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## Revaluating regional influences of ICT factors in Hungary

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# Revaluating regional influences of ICT factors in Hungary

Paper for the 45<sup>th</sup> European Congress of the Regional Science Association  
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## **Abstract**

At the beginning of the 21st century ICT factors got growing importance in shaping regional differences in Hungary. Determining differences of ICT competitiveness became needful in analysing regional inequalities recently, however, according to some opinions there are ICT-like factors on the scene for longer time.

Depending on theories and interpretations these factors are treated mainly as new although sometimes as traditional ones. In accordance with the generally accepted approaches ICT factors began to demonstrate their effects in the last decades. Other (wider) approaches on the contrary state that the most characteristic elements of ICT presented themselves earlier in determining regional differences that have been supplemented only with features of modern communication infrastructure.

The paper focuses on measuring the spatial differentiating influence of ICT factors within Hungary. It is presented what spatial pattern can be connected to ICT factors in determining the level of regional competitiveness and development. In connection with the results the rank of regions could be revaluated in the socio-economic competition of the new century.

## **Keywords:**

ICT factors, regional inequalities, Hungary, information society

## **INTRODUCTION**

It is obvious at the first sight that the topic of information society and economy belong to the new elements of spatial analyses. At the beginning of the 21<sup>st</sup> century in order to catch the new processes affecting spatial structure of the economy the emergent new social and economic phenomena of information and communication development should be definitely evaluated. Similarly, the consideration of this factor is already crucial at developing regional competition strategies as well, so thus we should be aware of the influencing processes, the elements affecting the level of information society development as well as the previously mentioned factor's effects on regional competitiveness. This subject, however, in function of the diversified approaches of literature can be characterised by different sets of influencing elements, which in many aspects can not be named always as new ones.

Numerous definitions and approaches are having command of the literature in the background of the phase "information society". Without considering any of these approaches as only acceptable or even rejectable, by deeper cognition of them it becomes clear that there isn't any sole, comprehensive contented indicator to be assigned to information society. Depending on what interpretation our examination is based on, different spatial characteristics and naturally diverting explanatory factors are experienced.

This paper places the features and the describing factors of different interpretations in the focus. Even though the subject of information society figures among the *new* topics of examinations, several influencing factors can be found, which belong among the elements of spatial explorations already from of *old*. The novelty of information society can be understood as an aggregation of certain formerly unknown factors and some already known ones but with altering notability. These all can be supplemented with factors having the same effect in the past and today. On the whole in virtue of these the spatial structure of information society can be characterised with stable and altering (new) features.

## **DIFFERENT APPROACHES – THE INTERPRETATIONS OF THE INFORMATION SOCIETY AND ECONOMY**

As a general rule while looking for the prehensile of this complex category, in relation with the definition of information society the phases of telecommunication, informatics, computation and knowledge are turning up the most. Depending on which of these and other

connecting wide range of notions are actually used, the *wider* or *narrower* definition of information society can be designed (*Table 1.*).

*Table 1.: Different interpretations of information society*

	<b>The name of the approach</b>	<b>The content of the approach</b>
Broadest 	Postmodern, postfordian phase of social development (Nowotny, H. 1994)	The phase of social development after the fordian, modern or industrial stage. Era-like approach.
	Knowledge society (Nyíri, K. 2000, Varga, Cs. 1998)	A desirable alternative for information society. Complex socio-economic system that's basic entity is knowledge on a higher quality level than pure information.
	Information society (Fodor, I. 2000)	New socio-economic inducement, category and value order that is combined with information technologies.
	Information communication technologies (ICT)	Technology-based social development, in which main role is played by informatics and telecommunication. New activities and expectations are connected to the processes.
	Narrowest	Infrastructure-centred approach (Erdősi, F. 1998)

One of the most accurate definition was written by Fodor (2000), whose approach is applied, cited and considered to be plausible by the majority of those dealing with this topic. “Primarily as a consequence of the rapid development and convergence of information and communication technologies, by the globalisation of the connecting production-, service- and media-industry, a new form of life, a novel functioning and behaviour evolved in the society. New value orders are coming into existence. This widely diffusing new way of living, attitude, and economy impregnated with information technologies is called information society.” This approach heightens the broad effects and dispersion of the mentioned features,

which obviously denotes that this subject can not be treated just as a partial element. It follows that this opinion is often named as the wide interpretation of information society. It has to be clarified, however, that if this case were followed during examinations, then actually it would be dealt with a subject influencing most elements of the society thus having rather complicated connections that needs – suitably – enormously great amount of information to understand. Certainly it is not possible to escape from the task having such an answer.

Sometimes information society is applied as a synonym for the top modern, evolving or rather future characterising society. It represents itself in parallel with the postfordian and postmodern attributes as a subsequent step after the social development phases of fordism, modernism and industrialism (Nowotny, H. 1994). These theories apply a sort of broader or probably the broadest interpretation of information society that can be in this way rather regarded as an era-like approach.

A newer approach is represented by those, who are substituting information society with the collective noun of information and communication technologies (ICT). According to this point of view there goes rather a technology-based development, in which decisive role is played by telecommunication and informatics (information attainment, storage, transmission, processing and consumption). Compared to former societies the new element is carried out by new technologies, technological instruments and by the connecting activities and expectations. This approach is well typified beside ICT by the widely diffused phase of telematics, which above all means the technological casemaps of information society (means and methods of informatics and telecommunication).

This latter approach signs already that there exists also a narrower approach in connection with information society that can be simply and comprehensively named as the infrastructure-centred approach. According to that information society is a complex of social changes supplementing the ordinary socio-economic development based mostly on technological innovations. In this case we are staying at a phase mainly as a consequent of technical achievements. In the background of social transformations and modern market competitiveness the new and developing instruments of informatics and communication are forming the catalyst role, therefore primarily society can develop itself by learning and disseminating the proper use of these tools. This opinion expounds perhaps slightly utopian the significance of infrastructural tools, on the other hand, however, the one named as information society is described clearly and only by obviously tangible new elements.

Among different definitions it should not be forgotten of those not using the phase of information society in itself, just as an important component in a greater system, the so-called

information and knowledge society. Knowledge, namely the cognitive information understood from cause and effect relations means therefore the main category of the approach. The relation between information society and knowledge society is graphically interpreted by Nyíri (2000): “Information and knowledge mean not the same: knowledge is the information perceived in its contexts. Information society is the more prevalent one, but knowledge society is the more favoured formula.”

It stands to reason that the professional literature treats the phases of information- and knowledge society as relative but not similar notions. Knowledge society carries wider meaning than information society that is reflected well in differences between the basic entities of the two concepts. Starting from data towards knowledge some kind of logical chain can be constructed, where data, as a basic unit does not contain any new, unknown thing, does not qualify or evaluate, the information on the contrary means processed data that gives new cognitions for us, finally knowledge can be realised already as cognitive information originated from the understanding, generalising and abstracting of the cause and effect relations of a phenomenon eventuated in the external environment (Masuda, Y. 1988).

Some concepts mention knowledge society as a desirable alternative for information society. Its basic elements are notions like knowledge-based economy, information society, telework, information technology, information access, knowledge-parliament, knowledge-state, knowledge-democracy, knowledge-education, knowledge-communication, distant education, knowledge-region, knowledge-city, knowledge-family, knowledge-citizen, quality of life (Varga, Cs. 1988).

Just as at the case of information society several concepts are to be found at the definition of information economy (*Table 2.*). Taking the difference of society and economy as basic, next to the information society's above-mentioned approaches the explanations projected on economy can be found as well. The definitions developed in this way, however, cover not the whole range of the existing explanations of information economy.

The information sector was practically organised in order to supply the information necessity of the economy and the society by managing, transforming, producing, processing and distributing information and furthermore by containing the activities, professions and establishments that are creating the technological conditions of all that (Varga, L. 1986).

According to the wider interpretation of information economy it can be explained as the information claimant, consumer and producer part of the economic activities. Eventually there can be defined at all forms of activities and occupations a fraction that needs a certain level of information to be managed. On the grounds of that by the arrangement of activities the scope

of information-intensive and not information-user branches can be separated. Thinking further this concept it is possible to get to a narrower interpretation of information economy.

*Table 2.: Different interpretations of information economy*

<b>The name of the approach</b>	<b>The content of the approach</b>
Broad interpretation of information economy (Varga L. 1986)	Compliance of information necessity of the economy and society by managing, transforming, producing, processing and distributing information and by creating their background conditions.
Classical interpretation of information economy	Sectors of information services and production of information instruments.
Narrow interpretation of information economy (HCSO 2001)	Activities and services in relation with ICT sector, as well as the branches connected to content providing.

The identification of information society with the sectors of information services and information instrument production can be considered as the “classical approach”. This interpretation excludes the “internal used” information of other activities, on the other hand practically includes the whole industry of manufacturing ICT materials within the physical completion of the products. It is also much more practical that not the whole set of services is included. The so-called information services do not contain the industries those of not increasing the information supply and the level of knowledge of the consumer.

As a result of the evolving new forms of activities in the ‘90s the definition of information economy narrowed further, to be more exact some new opinions came to the light. Accordingly the newest activities of informatics (telecommunication, network informatics etc.) and the connecting other services, primarily the economic branches twitting to content services (e-commerce, internet activities, media industry) are meant by information economy. Ever more important weight is represented by the activities processing and producing metainformation, namely by the ones providing information on information.

According to the widely accepted opinion of the Hungarian Central Statistical Office (HCSO) information society (IS) is an aggregation of information economy (IE) and its social and economic effects (S+E).

$$IS = IE + (S+E) \text{ effects}$$

The most important subsystem of information society is information economy. The common feature of the different explanations is that information society has the subsystem, which was affected by the multitudinous production, distribution, aggregation and consumption of the new products and services, namely informational goods, which were came into existence as a result of growth and convergence (HCSO, 2001).

Information economy contains on the one hand enterprises, which give services and produce goods that belong to the set of information and communication technologies (ICT). On the other hand it consists of activities and enterprises, which give services and electronically visualised informational content with the aid of the above mentioned products and services. This second part can be named as content sector (C).

$$IE = ICT + C$$

Regarding the two subsystems there exists an internationally accepted definition only for the ICT sector, nevertheless definition of the content sector is still under reconciliation. In today's development phase of explaining content sector the branches are counted here that are characterised by authorial-publisher activities as main profession and producing communicational goods as primer outcome. Basic components of communicational products are authorial inputs (the contents) and the ICT sector's transmitting tools (medium) that helps to get content to the users.

The relationship between content and ICT is rather close, namely products and services of the latter one make up the infrastructural ground that content sector should be built on. ICT sector ensures the products on which production, preparation, transmission and visualisation of information is happening, as well as components, which serve primarily the above mentioned activities, and also services, which make possible with electronic instruments the operation of information-processing and communication. This explanation is an activity-based definition at present; the product-based international definition of the future is standing still before acceptance.

The branches (main activities, professions) got into the definition of ICT sector are tending to turn out products that comply with at least one of the following criteria:

1. in case of manufacturing activity:

- the primer function of the product is information-processing and communication, including information-flow and visualisation
- the primer function of the product is the detection and/or measurement and/or registration and/or monitoring of physical processes by electronic data procession

2. in case of services:

- the service come to fruition through electronic materials
- the aim of the service is to provide information-processing and communicating abilities for the customer.

## **SET OF INDICATORS AND SPATIAL ANALYSING METHODS ASSIGNED TO DIFFERENT INTERPRETATIONS**

It is generally known that there aren't any simple (one dimensional) indicator, which information society may have as its own one. There were, however, several experiments about defining or disseminating such indicators, but not any could acquire a reputation like GDP and none of them achieved a total professional consensus. In the background naturally the varied approaches of notions should be found again, as well as the inner diversity of applied components.

Measuring information society and economy has several opportunities (Jakobi, Á. 2002), of them all (the majority) operates with sets of indicators, namely with lots of factors for description. Several examples can be found (Johoka, H. 2000; Ramachandran, R. 1999; Nagy, G. 2002; Rechnitzer, J. et al 2003) that are using partially different or similar factors while try to explore topics based on slightly variant approaches.

Heading from narrower towards broader interpretations the easiest tangible and most concrete variation is the one that measures differences of competitiveness in information society only with the assistance of infrastructural factors, representing the new processes just as a kind of instrumental alteration. According to this the infrastructural supply of informatics, information transmission and communication should be taken into consideration.

The definite majority of the here-applied factors are referring to the new materials originated as achievements of modern technological development, therefore can be beyond doubt regarded as novel factors among influencing elements of regional inequalities. Within

this group for example the *modern communication instruments* (cellular phones, computer networks) and *certain closely connecting services* (Internet, digital services) can be mentioned. A significant part of infrastructure factors is not completely new of kind (neither regarding the role played in shaping regional inequalities). A great proportion of them can be already regarded as not new innovations any more (e.g. telephone, cable-television etc.), their role and influence, however, is continuously changing, transforming. These long performing forms of communication channels are traditional elements of the infrastructure in physical sense, but having transformed characteristics from the view-point of information society and regional differences.

Beyond physical elements of information-communication technologies as information society researches are going towards wider interpretations more and more factors are included that reflect direct influences of infrastructural elements. At this level are appearing the *new forms of activities, services and social expectations* connecting to the new instruments and technologies (e-commerce, network services, e-government) obviously as forms of new and not traditional or transforming factors.

Expanding broader the interpretations of information society ever more social-like component should be involved aside infrastructural and technological factors. If we consider the topic as a new value order, a socio-economic driving force, then also the elements indicating *ICT preparedness of the society and economy* (qualification, R+D, ICT employment etc.) had to be mentioned. The in this phase involved factors are rather various considering their novelty. A part of them – since connecting directly to modern infrastructure – can be mentioned as new, a significant proportion of them, however, belongs to the group of from of old measured factors, although here with definitely altered role and as an indicator of one information society feature.

In the broadest approach of knowledge society already the social factors constitute the majority. This wider interpretation takes also complex social effects and long-term processes of new waves into consideration, so that regarding its indicators it has lots of long-term elements as well. Here belong the indirect indicators of the *social inclination of accepting new phenomena*, as well as the elements of *knowledge-production, knowledge-improvement and knowledge-efficiency* (skills, learning abilities, innovativeness), and also the widely read factors of *social infrastructure* (liberty of the press, graduating ratio etc.). These kinds of factors are typically altering ones regarding spatial inequalities, on the other hand traditional ones, being always important participants in shaping regional differences.

## **STABLE AND ALTERING FEATURES OF THE SPATIAL STRUCTURE**

The formerly introduced conceptual statements were empirically tested as well. In the following the hypothesis is tried to be tested that going from narrower interpretations of information society and economy towards broader concepts the connecting regional pattern and spatial structure would substantially alter.

The examinations were practical to be done on the level of Hungarian counties, since this was the most responsible concerning data attendance. On higher regional level it is possible only to draw much general spatial inferences, lower (small region or settlement) levels are unfavourable due to their problems with data specification. Results are presented for 19 counties excluding Budapest, since the capital city's data would significantly distort general tendencies (as the control experiments confirmed).

Same as most spatial researches about information society development, recent survey operates also with creating, aggregating and analysing sets of indicators or groups of factors. With the aggregation of factors ordered next to different interpretations of information society a complex indicator was created, from which the picture of the given interpretation's spatial structure could be outlined. At creation of the complex indicator the Bennett's well-known method (Bennett, M. K. 1954) was applied (data for 2001 and 2002 were used in the examinations)(see also Jakobi, Á. 2003).

At first the indicators of the narrowest interpretation of information society were taken. This approach takes only the novel or revaluated factors of information and telecommunication infrastructure into consideration, thus building up the set of indicators – in a certain sense – was not so hard. The spatially disaggregated review of infrastructural factors, however, still stands far from ideal, therefore many compromises were made at setting up the database. The set of indicators applied in the first examination was as follows:

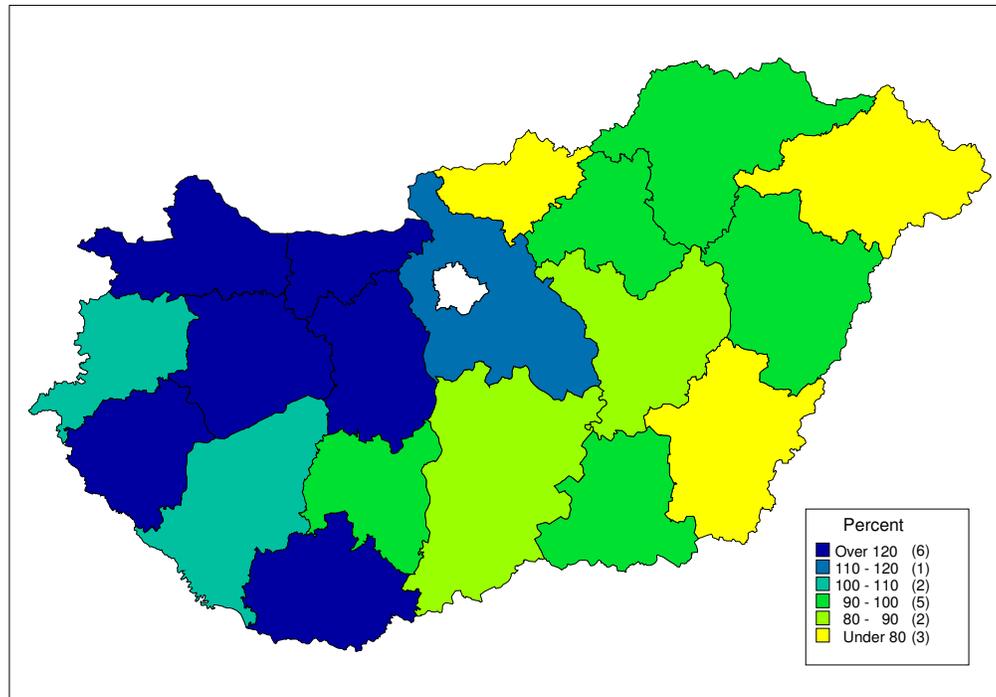
- Telephone main lines per 1000 inhabitants
- Share of ISDN lines in the total number of telephone main lines
- Share of dwellings with cable TV access per 1000 dwellings
- Mobile phones per 100 households
- PCs per 100 households
- Share of Domain Name Servers per 1000 inhabitants

Among the indicators traditional (telephone), transforming (cable TV) and new (domain name servers etc.) elements of information infrastructure can be found as well that on the whole are catching after all a new phenomenon and notion: the trans- and revaluation of

information infrastructure. By contracting the indicators of telecommunication and computing infrastructure an indicator was created, which was serving the description of the narrowest interpreted information society competitiveness.

*Figure 1.*

***The level of information society development in Hungary according to the infrastructure-centred approach (avg.=100%)***



The map created on the basis of the first results (*Figure 1.*) features an unambiguous spatial structure. The picture, which was evolved as a result of the joint effects of the six indicators, shows a characteristic west-eastern split. The eastern and north-eastern part of the country indicated uniformly below average results.

The here outlined picture of spatial structure can be regarded as a *stable* base, which, however, is changing by the increasing indicator set of the ever broader approaches of information society, but have always a significant role in shaping final spatial structure. In other words since the basic factors of infrastructure get room in indicator sets of all wider interpretations, the features of telecommunication and computing infrastructure in the spatial structure can be found with significant influencing role also at broader variations.

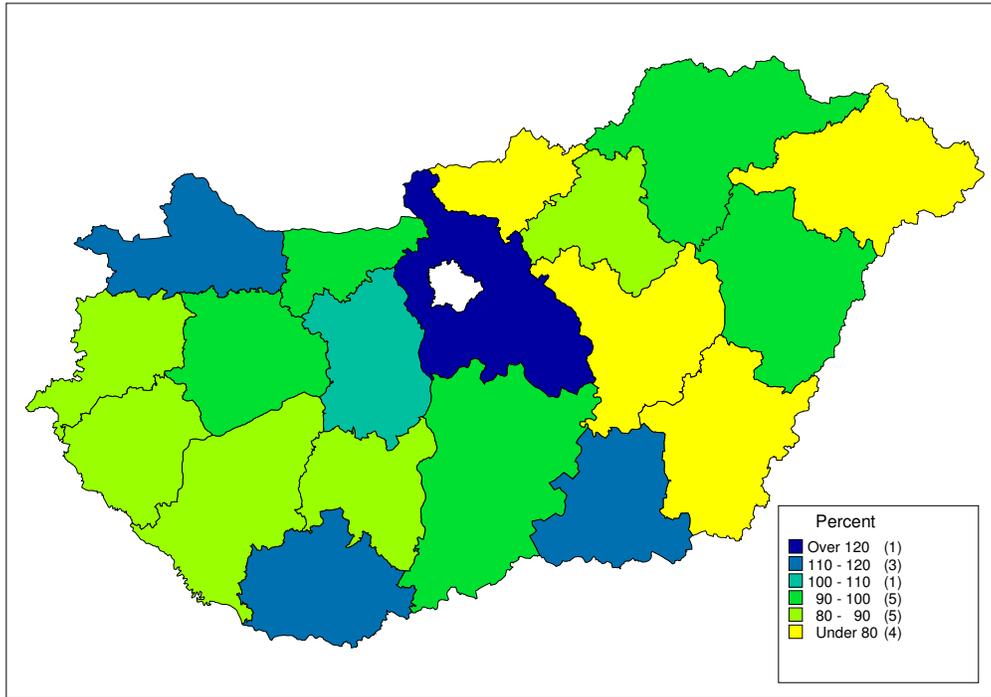
Resuming the examinations, in the next step factors for a bit wider interpretations were collected. In this phase new services and revaluated activities as outcomes of infrastructure changes were taken into consideration, as well as the ICT preparedness of the society and economy. The newly included variables were examined firstly on their own, namely without previously applied infrastructural factors, after that in accordance with the wider interpretation of information society both groups of factors were used together. An examination was prepared that shows spatial structure of the segment of new ICT services and revaluated activities, and an other that reflects spatial structure of the expanded information society. The following indicators were included in this round of examinations:

- Number of Internet Service Providers per 1000 inhabitants
- Share of enterprises in informatics in the total number of enterprises
- Number of firms in ICT in percent of the average of the counties
- Number of firms in media-economy in percent of the average of the counties
- Number of domain registrations per 1000 inhabitants
- Share of persons employed in information-intensive services in the total number of employees
- Share of white-collar workers in percent of the total number of persons employed

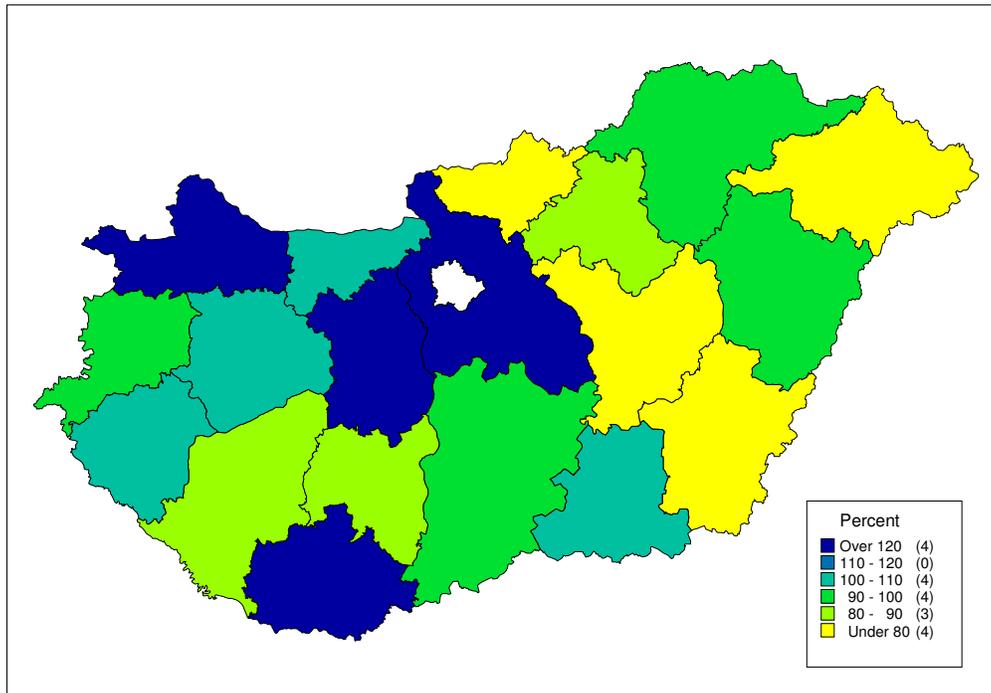
The primarily outlined map (*Figure 2.*) was prepared basing on the complex indicator calculated as an aggregation of the above mentioned 7 variables. The spatial structure of the aggregated indicators of revaluating new services and activities is already more mosaic-like than found at *Figure 1.* Pest county around the capital region seems to be in extraordinary state in this segment and also counties with major towns (e.g. Baranya, Győr-Moson-Sopron, Csongrád) performed well. The existence of greater cities determinates, however, the outcome not (e.g. Hajdú-Bihar, Borsod-Abaúj-Zemplén), neither the eastern or western position of the counties.

*Figure 3.*, which is showing the spatial structure of wider interpretation of information society, is turning up as the summation of *Figure 1.* and *2.* This figure covers both infrastructural elements and the factors of the revaluated services and activities. Inherited from the two start-up figures both *stable* and *altering* features can be found on this map. According to this approach principally the western half of the country has better results, but more was developed in relative position of regions, where *Figure 2.* resulted good outcomes (mainly in Pest county).

*Figure 2.: Spatial structure of the aggregated indicators of the revaluated new services and activities in Hungary (avg.=100%)*



*Figure 3.: The level of information society development in Hungary according to its wide interpretations (avg.=100%)*



The third and within the last examination widened further the interpretation of information society and with that also the set of descriptor indicators. Components of knowledge society formed the newly included elements of this analysis, with factors, which – according to numerous other (so-called traditional) examinations – are appearing among regional researcher’s collection of indicators already for long. In this phase of examination three new factors were applied that can be indirect indicators of knowledge-productivity and knowledge-improvement (see Ramachandran, R. 1998). The involved indicators were these:

- Ratio of high-qualified to low qualified workforce
- Share of regular students of higher education (universities and colleges) by residence of parents in the total population
- Share of tertiary graduated persons in the age-group of 25 or older persons

As in previous case two experiments were made here, too. Primarily the segment of knowledge society indicators were analysed on their own, then together with the formerly introduced factors the spatial structure of compound information and knowledge society was outlined in a complex calculation. Due to methodological reasons – whereas the number of the examined variables can be half so great as the number of the units observed – this latter examination did not include all formerly mentioned variables, but only a narrower, representative circle of indicators featuring the most important ones from all segments. The complex examination applied the following indicators:

- Share of ISDN lines in the total number of telephone main lines
- PCs per 100 households
- Share of Domain Name Servers per 1000 inhabitants
- Number of firms in ICT in percent of the average of the counties
- Number of domain registrations per 1000 inhabitants
- Share of white-collar workers in percent of the total number of persons employed
- Share of regular students of higher education (universities and colleges) by residence of parents in the total population
- Share of tertiary graduated persons in the age-group of 25 or older

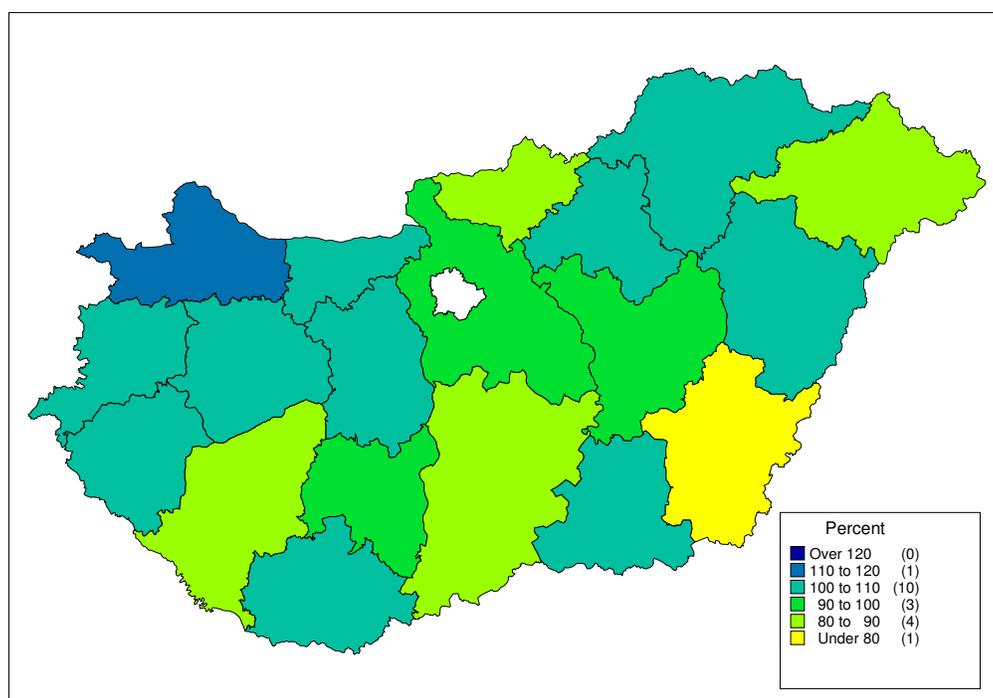
The separate space of the segment of knowledge society is to be seen on *Figure 4*. Standard deviation of the results proved to be the smallest in this segment, thus the regions’ average-like character is not surprising. The results of the highest Győr-Moson-Sopron (112%) and the lowest Békés county (79%) show relatively small differences.

The in itself comparatively homogenous spatial structure of knowledge factors suggests relative spatial uniformity in this segment. But if we applied these factors together with

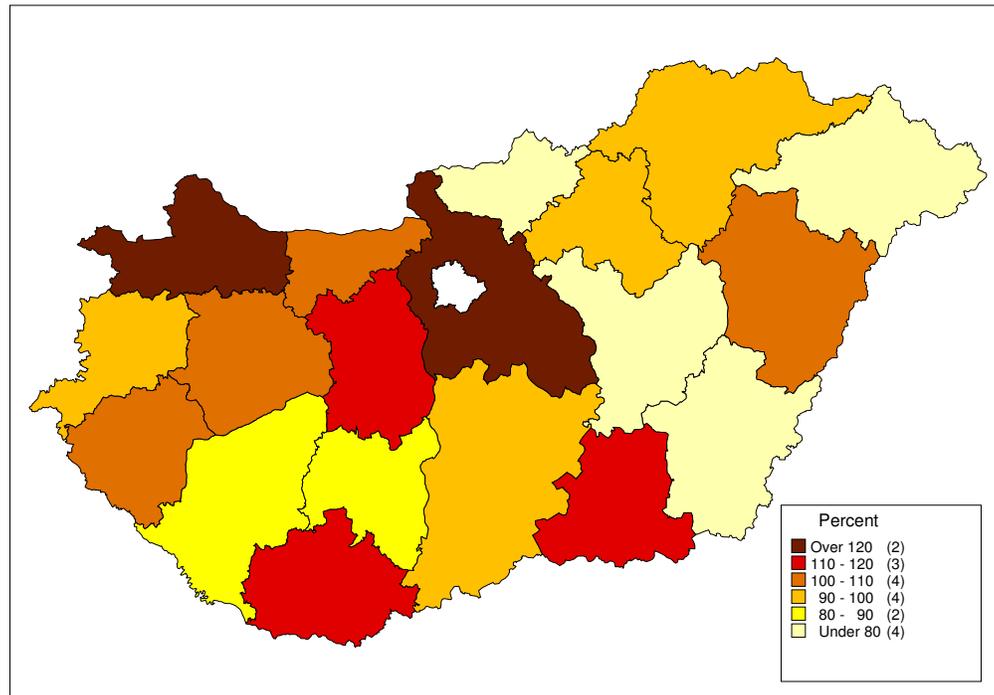
previous ones, namely by summing results of *Figure 1.*, *Figure 2.* and *Figure 4.* (with small alterations since the set of indicators was reduced), then the broadest explained spatial picture of information and knowledge society would result in the outcome (*Figure 5.*).

According to the broadest or widest approach Pest country (179%) can be considered as the best standing region in the competition of information and knowledge society, with Győr-Moson-Sopron county at second place (130%). Generally speaking good results evolved also in Fejér county and in counties with cities of regional centre functions (Baranya, Csongrád). In the competition of counties Tolna and Somogy in the western part, Jász-Nagykun-Szolnok, Nógrád, Békés and Szabolcs-Szatmár-Bereg in the eastern part of the country seem to be lagged behind.

*Figure 4.: Spatial structure of the complex indicator of knowledge variables in Hungary (avg.=100%)*



*Figure 5.: Level of information society development in Hungary according to the broadest knowledge society approach (avg.=100%)*



## CONCLUSIONS

The demonstrated examinations proved that information society researches operating with ever broader sets of indicators are determining the expected outcome already at the selection of basic factors. Heading from narrower towards broader interpretations and sets of indicators new and subsequent features of spatial structure are complementing the picture. In contempt of the flaring frames of the examination some stable spatial element is still to be discovered, such as the prosperity of the northwestern part of the country and Pest, or the favourable position of some counties with major cities.

Though it was not dealt with applied factors in details, still a definite opinion can be formed regarding spatial patterns of different decisive segments of information society. The infrastructure of informatics and telecommunication shows a characteristic west-eastern difference, the spatial structure of the revaluated services and activities is rather mosaic-like with the advantage of major town regions, while in components of knowledge society the equality of counties is to be seen. Combining and putting up the segments on each other can finally design the spatial structure of the broadest interpretation of information society.

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