**CENTRE FOR REGIONAL STUDIES
OF HUNGARIAN ACADEMY OF SCIENCES**

DISCUSSION PAPERS

No. 10

Regional Spread of Computer Technology in Hungary

by

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Pécs
1990

ISSN 0238–2008

Kiadja a Magyar Tudományos Akadémia Regionális Központja
Felelős kiadó: Enyedi György
Sorozatszerkesztő: Hrubi László
Készült 250 példányban, 2 (B/5) ív terjedelemben
Agora nyomda Pécs - 91-545
Felelős vezető: Csefkó Ferenc

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Rechnitzer, János: Regional Spread of Computer Technology in Hungary.
Pécs: Centre for Regional Studies, 1990. 22 p.
Discussion Papers, No. 10.

INTRODUCTION

In starting an analysis of the system of relations and the relationship between electronization and socio-economic spatial structure two groups of issues emerge.

1/ The first question is how much the spread of electronization – the general emergence, existence of its entirety and elements – is helped or hindered by the network of settlements, its structure and determining features. Or in a wider sense: how the many-sided and multi-level spatial distribution of the society and economy can contribute to the spread of electronization and also how electronization itself with its different outward forms affects the spatial differences, their moderation or even elimination.

2/ In the spatial structure of the society and the economy nodes – centres – with „own resources" have been formed, exercising thus spatial regional impact. To what extent are the spatial resource centres supplied with systems of tools of electronization? Do these centres produce, transmit electronization, or rather they take part in the comprehensive, quicker spreading of these devices bearing modernization? Do the regional centres of the economy play a mediating function in the spread of the different formations of electronics or are these conditions bearing dynamics and renewal merely concentrated in one centre, in *Budapest?*

I tried to analyse the relationships of electronization and the spatial socio-economic structure, at the same time I have to make some reservations to make the objectives of this paper clear and unambiguous.

I did not deal with all the elements of electronization, their appearance and way of functioning. I examined only one of them: the spatial spread, appearance and presence of computers. Unfortunately because of the lack of data I could not touch upon either the electronization of the production processes /e.g. NC lathes, robot technology, the spreading of CAD/CAM systems/ or the evaluation of the regional presence and effects of communicative systems /data transfer, spatial networks, local TV and information systems/. I did not undertake to give a survey of the activities outside the production sphere, to discuss the electronization levels of the population, private persons, entrepreneurs, of the tertiary and quaternary sectors or their territorial structure.

Thus in the analysis I will touch upon the spreading of the devices of computer technology, their spatial and temporal structure and the space-forming functions of their forms of appearance. I am going to demonstrate not only the economy and its supply but also the possibilities of access to the devices – for their functioning – as well as their spatial, settlement-network determinants. I shall give an outline of the supply of the educational system with machines, its composition and changes. At the same time I am going to deal with the regional characteristics of the degree of supply of the cultural, educational and extension training sphere with equipment. At last I am going to make an attempt at showing and outlining the regional

characteristics of the possible supply the private sector, the population with computers by using indirect information

The special literature on electronization and within this on the socio-economic conditions of computer technology, the number of analyses on the social effects of computer technology is rather small and limited in Hungary. Within this there is a total lack of papers in connection with its spatial structure in Hungary but even in the foreign technical literature their number is small. For this reason I am not in the position of relying on an existing conceptual, analytic and methodological apparatus and I had to elaborate it on my own. Consequently my attempts are only approximations of these series of related phenomena being still in need of further evaluation and reconsideration.

I was also in a difficult situation with the handling of the statistic data base. Statistic surveys, mainly data publications presenting computer technology have been published in Hungary since 1972. In the seventies these surveys were not annually published, they could merely boast of the inconsistency of spontaneous temporality. Since the 80's this aperiodicity has been broken and comparable data bases are published yearly. *The Computer Technology Department of the Central Statistical Office* put at my disposal the data series in a deeper breaking down in addition to the official data publication. In this way I am able to publish information which demonstrates the supply with equipment and its different parameters both at the county and settlement levels – relating to one year. /This data base concerns only the economic units being under official statistical observation, including state enterprises, co-operatives, publicly financed institutions and educational units. In the analysis I always indicate the character of the data base./

I got access to a comprehensive data base in respect of the education as well. With regard to the supply of this sphere with computers I have a relatively complex statistical information system at my disposal, therefore – mainly at the county level – I could point out temporal change and its different implications.

The private sphere caused the greatest difficulties. Here I made use of indirect information in my paper trying to give an insight into some of the perceptible relations on this basis. I will try to conclude the regional relations of the supply of this very important sphere with computers from data concerning the residence of the members of certain associations and unions as well as form that of the subscribers to journals on computer technology.

REGIONAL DIFFERENCES IN SUPPLY WITH COMPUTERS

The new technology, development and devices bearing renewal were concentrated in the large centres in the seventies. From among them the capital

played an invariably important role, while the strengthening of the role of the towns with regional function was still perceptible to some extent and also the draining impact of the economic concentration of some other settlements. The territorial allocation of the computers is shown in /*Table 1*/.

78% of the stock of computers was concentrated in ***Budapest*** in 1972 and this ratio decreased only to 72% in 1979. The machine stock of the cities did not change essentially, that is to say there was no significant computer technology base in the Hungarian towns with regional function. The county distribution of the machine stock is hardly of any significance: its increase can be observed only in two counties, *Borsod* and *Fejér*, and even there the existence and operation of the machines are based partly on the computer technology-related industrial base and partly on a high percentage of the bases of the extractive and manufacturing industries and R + D centres.

In the case of the other counties the situation is rather bad, since the stock is basically concentrated in the county seats and its size settles on the level reached in the middle of the decade, in brief, the increase is insignificant and minimal.

We have to continue analyses on the merits with the eighties, as the explosion in the number and regional spread of the computers has produced spectacular and easily demonstrable restructuring. The main cause of the change fundamentally lies in the headway of the personal computers /PC's/, their appearance on the market, their very quick reception and use. In 1982 the computer stock of the country was only 2665 units, in 1987 already as many as 64983, that is the increase was twenty-fourfold. /Here and from now on I will analyse the machines recorded by the official information system, making use of the number as shown there. In this system the machines used by private enterprises and the units owned – and used – by the population are not taken into account./

The regional proportions also changed between 1982 and 1987. While in 1982 about two-thirds of computers were concentrated in the capital in the last year of observation the share of *Budapest* was only 40%. The provinces nearly doubled their stock of computers, which is characterized also by the difference in the yearly rates of growth /*Table 2*/.

The data illustrating the number and increase of the computers show a gradual decrease and after 1986 they are significantly reduced. This trend is the most powerful in the case of the capital. Here presumably the change in the number of computers has arrived at the starting point of a new phase, while the rise in the provinces continues with a steadily decreasing rate and intensity. In this case, however, I may not speak of either classical saturation or the flattening of the growth curve of the provinces, I may only state that the former expansion rate has been moderated, consequently the spreading of computers has become even in the provinces, too.

The absolute index of the stock of computers naturally does not give an exact picture of the spreading of its use and actual role in either the temporal or regional comparison. It is less suitable for direct regional comparison /e.g. according to counties/ because the differences in economic structure and the level of development significantly influence the trend of this index. A somewhat more exact picture is given if we examine the regional distribution in relation to a standard projection base. For this purpose I chose the number of the employees of the individual counties and characterized the degree of supply by the number of computers per 10,000 employees /*Figure 1*/.

I broke down the country into 6 regions and investigated the supply of these regions with computers. Clearly the number of the computers is the highest in *Budapest* and also the increase in the level of supply is spectacular excelling the curves of the other regions. The difference is rather great between the capital and the other regions, namely in the capital as in the only multi-directional innovation centre of the country the supply with computers is becoming increasingly favourable. In principle an ever greater mass of employees get access to computers, that is an increasingly greater circle of the production and activities get in connection with this determining means of modernization.

The rest of the country – the other 5 regions – are at about the same level concerning supply, in fact the trend line is broken only after 1985 with a manifold differentiation taking place.

Beyond the number of computers the index of the size of the capacities of computer technology – which can be characterized by the actually available total performance – also refers to the composition and quality of the stock /*Table 3*/.

The data of the table illustrate the capacity of computers as recorded in the individual counties for 1985 and 1988. Between the two points of time the registered computer capacity of Hungary grew 8.9 times. This was significantly exceeded by the total increase of the provinces which was 11.1-fold, while in *Budapest* the expansion of capacity was below the average /7.4-fold/.

The regional distribution of the capacities fundamentally changed, as the position of the provinces was improved by about ten percentage points, which can be accounted for by the steady and comprehensive spreading of computers. The paces of the capacity expansion of the individual counties are different, which is indicated by the fact that the two extreme values are a 4-fold and a 22-fold increase calling attention to differentiation.

The spreading of computers in the provinces /outside Budapest/ has taken place with relative intensity since the second half of the eighties. Within this, however, the concentration related to certain settlement functions and settlement size is very strong as shown by *Table 4* and *5*.

We can make conclusions to the degree of supply from the distribution of computer capacity. In this respect the high ratio of *Budapest* is determining again,

the total capacity of computers in the county seats is a little bit more than a half of it, while the other towns together have a value amounting to about half of that of the county seats and finally the villages dispose of about half of the capacity of the town category. That is to say the capacities have been developed on the basis of a strongly hierarchical structure.

The hierarchical diffusion of computers adjusted to the role and functions of the settlements is revealed in their distribution according to the size of the settlements as well. Besides this the difference of distribution in the number and capacity of computers also refers to the fact that a symmetrical spatial and temporal diffusion model prevails. The diffusion of computers reaches the larger settlements with national and regional functions and greater role first and then the smaller settlements having local functions, at the same time this delay generally results in the adoption of qualitatively better /more up-to-date/ computers with higher capacity.

EMPLOYMENT AND ORGANIZATIONAL SYSTEM

The impact of computer technology upon employment cannot be disregarded. The fact of the matter is that it creates a mass of new places of work that can be taken into account both directly and indirectly in the institution, factories, production units and services centres. From the aspect of our topic it is a question of importance where the workers of computer technology find employment, partly in which regions, partly in what type of settlement they are concentrated. In this way it will be possible to point out what impact the spread of this new device – regarded in several places of this paper as one of the most important vehicles of innovation – or rather activity has on the division of labour and employment. Or again, whether the regional distribution of the employees of computer technology is definitely concentrated in the central settlements being linked to the central functions or it merely represents a wide-spread service /activity/.

Figure 2 shows the number of employees in the computer technology line between 1975 and 1987. I divided the total number of employees into three groups which are separately shown in the figure as well. They are as follows:

– programmers doing organization and management /let us call them software experts/

– experts of the apparatus serving /and supplying/ the hardware stock /let us call them hardware-operators/

– other additional staff doing jobs not directly connected with computer technology /let us call them other employees/.

On the basis of the national data, the number of the computer technology people more than doubled, the more vigorous changes started in the early eighties.

In the case of the groups formed according to the character of activity a similar pace of development can be registered. From among the two main groups the number of the employees serving, preparing and managing the hardware stock has increased somewhat more steeply than that of the experts dealing with programming management. The number of those indirectly engaged in computer technology /other employees/ has changed with lesser or greater fluctuation but steadily.

Let us start the examination of the regional, settlement distribution of the computer technology people with the analysis of the population census of 1980, as this was the first time that the number of active wage-earners in these jobs was made public at the county and town levels in Hungary.

Figure 3 illustrates the regional distribution of the computer people employed in the regions on the basis of the population census of 1980 on the county average and according to towns.

The structure shown earlier does not show a significant change, since this is the year prior to the explosion in computer sciences in Hungary but it is already obvious that the active wage and salary earners were predominantly concentrated in the counties considered to be economically developed and the same applies to the cities with many-sided functions, the regional centres, the organizing and management centres. In this way computer technology is an urban service expanding the urban tertiary functions and slowly starting the restructuring of employment there, although it still does not result in the radical transformation of the traditional structure.

A more powerful change in computer technology was brought about by the transformation of the organizational system. The discussion of this together with employment can be justified by the fact that these new organizational formations have created job opportunities based on innumerous new ventures, the economic dependence and relations of which are radically different from the structures having existed and functioned in the seventies or the early eighties.

In the organizational systems of the seventies the sectoral character and the traditional form of the centralized large-scale enterprises and large-scale organizations were predominant. Nearly each sector formed its own – one or more – mainly organizational, administration-mechanizing enterprises which established their regional offices in some kind of territorial organization afterwards. These offices organized the enterprises belonging to a particular sector of two or more counties and also served their slowly launched computerization later on. In the period of large-scale computers the endeavour towards central processing was prevailing at the sectoral level in the form of jobwork. It is not the task of this paper to make judgements about the deficiencies and competence – from the professional

aspect or otherwise – of these organizations but it cannot be denied that undoubtedly they played an important transmitting role in the spatial spread of Hungarian computer culture. A great number of branches and enterprises got to know computer technology through these organizations, obtaining thus the foundations for the further expansion and exploring of the possibilities of the creation of the mechanization conditions.

The explosion in the number of computer organizations was brought about by the legal rules concerning the new forms of small organizations becoming operative in 1982. These small organizations are suitable for responding to the market, a quick switch and adjustment to conceptions, to say nothing of their more flexible management, more moderate price policy etc. The rapid development of these organizations started. Their temporal changes and changes in the forms of activity are illustrated by *Table 6*.

It can be concluded that the number of the units operating in the „traditional" form of enterprises and co-operatives is determining, the overwhelming majority of the employees and the market share is concentrated by them. At the same time on account of the high number of employees their per capita sales receipts are already unfavourable. There has been a spectacular rise in the number of so-called „small enterprises" and „small co-operatives" only during the past few years as a result of the new regulation and the improvement of interests. On the other hand, the initially rapidly mushrooming so-called „business partnerships" came to a halt and a great number of organizations were converted into the forms of small enterprises and small co-operatives because the income conditions there have become more advantageous recently.

The number of the people employed in business partnerships is being reduced and the rate of the per capita sales receipts is also below the total average of the organizations from year to year. The so-called „business partnerships within the enterprises", the „specialized industrial co-operative groups" and the „associations" do not play an important role either in employment or the market share.

In this way the number of organizations dynamically increased, all this, however, has not been accompanied by a radical rise of employment level in the field of computer technology. The traditional form of enterprises and co-operatives is invariably prevailing but the new small enterprises and small co-operatives employing only a few people have gained ground, too. After the initial pace the number of business partnerships did not increase further, nevertheless the number of their employees was still on the increase.

At present there is no available data base for presenting the regional distribution of these organizations. It is possible, however, to make an approximate estimation of the regional structure with the help of the data series of *Table 7* which show the regional distribution of small venture organizations that support technical innovation. /It should be mentioned that because of classification which is different

from that of the previous table it is not possible to make a direct comparison between the two tables./

From among the 1570 small businesses 46% is engaged in providing computer technology and organization services, 45% of which can be found in *Budapest*.

The role of *Budapest* capital as an innovation node is also obvious in the case of the „small organizations", since the information, the market relations and the production-service-management activities ensuring the demand are concentrated here. Furthermore precisely on account of the concentration of the intellectual potential the strata of entrepreneurs ready and able to run new ventures can be found here.

It is natural that the regional distribution of these organizations is so to say the mirror image of the regional spread of the computer stock as outlined above. The machine supply as well as the demand for computer technology services of the peripherically situated territories is moderate. In the settlement distribution of these organizations the county-seats play a determining role, in the other cities their number is significantly lower, while in the villages there are organizations of this kind only once in a while.

On the whole we can conclude that the number of the employees of computer technology has dynamically risen during the past ten years. A real breakthrough was brought about by the establishment of the small organizations when the number of jobs significantly rose and more flexible, simple organizational forms grew in number. It is also due to them that the demand is on the increase, computer technology is becoming a more and more relevant economic factor.

The regional structure of employment and the organizations is characterized by an overwhelming concentration in *Budapest*. Besides it the larger regional centres and the county-seats concentrate the intellectual bases of computer technology. In the other cities their presence is perceptible but not significant yet, in the villages the job opportunities and organizational forms are still scarce.

COMPUTERIZATION OF EDUCATION

The diffusion of computers and related knowledge can be made most efficient in the case of the younger generations. They are not only most responsive to the new but also represent a large mass of people, therefore the transfer of knowledge can be rapidly integrated in their daily activities, thus – later – in production and services. Finally the knowledge passed on in school education may induce further demand – interest – within the family, the smaller or larger community for computer technology which may result in the expansion of the market and the faster reception of the devices and the transformation of the former means of

communication /entertainment, reception and processing of information etc./. In my opinion today we cannot realistically assess the impact of computer science yet, its influence on the active generations of the future but it is certain that the appearance and application of these devices as widely as possible on the different levels of education is indispensable.

In the early 80's a countrywide project was launched to provide computers for the schools. For this purpose budgetary resources were used and local-council and – with some restriction – institutional funds were mobilized as well. The demand for computers increased in this way, which naturally had an impact on domestic production. Computer types complying with the educational needs came into existence and the institutions were inundated with them. According to the „Hungarian practice" several elements of this action were criticized: the performance of the computers, their comparatively primitive character, the degree of equipping, the way of distribution etc. Unfortunately, the domestic industry – owing to the monopolistic situation of the manufacturers – did not make use of the possibilities of the development-generating computerization of schools and it was unable to develop – despite the high demand – the computer type which might have led to the establishment of the domestic base of computer science culture through mass production./

The computerization project of schools was an extremely important step, a milestone in the domestic spreading of the devices and activities. It had a great impact on a great number of educational institutions and the computers became available nearly everywhere. Not only a part of the teachers had to be trained for coping with the new forms of communication but all the pupils and students had a chance of coming across this basic device of innovation in real life. The success of the project is proved by international standards, too. Through intensive computerization we could catch up with the highly developed countries by the end of the 80's and the rate of supply reached is laudable in all respects.

Computerization rose powerfully in the primary schools. While in 1986 there were not any computers in 50% of the schools, by 1987 this rate decreased to 22.6%. There was a spectacular restructuring of the stock of computers with the percentage of schools having five or even more units having been quadrupled. The supply of the secondary schools showed a more favourable picture than that of the primary schools because in this group the number of schools without computers is relatively low and there are more and more secondary schools /81.6%/ equipped with five or more units. Finally computers are already available in the vocational schools, too, in fact the circle of schools with more than one computer is on the increase /*Table 8*/.

A survey of the regional structure of the stock of computers does represent spectacular dynamics because while in 1986 in the primary schools there was only one computer per 252 pupils, by 1988 one computer was at the disposal of 72

pupils. The rates of the secondary schools are more favourable, while those of the vocational schools are near the level of the primary schools.

The differences between the counties are extremely great. There are regions in which the project embraces all the spheres of education, while in others only certain types of the educational institutions get support and finally in the third group the whole project has not gained ground yet /*Table 9*/. The regional structure of computerization is rather divided. On the one hand, the regional educational structure and policy differentiated between the institutions, on the other hand, the regional adaptation and implementation of the central programmes created the differences between the educational institutions of the individual regions.

Here we have to mention the supply of the settlements with machinery, as this index gives a relatively balanced picture in the comparison of the county-seats, towns and villages. The formerly experienced imbalances are somewhat eliminated and significant, great differences in the distribution of the stock cannot be observed.

COMPUTERIZATION OF HIGHER EDUCATION AND CULTURAL SERVICES

It is needless to emphasize the importance of the computer supply of higher education because the equipment available in these institutions serve education as well as research and development. In the individual types of the institutions the standards are different because of the character of education and the market demand of research, thus significant differences can be pointed out in the regional structure.

Table 10 characterizes the equipment of the higher education institutions which function in the individual counties. On the whole the degree of supply is getting more and more favourable. The majority of the traditional university centres /thus *Szeged* in *Csongrád* county, *Debrecen* in *Hajdu-Bihar* county, *Sopron* and *Győr* in *Győr-Sopron* county, *Gödöllő* in *Pest* county, *Pécs* in *Baranya* county and *Miskolc* in *Borsod-Abauj-Zemplén* county is in a better position, although there are significant differences in their supply.

In addition to them new centres have been established. *Kaposvár* in *Somogy* county is becoming perceptibly a base of agrarian research or s could mention *Veszprém* in *Veszprém* county as an example of a centre with certain traditions, the centre of chemical industry and biotechnology, where the degree of supply is fairly good.

In some counties where non-traditional but in numerous cases non-independent institutions of higher education are run – perhaps precisely for these

reasons as well of non-independence, but – mainly as a consequence of the specialized character of the educational units the degree of the computer supply is low. It can be pointed out that, for example, in the counties of *Békés, Szabolcs-Szatmár* and *Szolnok* the machine supply of higher education is worse than that of the secondary schools there, in *Heves* and *Vas* counties, however, the institutions of higher education are very near the mechanization level of secondary schools institutions. The consequences of this unfortunate situation asserted themselves not only in the counties in question but in other places, too, and they may give rise to a complex effect. The secondary school pupils with some knowledge of computer science may not be able to find the possibility of using and applying it in such higher institutions – and just because of the rapid and explosion-like development of the hardware and software – their knowledge will become out-of-date and obsolete before long. After graduation already they may get employment in well-equipped institutions, thus the lack of knowledge may impede adaptation or the application of up-to-date education.

Computerization in the higher education fed on a great number of financial sources /receipts from contractual work, research and budgetary subsidies, donation, private etc./ and this has contributed to putting a lot of computer types to work in the institutions. Just for the sake of illustration: in 1987 251 different types of computers were registered at the institutions of higher education, 97 kinds of which could be found only in a single institution! This extraordinary heterogenity according to computer types has begun to disappear only recently, mainly with the spread of the distribution of the IBM PC types in Hungary. When the stock of computers is scrapped, it is generally replaced by this type.

On the whole the computer supply of higher education is gradually increasing, this increase is perceptible, while it is influenced by the character of the individual institutions, the size of resources to be obtained or available from the supreme authority. Therefore the regional structure is not balanced either, the great differences affect the standards of education, training and research carried out in the institutions. In a lot of institutions of higher education – mainly in the colleges – we will have to reckon with the fact that the new students entering there will possess knowledge of computer science on a higher level than at the time when they graduate. That is the extending of knowledge concerning this very important device and activity bearing innovation is not ensured by these institutions, not to speak of preparation for the application of the obtained knowledge in practice.

In the computer supply of the different branches of *culture, general education* and *communal entertainment* today our falling behind is still extremely great, consequently the regional distribution gives a very depressing picture. Although these forms might ensure for the different strata of society – besides work or education – large-scale access to computers and getting acquainted with this boon of electronization as well as their preparation for further use. At the same time they might play a transmitting role in the main activity of particular strata partly through

retraining and post-graduate studies, partly through the facilitation of communication and the acceleration of information.

In *Table 11* I am trying to put the scanty Hungarian data base on a standard projection base. It shows the standards of the computerization of cultural services, the book stock of libraries and the free-time activities of the young generation and finally the computer supply of a determining professional stratum, the educators.

On the average 12.2% of the *community culture centres* had computers, their number of computers was between 3-4 according to the national average. The counties with tiny villages attract attention with their bad supply */Baranya, Borsod, Nógrád, Zala, Vas/* while in the region of the *Great Plain* we get more favourable values, often above the average */Hajdu-Bihar, Csongrád, Szolnok/*, in the remaining counties these values vary. A close and unambiguous relationship of a positive trend cannot be pointed out between the economic potential and the computer supply of the community centres, as in counties such as *Győr-Sopron* and *Veszprém* the equipping is unfavourable /in the former county there were 5, in the latter only 3 computers per community centre on the average/, but again the values in *Fejér* county are much higher and hence the access to computers. /Naturally the structure of settlement network is a very important factor, since in the counties with comparatively fewer settlements the supply is higher than in the ones with small or tiny villages. The data base does not orientate us with regard to the whereabouts of these computers, by all probabilities they are overwhelmingly concentrated in the towns./

The equipping of the libraries with computers /for the purpose of public education/ is below criticism, as throughout the country there are nearly half a million volumes per one computer, which means overloading even in the case of the most up-to-date machines /not to speak of the real composition of the stock/. In some counties endeavours towards computerization can be observed */Hajdu-Bihar, Vas, Szolnok/*, but the general situation is very bad.

I analysed the access of the young generation to computers in the part on education and within this in the primary schools. The presentation of the equipment of the *Houses of the Children* – taking pupils of the counties of precisely this age as a projection base – is important both for entertainment, pastime and for laying the foundations of the completion of education and absorbed activities. Nationally there is one computer per 91 pupils in the *Houses of teh Children*. These are concentrated in the towns of certain counties and basically may have influence only on some centres or at best on their environs. The dispersion is very great, therefore it is difficult and not expedient to outline overall, general trends. There is no doubt about one thing: this data base can give orientation concerning personal commitment and the standard of concern for the children.

Finally, in this table I am giving an illustration of the computer supply of a single professional stratum, the educators and within this that of the pedagogical institutes that support the professional training of the secondary school teachers.

This data series with a signalling value is also thought-provoking, since how can up-to-date education be expected if the organs of training, post-graduate education and professional consultation do not have enough computers – of adequate standard – and the regional distribution is extremely uneven? This not very promising situation is worsened by the fact that the overwhelming majority of the existing computers are types of lower capacity. The high capacity computers able to provide a wider range of services are rare to find, their occurrence is random, thus from the large mass of the institutions only a few are able to provide effective computer technology services.

On the whole the computer equipment of the cultural services, public education and certain branches of extension training is unfavourable, the possibilities of access are limited, moreover, they are regionally differentiated. It is impossible to notice deliberate and planned intervention and development or in the case of their existence – declaration – any perceptible impact. The neglect of these spheres and their slow diminution – which is not revealed even in the preservation of the stock at the current level – may cause enormous damage to the economy.

PRIVATE SPHERE

I have reached the most complex part of this paper. The question itself is rather simple. How many PC's are privately owned and where are they situated in the country?

Let us start with the definition of „private sphere". I mean by this concept the computers used in households by families for games and – perhaps – household chores as well as the units used by small organizations, private or joint ventures, the ones that are not taken into account or registered by the official statistical data collection. It would be essential to explore what proportion of the families in today's Hungary get close to computers, in how many families such units can be found and how they are distributed between the different levels of the settlement network.

It can be assumed that the strata of entrepreneurs and propertied people with high income buy computers for the households. From among them the entrepreneurs also make use of this technical device – in an increasing number – in their everyday work. The computers applied in accounting, filing and solving other contractors' tasks /planning, designing etc./ increase the safety of the business decisions and widen the range of the activities in entrepreneurship.

Unfortunately, I could not obtain surveys and information on the computerization of the population or the households and their regional distribution. Thus I was compelled to estimate the levels of supply and its possible spatial distribution on the basis of approximate procedures.

The indirect data bases only suggest the computer supply of the population. The data were processed in a way enabling me to show the character and distribution of the regional structure between the larger spatial units or between settlements and to refer with them to the regional units bearing innovation. The secondary data sources are not suitable for pointing out the degree of equipment with computers, they can give only orientation about the higher concentrations with the value of signalling, and also about their spatial distribution or rather their relationship with the network of settlements.

I am going to start the analysis with describing a professional society. The *János Neumann Society of Computer Science* was founded in 1970 with the objective to unite the workers and students of different institutions so as to promote by social means the development of computer technology as a science, the spread of applications, the solution of topical issues supporting the spread of the culture of computer science, the regular information and extension training of experts.

Among these complex objectives it is essential for us that the society is the professional and scientific scene of the experts whose interests are official and job-related and of the people interested on the private, individual level. Their whereabouts also expresses the strength of affinity towards computer technology as well.

In *Table 12* I grouped the members of the society living in county-seats according to the year of joining. After the initial upswing the number of the members increased in 1976-80, then significant change was brought about in the period of 1984-87. The number of the experts officially interested in computer science increased at an identical pace with the spread of personal computers.

Most of the members can be found in *Budapest,* then in the regional centres, in order of importance: *Debrecen, Szeged, Pécs* and *Székesfehérvár*. In the other county-seats the number of the members varies showing at the same time great dispersion. This can be accounted for by the activity of the organization, the size of the local computer capacities and all the attracting factors that influence individual activity and willingness to participate. It is obvious that higher growth in the number of the members can be put at the time of the period of 1984-87, the circle of those interested in computer technology not just in general but professionally as well is on the increase.

Particularly in the private sphere the most widely used type of computers in Hungary today is the *Commodore*. The owners of such computers formed the *Commodore Association* which is regarded as the other important social-professional organization of computer science in Hungary today.

The Association is a purposive business venture and advertising activity at the same time, since the allowances accompanying membership serve both the spread of the hardware and software stock and close attachment to the product.

Table 14 shows the regional distribution of the members of the *Commodore Association* according to the individual counties and within them according to the types of settlements. /Here private persons and institutions figure together but in the latter case individual interests are embodied as well./ It can be seen again that the activity of the regional centres and large cities is powerful. For *Miskolc, Szeged, Debrecen* and maybe *Pécs* unite most of the members from among the county-seats, while the second group includes *Győr, Székesfehérvár, Veszprém, Kaposvár, Szolnok, Kecskemét* and *Nyíregyháza* where interest in computer technology is perceptible. In addition to these some other centres – where the higher educational and economic base is significant – make use of the services provided by the Association.

In analysing the private sphere we may not disregard the media of innovation and their spatial appearance, namely the examination of the subscribers of journals and periodicals on computer technology. I carried out the analysis of two widely distributed journals */Mikro Magazin, Computer World - Számítástechnika/* and of four pronouncedly professional periodicals */Információ Elektronika, Magyar Elektronika, Hiradástechnika, Mérés és Automatika/* on the basis of the domiciles of the subscribers and the number of copies subscribed to projected to the number of the inhabitants.

In *Figure 4* I indicated the settlements where the number of the subscribers is of perceptible magnitude /that is minimum one journal-one subscriber per 1,000 inhabitants/. The towns show the highest values. Some non-urban settlements also have a significant concentration of subscribers /industrial settlements with low population/. In the zones of the country that are poor in towns the number of subscribers is either low or non-existent and it can be observed that basically in the /commuting/ zones of the town environs quantifiable values also emerge.

The knowledge about computer technology disseminated by the journals is concentrated in the towns and the attracted settlements of the town environs also excel in this respect but the journals do not already reach some zones of the country /regions with tiny villages, depression zones, underdeveloped regions/, therefore the number of the interested people – and with this the possibilities of adaption – are limited and strongly determined.

The whole activity of the private sphere in computer technology is basically concentrated in the large centres and the centres with definite and significant economic potential /small towns/. We can conclude that the presence of the devices of computer technology is also significant in the zones of agglomeration and commuting zones. A lot of settlements of the other zones of the country do not have access to the application of this innovation-bearing device even through the private sphere, which is due to the lack of intellectual resources or their unfavourable composition.

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SUMMARIZING

In Hungary computer technology has penetrated into the various spheres of life, widely manifesting itself at work and in the working processes but it also crops up in the homes, families and private life. It is spreading relatively rapidly in many directions with a trend which is still exponential, nevertheless in certain centres and activities the first signs of saturation can be already discerned. Computer technology is communicated by the market mechanisms, competitive organizations have been formed, a lot of which are well provided with capital and participate actively in the forming of the market and there are the small flexible intermediary, organizing and management businesses which stimulate competition and increase supply.

The market, the devices and services of computer technology are concentrated in the capital of the country. *Budapest* today is the only innovation centre of this activity that can be classically *designated.* In other words the market processes start and are concentrated here. This applies to both the large-scale ventures well provided with capital and the small flexible organizations, that is *Budapest* is the centre of the intellectual capacity managing and organizing this market. In the big cities of the country organization of supply of computer technology is lower by dimensions, the organizations there are generally local offices, subsidiary companie, of the organizations of *Budapest* and less frequently ventures relying on local resources. Nevertheless, more and more of the latter organizations managed to achieve a break-through on the regional and national markets. The supply of machinery, devices and specialists in the big cities is the multiple of that of the other settlements. Consequently the economic organizations there are closely related to computer technology. These centres concentrate the references of computer technology in the extra-economic spheres as well, the differences in these fields of activity are, however, already extremely significant. Although computers appeared in the network of medium-sized and small towns, in their economic organizations, it took place in a very differentiated way. For the great variety of the organizations and activities implies great differences in the equipment and the degree of supply. In the extra-economic spheres the spreading is not significant yet, alleged centres come and go but their equipment is often related to their specialized functions. In the villages the presence of computer technology can be perceived in the centres where the economic and service activities are organized and managed, namely in the economic centres of micro-zonnes. It is difficult to point out and demonstrate the further spread of computer technology in the villages. In the agglomeration zones of several large centres or in the industrial, agricultural villages with standard economic potential the presence of computers is tangible even in the private sphere but these villages appear in each case separate.

In the spread of the culture and knowledge of computer technology the provision of schools with computers has played a determining role. In numerous

counties with less developed or rather traditional economic structure the possibilities involved by this project were recognized and the schools were flooded with computers. At the same time in other places where significant economic potential has been accumulated, the support of education in this direction is still moderate and restrained. The future, however, can be established only through the quick replacement of the present computer stock, the development of the peripheries and the diffusion of the many-sided educational and learning programmes because the composition and equipment of the current stock is obsolete and out-of-date. The computer supply of higher education is also differentiated. Several university, college centres are just about to adopt and apply computer technology, while, for example, some smaller institutions have already taken important steps in introducing this infrastructural element of education and research. Unfortunately, the composition of the machinery in higher education is extremely heterogeneous and in several places – maybe everywhere – it has unfavourable composition of age.

The computer supply of the community centres that provide for culture, free-time activities and aptitude-developing is depressingly primitive. They cannot comply with their tasks or services with the help of the present stock and cannot become centres disseminating and transmitting knowledge on computer technology.

In the private sphere it is not easy to register the presence of computer technology or, in particular, to demonstrate its composition on the level of the regions and settlements. It can be concluded by all means that in the large centres the presence of the devices and activities is more active, while in the medium-sized and small towns only their occasional presence can be found. In the rural regions „white spots" indicate the lack of the spread of computer technology. This monotony is sometimes broken by some settlements where their presence, however, is also accidental.

The regional spread of computer technology has started in Hungary. Its pace and intensity are closely connected with the changes of the society and economy, therefore it can be expected that the regional structure of supply will have become more balanced by the turn of the millennium.

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TABLES AND FIGURES

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Table 1

Regional location of computers in the 70's

Naming	Computer stock /pieces/				The number of population per 1 computer /1000 persons/	
	1972	1975	1977	1979	1972	1979
Big Cities						
Budapest	125	281	387	467	16	5
Debrecen	4	9	14	16	43	12
Győr	3	9	9	11	36	11
Miskolc	4	9	11	11	47	19
Pécs	1	5	7	7	157	24
Szeged	2	8	10	12	67	14
Big cities altogether	139	321	438	524	20	6
Counties						
Baranya	-	-	-	-	-	-
Bács-Kiskun	-	4	4	4	-	142
Békés	-	2	2	3	-	145
Borsod-Abaúj-Zemplén	-	2	11	23	-	35
Csongrád	-	1	1	1	-	467
Fejér	3	16	13	27	133	16
Győr-Sopron	-	2	-	2	-	214
Hajdú-Bihar	-	-	1	1	-	552
Heves	5	6	7	7	68	50
Komárom	1	6	5	8	265	40
Nógrád	-	-	1	3	-	80
Pest	6	8	11	17	152	57
Somogy	-	-	1	3	-	120
Szabolcs-Szatmár	-	1	1	2	-	297
Szolnok	2	4	6	8	218	56
Tolna	3	1	1	1	84	266
Vas	-	2	2	2	-	143
Veszprém	2	4	7	7	208	55
Zala	-	1	1	3	-	105
Counties altogether	22	60	75	122	380	68
Sumtotal	161	381	513	646	64	16

Sources: Számítástechnikai Statisztikai Évkönyv. 1972., 1976., 1978., 1980. (Statistical Yearbook of Computer Technology. 1972., 1976., 1978., 1980.). Budapest: Központi Statisztikai Hivatal

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Table 2

Yearly rates of growth of computer stock (%)

Naming	1983	1984	1985	1986	1987
Budapest	174	191	165	186	148
The provinces	211	253	207	205	184

Source: Számítástechnikai Statisztikai Zsebkönyv, 1988. (Statistical Pocket Manual of Computer Technology). Budapest: Központi Statisztikai Hivatal

Table 3

Change of the capacity of the computer stock between 1985 and 1988

Naming	1985		1988		Change /%/
	Capacity /thousand Kbyte/	Proportion /%/	Capacity /thousand Kbyte/	Proportion /%/	
Central region					
Budapest capital	891.9	60.8	6,610.9	50.9	741
Pest county	39.5	2.7	451.8	3.5	1,144
Northern Transdanubia region					
Fejér county	73.1	5.0	294.8	2.3	403
Győr-Sopron county	29.4	2.0	374.0	2.9	1,272
Komárom county	28.4	2.0	440.6	3.4	1,551
Vas county	13.9	1.0	202.1	1.6	1,477
Veszprém county	28.2	1.9	416.5	3.2	1,477
Southern Transdanubia region					
Baranya county	39.3	2.7	308.5	2.4	785
Somogy county	23.8	1.6	165.9	2.0	1,117
Tolna county	15.4	1.0	170.4	1.3	1,107
Zala county	28.2	1.9	416.5	3.2	1,477
Northern part of Great Plain region					
Hajdú-Bihar county	47.3	3.2	447.2	3.4	946
Szabolcs-Szatmár county	15.7	1.1	255.7	2.0	1,629
Szolnok county	23.2	1.6	322.9	2.5	1,392
Southern part of Great Plain region					
Bács-Kiskun county	16.3	1.1	364.0	2.8	2,233
Békés county	17.6	1.2	225.6	1.7	1,282
Csongrád county	38.4	2.6	528.8	4.1	1,377
Northern Hungary region					
Borsod-Abaúj-Zemplén county	71.5	4.9	534.5	4.1	748
Heves county	13.5	0.9	250.6	1.9	1,856
Nógrád county	11.4	0.8	97.7	0,8	859
The provinces altogether	574.1	39.2	6,368.1	49.1	1,109
Sumtotal	1,466.0	100.0	12,979.0	100.0	885

Source: Special data by Computer Technology Department of the Central Statistical Office.

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Table 4

Distribution of computer stock and capacity according to settlement types in 1988

Naming	Computer stock		Computer capacities	
	in pieces	distribution (%)	in 1000 Kbyte	distribution (%)
Budapest capital	31,857	57.5	6,611	50.9
County seats	13,154	23.8	3,648	28.1
Other towns	7,298	13.2	1,777	13.7
Villages	3,048	5.5	943	7.3
The provinces altogether	23,500	42.5	6,368	49.1
Sumtotal	55,357	100.0	12,979	100.0

Source: Special data by Computer Technology Department of the Central Statistical Office

Table 5

Distribution of computer stock and capacity according to settlement size in 1988

Naming	Computer stock in pieces	distri-bution (%)	Computer capacities in 1000 Kb	distri-bution (%)	Distribution of the settlements' population
Settlements with population over 100,000	8,575	36.5	2,320	36.4	20.4
Settlements with population of 50-100,000	5,199	22.1	1,469	23.1	14.2
Settlements with population of 20-50,000	4,495	19.1	979	15.4	20.8
Settlements with population of 10-20,000	2,033	8.6	533	8.4	16.7
Settlements with population of 5-10,000	920	3.9	380	6.0	12.2
Settlements with population of 2-5,000	1,259	5.4	374	5.9	11.4
Settlements with population of 1-2,000	722	3.1	226	3.5	3.2
Settlements with population of 500-1,000	240	1.0	70	1.1	1.0
Settlements with population below 500	57	0.3	17	0.2	0.1

Source: Special data by Computer Technology Department of the Central Statistical Office

Table 6

Main data of organizations in computer technology

Organizational forms	Number of units in				Number of employees in computer technology in				Sales receipts per one employee /thousand Ft/ in			
	1984	1985	1986	1987	1984	1985	1986	1987	1984	1985	1986	1987
Traditional enterprises, co-operatives	2,079	2,056	2,510	2,760	24,902	24,875	25,683	26,716	270.1	324.7	351.2	454.7
Small enterprises	23	40	55	240	571	829	826	1,091	884.4	720.1	758.7	939.5
Small co-operatives	22	64	93	295	194	408	660	1,076	732.0	975.5	927.9	1,177.5
Business partnerships within the enterprises	474	636	738	678	3,565	5,734	6,832	6,622	66.2	60.2	63.4	68.3
Specialized industrial co-operative groups	43	57	59	60	445	1,273	1,479	1,719	112.4	130.4	185.3	151.3
Business partnerships	600	952	1,032	1,037	4,927	5,385	5,975	6,138	185.1	211.9	230.8	263.6
Associations	100	45	44	41	348	228	214	200	293,1	241,2	79.4	120.0
Altogether	3,341	3,850	4,531	5,111	34,952	38,732	41,669	43,562	248.1	278.3	296.8	385.5

Source: Computerworld-Számítástechnika. vol. III, no. 19. (Szeptember 21, 1988.)

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Table 7

Regional distribution of small businesses supporting technical innovation (June of 1987)

Capital and counties	Business partnerships in computer technology and organization	Business partnerships in technical designing and engineering	Business partnerships in innovation development	Business partnerships in county seats	Business partnerships in other towns	Business partnerships in villages	Altogether
Budapest	328	327	48	-	-	-	703
Baranya	21	17	4	40	1	1	42
Bács-Kiskun	22	34	3	30	25	4	59
Békés	12	23	2	19	13	5	37
Borsod-Abaúj-Z.	16	21	9	33	8	5	46
Csongrád	56	23	3	67	15	-	82
Fejér	57	24	7	61	21	6	88
Győr-Sopron	32	26	3	45	15	1	61
Hajdu-Bihar	26	19	2	44	2	1	47
Heves	4	6	-	9	1	-	10
Komárom	24	35	2	24	19	8	51
Nógrád	8	9	1	13	2	3	18
Pest	54	36	10	-	60	50	110
Somogy	15	24	3	25	16	1	42
Szabolcs-Szatmár	10	14	3	23	2	2	27
Szolnok	8	20	1	20	8	1	29
Tolna	8	23	-	18	5	8	31
Vas	5	13	-	14	3	1	18
Veszprém	15	11	1	18	8	1	27
Zala	9	31	2	25	16	1	42
Altogether	730	736	104	528	240	99	1,570

Source: Ruttkay É. 1988.

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Table 8

Distribution of schools on the basis of supply with computers
(Academic years 1986/87, 1987/88)

Type of schools	Years	Number of schools	Proportion of schools without computer	with 1 computer	with 2-4 computers	with 5 or more computers
Primary school						
	1986/87	3,540	49.7	18.2	23.2	8.9
	1987/88	3,541	22.6	11.1	30.2	36.1
Secondary school						
	1986/87	587	8.0	1.2	33.2	57.6
	1987/88	608	7.7	0.5	10.2	81.6
Vocational school						
	1986/87	278	22.3	3.6	48.9	25.2
	1987/88	284	19.4	1.8	23.2	55.6

Sources: Statisztikai Tájékoztató. A művelődési ágazat számítástechnikai eszközellátottsága. 1986., 1987., 1988. (Statistical Bulletin. Supply of cultural branch with computers. 1986., 1987., 1988.) Budapest: Tudományszervezési és Informatikai Intézet

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Table 9

Regional distribution of the computer supply of schools

Naming	Supply of primary schools in		secondary schools in		vocational schools in	
	1986	1988	1986	1988	1986	1988
Central region						
Budapest capital	244	69	64	33	297	133
Pest county	348	87	57	30	135	70
Northern Transdanubia region						
Fejér county	457	61	72	30	85	28
Győr-Sopron county	200	70	64	29	203	83
Komárom county	314	86	70	32	185	90
Vas county	385	82	68	23	117	51
Veszprém county	252	63	50	23	194	88
Southern Transdanubia region						
Baranya county	225	77	60	31	161	82
Somogy county	174	76	50	25	109	57
Tolna county	241	64	48	23	225	63
Zala county	163	66	62	23	222	88
Northern part of Great Plain region						
Hajdú-Bihar county	270	71	79	39	232	90
Szabolcs-Szatmár county	273	76	64	20	223	67
Szolnok county	278	83	48	19	174	47
Southern part of Great Plain region						
Bács-Kiskun county	190	50	60	22	161	67
Békés county	280	54	74	25	164	56
Csongrád county	175	75	66	170	72	
Northern Hungary region						
Borsod-Abaúj-Zemplén county	289	65	64	26	220	72
Heves county	282	79	102	27	113	86
Nógrád county	239	85	52	25	149	64
Altogether	252	72	64	28	177	72

Source: Special data by Computer Technology Department of the Central Statistical Office

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Table 10

Computer supply of the institutions of higher education

Counties	Number of students per 1 computer in	
	1986	1987
Baranya	23	25
Bács-Kiskun	25	13
Békés	25	39
Borsod-Abaúj-Zemplén	12	14
Csongrád	36	28
Fejér	19	8
Győr-Sopron	19	14
Hajdú-Bihar	19	15
Heves	43	24
Komárom	-	-
Nógrád	17	13
Pest	14	6
Somogy	60	10
Szabolcs-Szatmár	27	41
Szolnok	28	21
Tolna	-	-
Vas	-	2
Veszprém	6	6
Zala	29	12
Budapest capital	16	13
Total	20	15

Sources: Statisztikai Tájékoztató. A művelődési ágazat számítástechnikai eszközellátottsága 1986., 1987., 1988. (Statistical Bulletin. Supply of cultural branch with computers. 1986., 1987., 1988.) Budapest: Tudományszervezési és Informatikai Intézet

Table 11

Computer supply of cultural services in 1987

Counties	Rate of community centres with computers /%/	Book stock of library /1, 000 pieces/	Number of members of study circles in Houses of Children per 1 computer	Number of secondary school teachers
Baranya	7.6	1,691	95	42
Bács-Kiskun	12.8	441	114	62
Békés	9.4	367	98	38
Borsod-Abaúj-Zemplén	9.8	374	78	123
Csongrád	26.1	968	63	-
Fejér	18.2	672	85	28
Győr-Sopron	8.5	373	49	88
Hajdú-Bihar	27.8	188	75	74
Heves	10.5	215	70	53
Komárom	11.8	617	51	81
Nógrád	5.1	218	89	18
Pest	12.5	1,644	150	96
Somogy	11.2	583	-	37
Szabolcs-Szatmár	7.3	-	-	37
Szolnok	23.6	177	175	54
Tolna	13.1	1,258	159	8
Vas	3.2	157	241	36
Veszprém	10.4	304	148	40
Zala	4.9	259	82	39
Budapest capital	57.5	1,686	83	182
Total	12.2	429	91	53

Sources: Statisztikai Tájékoztató. A művelődési ágazat számítástechnikai eszközellátottsága. 1986., 1987., 1988. (Statistical Bulletin. Supply of cultural branch with computers. 1986., 1987., 1988.)

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Table 12

Number of the members of the János Neumann Society of Computer Science in the county seats in 1987 according to the year of joining

County seats	Number of members joined in 1971-75	1976-80	1981-83	1984-87	Number of members in 1987
Budapest capital	297	394	491	1,212	2,394
Tatabánya	1	16	6	54	77
Salgótarján	1	1	15	37	54
Eger	2	10	8	33	53
Miskolc	10	26	11	40	87
Nyíregyháza	2	28	16	80	126
Debrecen	21	21	45	97	184
Szolnok	1	24	9	20	54
Békéscsaba	-	16	4	40	60
Kecskemét	4	22	16	22	64
Szeged	14	21	43	88	166
Szekszárd	-	22	15	38	75
Kaposvár	1	6	5	28	40
Pécs	14	12	21	87	134
Székesfehérvár	12	43	11	63	129
Veszprém	5	3	5	25	38
Győr	2	14	3	22	41
Szombathely	2	26	21	18	67
Zalaegerszeg	2	19	8	23	52
County seats altogether	94	330	262	815	1,501
Total	391	724	753	2,027	3,895

Source: Special data by the János Neumann Society of Computer Science

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Table 13

Regional distribution of the members of the Commodore Association in 1987 (persons)

Counties	Number of members of the association in county seats	towns	villages	Total
Baranya	64	13	21	98
Bács-Kiskun	30	46	34	110
Békés	18	42	18	78
Borsod-Abaúj-Zemplén	82	38	22	142
Csongrád	84	56	12	152
Fejér	35	37	7	79
Győr-Sopron	39	37	11	87
Hajdú-Bihar	90	13	24	127
Heves	27	31	18	76
Komárom	28	48	17	93
Nógrád	14	9	8	31
Pest	-	76	129	205
Somogy	35	18	21	74
Szabolcs-Szatmár	29	14	19	62
Szolnok	34	27	16	77
Tolna	16	18	18	52
Vas	18	13	3	34
Veszprém	36	43	30	109
Zala	22	16	4	42
Counties altogether	701	595	432	1,728
Budapest	1,440	-	-	1,440
Altogether	2,141	595	432	3,168

Source: Special data by the Commodore Association

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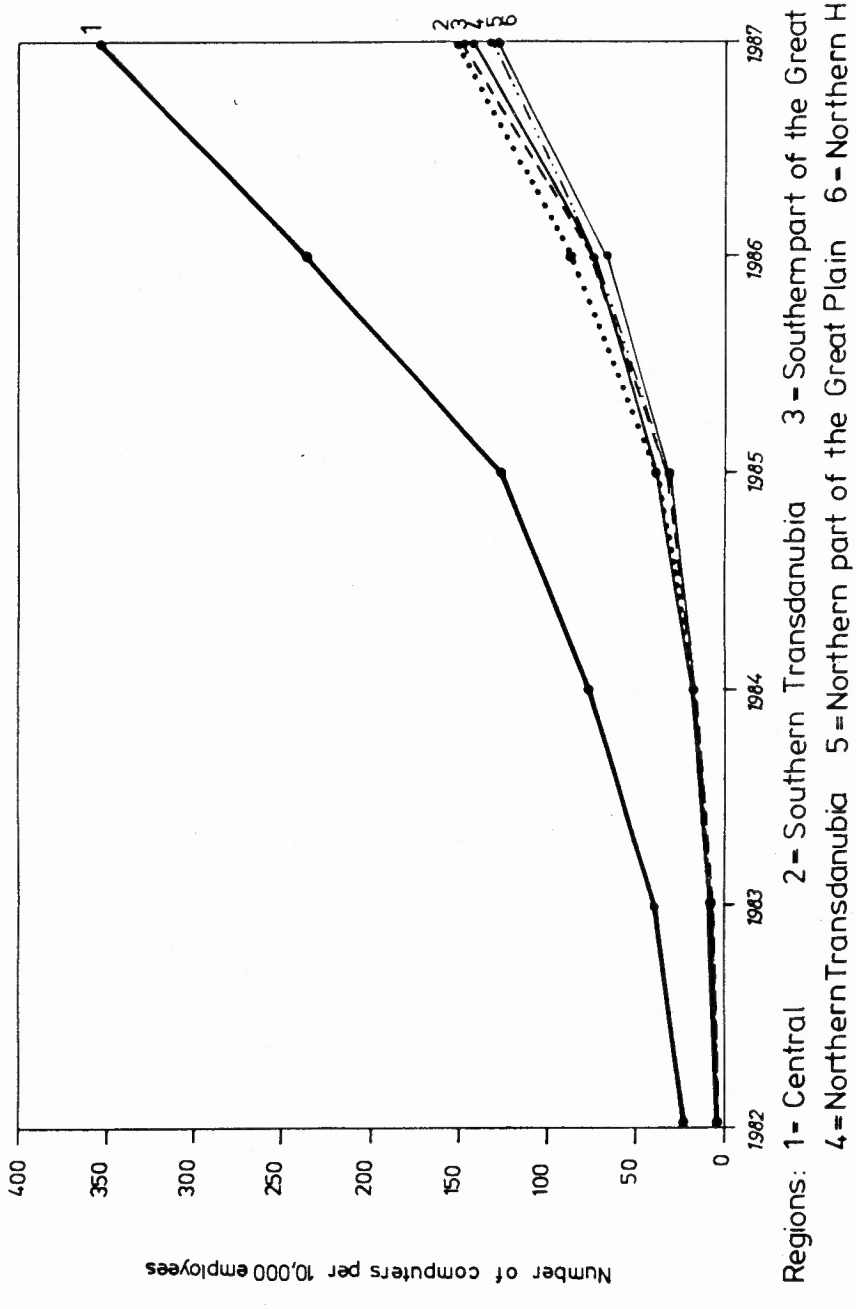
Figure 1

Computer supply of the regions of Hungary in 1982–1987



Regions: 1 = Central 2 = Southern Transdanubia 3 = Southern part of the Great Plain
4 = Northern Transdanubia 5 = Northern part of the Great Plain 6 = Northern Hungary

Rechnitzer, János: Regional Spread of Computer Technology in Hungary.
Pécs: Centre for Regional Studies, 1990. 22 p.
Discussion Papers, No. 10.

Figure 2 *Number of employees in the computer technology in 1975–1987*

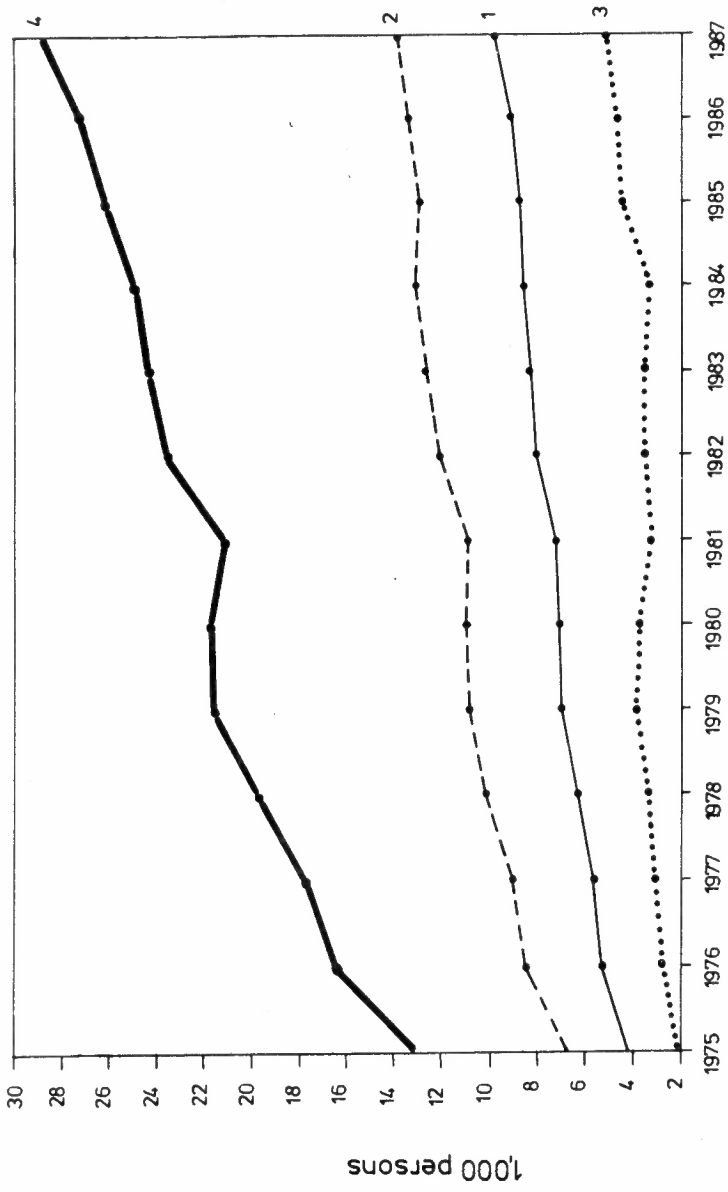
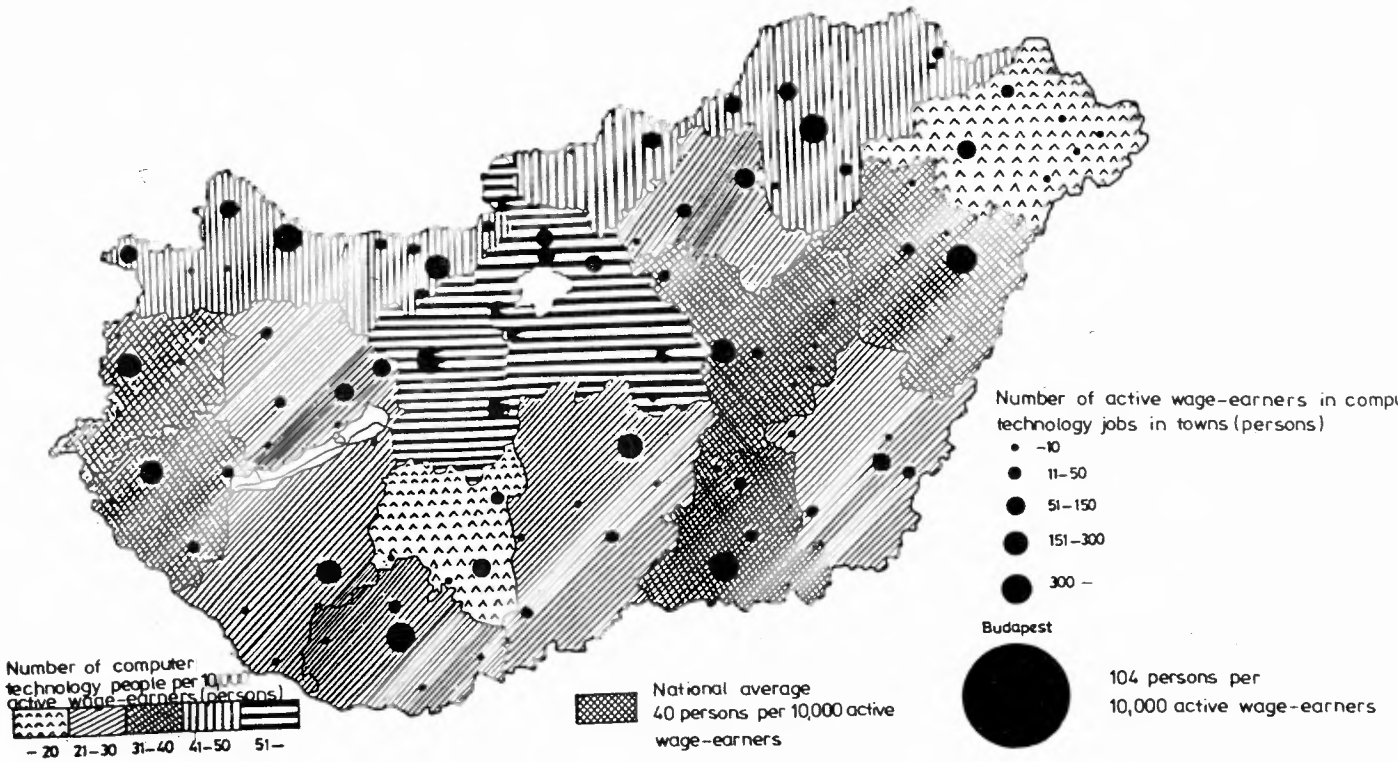


Figure 3

Number of active wage-earners in computer technology jobs in the towns and counties of Hungary in 1980



Rechnitzer, János: Regional Spread of Computer Technology in Hungary. Pécs: Centre for Regional Studies, 1990. 22 p. Discussion Papers, No. 10.

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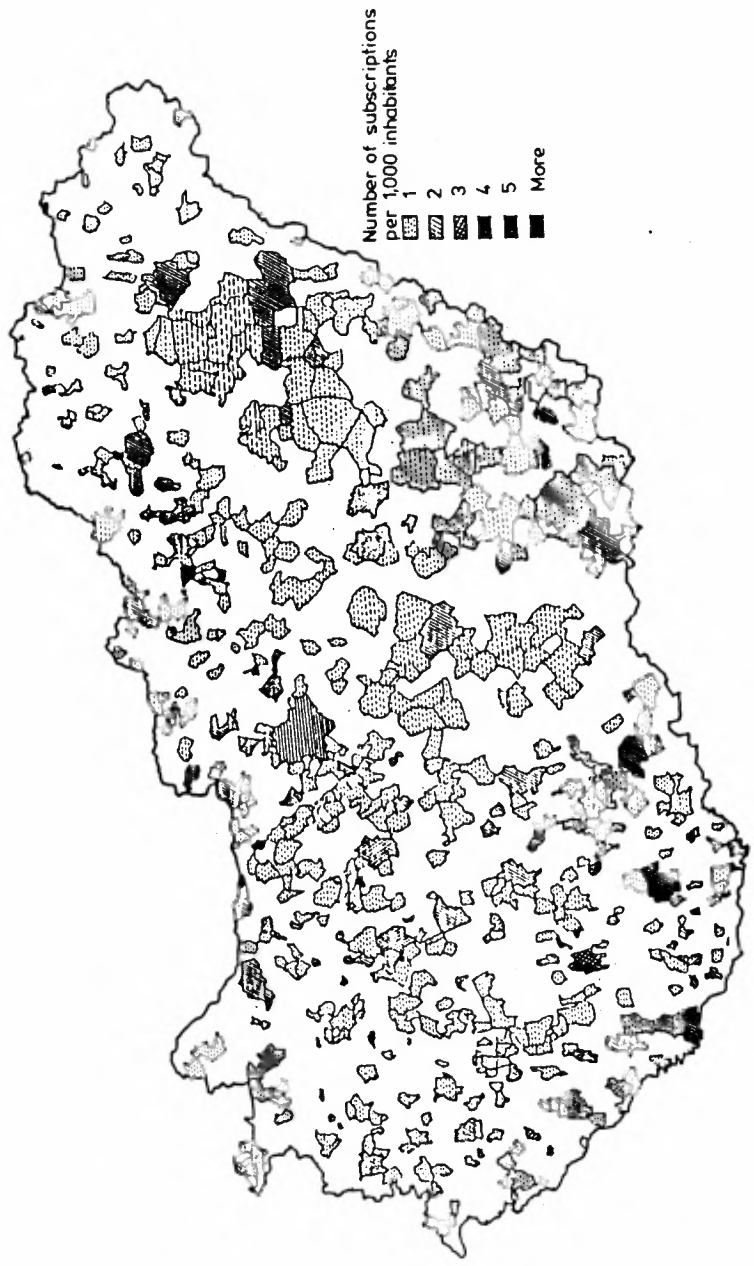

Figure 4

Number of subscriptions to computer technology journals in 1987

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