	*175*	*10,231*	*383*

Source: Hungarnet Egyesület, 2001.

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Table 18a

Rank of counties I. – Demography, Employment, Housing

Region	County	Number of inhabitants		Change in number of inhabitants	Number of employees	Rate of service sector in employment	People per one flat	Rate of newly built houses
		1990	2001	1990–2001	1999	1999	1999	1990–1999
Central Hungary	Budapest	1	1	20	1	1	1	18
Central Hungary	Pest	2	2	1	2	6	20	2
Central Transdanubia	Fejér	10	8	2	6	18	18	9
Central Transdanubia	Komárom-Esztergom	16	16	6	15	19	16	19
Central Transdanubia	Veszprém	13	13	8	11	15	13	5
West Transdanubia	Győr-Sopron-Moson	8	7	4	4	17	17	6
West Transdanubia	Vas	18	18	15	14	20	15	7
West Transdanubia	Zala	17	17	17	16	8	10	4
South Transdanubia	Baranya	11	11	12	10	5	11	14
South Transdanubia	Somogy	14	14	16	17	11	8	8
South Transdanubia	Tolna	19	19	10	19	16	9	13
North Hungary	Borsod-Abaúj-Zemplén	3	3	11	3	3	14	10
North Hungary	Heves	15	15	14	18	13	5	11
North Hungary	Nógrád	20	20	18	20	14	6	20
North Great Plain	Hajdú-Bihar	5	5	5	5	9	12	3
North Great Plain	Jász-Nagykun-Szolnok	9	10	13	12	12	7	16
North Great Plain	Szabolcs-Szatmár-Bereg	4	4	3	9	2	19	1
South Great Plain	Bács-Kiskun	6	6	7	7	10	3	12
South Great Plain	Békés	12	12	19	13	7	4	17
South Great Plain	Csongrád	7	9	9	8	4	2	15

Source: National Census 1990, 2001; Statistical Yearbook, Central Statistical Office, 1999.

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Table 18b

Rank of counties II. – Economy, Enterprises

Region	County	GDP/capita		Change of GDP	Volume of investments	Rate of investments in service sector	Number of entrepreneurs (per 1000 inhabitants)	Number of companies (per 1000 inhabitants)
		1994	1998	1994–1998	1999	1999	2000	2000
Central Hungary	Budapest	1	1	5	1	1	1	1
Central Hungary	Pest	16	11	6	2	14	10	2
Central Transdanubia	Fejér	4	2	1	5	18	14	8
Central Transdanubia	Komárom-Esztergom	10	8	4	8	19	7	6
Central Transdanubia	Veszprém	11	9	7	12	11	5	11
West Transdanubia	Győr-Sopron-Moson	2	3	2	4	17	2	4
West Transdanubia	Vas	3	4	3	9	13	9	13
West Transdanubia	Zala	6	5	10	13	12	3	5
South Transdanubia	Baranya	8	10	12	11	3	12	3
South Transdanubia	Somogy	15	18	19	18	5	6	12
South Transdanubia	Tolna	6	7	17	17	20	8	14
North Hungary	Borsod-Abaúj-Zemplén	18	17	9	3	16	20	15
North Hungary	Heves	17	13	8	7	15	13	16
North Hungary	Nógrád	19	20	16	20	4	19	19
North Great Plain	Hajdú-Bihar	9	12	18	6	7	16	10
North Great Plain	Jász-Nagykun-Szolnok	13	14	15	15	9	17	17
North Great Plain	Szabolcs-Szatmár-Bereg	20	19	14	10	2	18	18
South Great Plain	Bács-Kiskun	14	15	13	14	10	11	9
South Great Plain	Békés	12	16	20	19	8	15	20
South Great Plain	Csongrád	5	6	11	16	6	4	7

Source: Statictical Yearbook, Central Statistical Office, 1996, 1999, 2000.

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Table 18c

Rank of counties III. – Infrastructure, Higher education, R&D sector

Region	County	Number of cars (per 1000 inhabitants)	Main road network (per 100 sq.km)	Energy consumption of individuals	Length of sewage network (in % of water system)	Rate of flats with gas-heating system	Number of students in higher education (per 10000 inhabitants)
		2000	1999	1999	1999	1999	1999
Central Hungary	Budapest	1	20	9	1	8	3
Central Hungary	Pest	3	4	3	4	1	19
Central Transdanubia	Fejér	8	12	12	6	5	8
Central Transdanubia	Komárom-Esztergom	9	5	4	2	19	17
Central Transdanubia	Veszprém	7	8	10	14	16	9
West Transdanubia	Győr-Sopron-Moson	2	3	2	3	17	5
West Transdanubia	Vas	6	1	6	8	13	7
West Transdanubia	Zala	4	2	19	5	9	16
South Transdanubia	Baranya	12	7	7	11	20	4
South Transdanubia	Somogy	11	15	18	18	12	15
South Transdanubia	Tolna	10	14	1	16	18	18
North Hungary	Borsod-Abaúj-Zemplén	20	10	17	15	15	10
North Hungary	Heves	14	11	5	7	2	1
North Hungary	Nógrád	15	6	11	20	14	20
North Great Plain	Hajdú-Bihar	18	18	14	12	10	6
North Great Plain	Jász-Nagykun-Szolnok	19	19	15	10	4	11
North Great Plain	Szabolcs-Szatmár-Bereg	17	9	8	9	11	12
South Great Plain	Bács-Kiskun	5	16	13	19	7	13
South Great Plain	Békés	16	17	16	17	3	14
South Great Plain	Csongrád	13	13	20	13	6	2

Region	County	R&D expenditures	Investments in R&D sector	R&D investments per capita	Number of employees in R&D sector	R&D employees (in % of inhabitants)
		2000	1999	1999	1999	1999
Central Hungary	Budapest	1	1	5	1	1
Central Hungary	Pest	4	7	11	5	8
Central Transdanubia	Fejér	8	12	16	11	10
Central Transdanubia	Komárom-Esztergom	18	17	6	16	16
Central Transdanubia	Veszprém	6	8	7	8	6
West Transdanubia	Győr-Sopron-Moson	7	3	3	7	5
West Transdanubia	Vas	17	18	19	14	12
West Transdanubia	Zala	12	13	13	12	9
South Transdanubia	Baranya	5	10	17	4	4
South Transdanubia	Somogy	16	15	9	17	17
South Transdanubia	Tolna	20	19	8	20	20
North Hungary	Borsod-Abaúj-Zemplén	9	11	15	6	7
North Hungary	Heves	15	16	14	13	14
North Hungary	Nógrád	19	20	20	19	19
North Great Plain	Hajdú-Bihar	3	4	10	3	3
North Great Plain	Jász-Nagykun-Szolnok	13	6	2	18	18
North Great Plain	Szabolcs-Szatmár-Bereg	11	14	18	10	13
South Great Plain	Bács-Kiskun	10	2	1	9	11
South Great Plain	Békés	0	9	4	15	15
South Great Plain	Csongrád	2	5	12	2	2

Source: Statistical Yearbook, Central Statistical Office, 1999, 2000; Statistical Yearbook of R&D Sector, Central Statistical Office, 1999, 2000.

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Table 18d

Rank of counties IV. – Culture, ICT-sector, Media

Region	County	Rented books from libraries (per 1000 inhabitants)	Member of art-groups (per 1000 inhabitants)	Visitors in museums (per 1000 inhabitants)	Number of flats connected to CABLE-TV networks	Penetration of main phone lines
		1999	1999	1999	1999	2000
Central Hungary	Budapest	13	20	5	9	1
Central Hungary	Pest	17	17	10	20	6
Central Transdanubia	Fejér	12	16	18	4	11
Central Transdanubia	Komárom-Esztergom	16	11	6	1	9
Central Transdanubia	Veszprém	7	10	2	7	3
West Transdanubia	Győr-Sopron-Moson	18	1	4	6	2
West Transdanubia	Vas	5	7	8	8	4
West Transdanubia	Zala	8	15	7	2	7
South Transdanubia	Baranya	15	9	3	3	12
South Transdanubia	Somogy	3	4	13	12	5
South Transdanubia	Tolna	20	3	12	11	13
North Hungary	Borsod-Abaúj-Zemplén	9	18	11	5	19
North Hungary	Heves	6	2	1	14	10
North Hungary	Nógrád	19	13	14	15	14
North Great Plain	Hajdú-Bihar	4	14	15	13	17
North Great Plain	Jász-Nagykun-Szolnok	1	12	20	18	16
North Great Plain	Szabolcs-Szatmár-Bereg	14	19	17	19	20
South Great Plain	Bács-Kiskun	11	8	16	17	15
South Great Plain	Békés	10	6	19	16	18
South Great Plain	Csongrád	2	5	9	10	8

Region	County	Rate of primary schools connected to SchoolNET-network	Rate of secondary schools connected to SchoolNET-network	Number of telecottages (per 1000 inhabitants)	Number of domain-name servers (per 1000 inhabitants)	Number of Internet providers	Rank of county in the media-sector
		2001	2001	2001	2001	2001	2000
Central Hungary	Budapest	1	10	20	1	1	1
Central Hungary	Pest	3	17	14	2	2	2
Central Transdanubia	Fejér	7	14	15	7	4	7
Central Transdanubia	Komárom-Esztergom	9	13	16	11	9	13
Central Transdanubia	Veszprém	19	16	12	6	5	4
West Transdanubia	Győr-Sopron-Moson	11	5	11	4	3	10
West Transdanubia	Vas	20	6	8	8	7	17
West Transdanubia	Zala	12	1	1	10	11	17
South Transdanubia	Baranya	18	8	2	5	11	8
South Transdanubia	Somogy	10	20	3	14	11	11
South Transdanubia	Tolna	8	3	4	19	17	16
North Hungary	Borsod-Abaúj-Zemplén	17	15	10	20	11	3
North Hungary	Heves	5	4	19	9	18	15
North Hungary	Nógrád	13	18	9	16	20	20
North Great Plain	Hajdú-Bihar	4	7	7	13	9	9
North Great Plain	Jász-Nagykun-Szolnok	14	9	18	15	18	17
North Great Plain	Szabolcs-Szatmár-Bereg	15	12	6	18	11	14
South Great Plain	Bács-Kiskun	16	19	13	12	7	6
South Great Plain	Békés	6	11	17	17	5	11
South Great Plain	Csongrád	2	2	5	3	11	5

Source: Statistical Yearbook, Central Statistical Office, 1999, 2000; Ministry of Education, 2002; Telecottage Association, 2002; Hungarnet Association, 2001; Média Ász 14. (20

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