INFORMATION SOCIETY DEVELOPMENT LEVEL IN CARPATHIAN REGIONS

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Abstract

Introduction

Recently Information Society is one of the paradigms (tenets) of civilization development. It is synthetically defined by two features, and namely: (i) the general access to interesting the totality of population information as well as information satisfying interests of the different citizens' and residents' groups; this situation can be described as commonly well informed society; (ii) defined level of development and the spread of the ICT infrastructure, which in practice makes possible to treat them as general tools, the methods of work and the part of economic, technical, educational, cultural and different activity, both by individuals and mass.

Objectives

The aims of the project were the analysis of the development level of Information Society (IS) on Carpathian area in Europe as well as the study of coefficients characterizing the state of Information Society development and its dynamics. On the basis of analysis of definition the concept of Information Society there has been chosen the elements, which were recognized as the most essential factors influencing on development the IS. It has been assumed, that one of the most important factors of development the IS is the wide understood of accessibility to net.

The following hypothesis was formulated: modified (between others hierarchical, taking into account e.g. demographic profiles) spatial coefficient of population potential is the

suitable measure of network accessibility and permits to infer about the level of IS development.

Methodology

The hypothesis has been verified on basis of gathered data for NUTS-3 spatial units. The Digital Access Index has been construed, based on partial coefficients. They are standard, widespread with regard on mathematical construction, chosen on basis of literature and fit to the scale of research. Next the correlation coefficients with population potential has been calculated. The Factor Analysis has been applied to recover the latent, hidden determinants of IS on the research area.

Results

The study consists with two thematic parts. First of them concerns information society, where definitions and the process of IS forming have been talked over. Furthermore the utilization of ICT in Carpathian regions has been presented. The second part contains the discussion of the Digital Access Index and the presentation of the correlations with population potential within the NUTS-3 regions for the studied area.

Conclusions

Disparities between the regions exist. The regions of the states joining EU (Poland, Slovakia, Czech Republic, Hungary and Romania) were generally behind but some are catching up but there is evidence that their intensity of use is high. The regions of the states which are out of EU (Ukraine, Serbia) are also growing but slowly.

All regions are confronted with the challenge of extending the information society to people with little or no formal education, those not in employment and older people. These divides are less acute in countries which are more advanced in the adoption of ICT and in some new member states of EU. However, there is no sign that they reduce over time and an inclusive information society will not be achieved without policy support.

The paper present the most valuable part of the report of the research made for Institute for Spatial and Cadastral Systems, Gliwice, Poland within the framework of INTERREG III B CADSES CARPATHIAN PROJECT (with the agreement of ISCS).

Introduction

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Recently Information Society is one of the paradigms (tenets) of civilization development. It is synthetically defined by two features, and namely: (i) the general access to interesting the totality of population information as well as information satisfying interests of the different citizens' and residents' groups; this situation can be described as commonly well informed society; (ii) defined level of development and the spread of the ICT infrastructure, which in practice makes possible to treat them as general tools, the methods of work and the part of economic, technical, educational, cultural and different activity, both by individuals and mass.

Information society - the plurality and the multi-aspects of definitions

ICTs are recently among the most important and most dynamically-developing elements to the material base of the economy as a whole also on different geographical scales. The development of economy and the R&D sector depend recently (among others) on possibilities of use and link of two sectors: telecommunication and computer technologies. The information society use the listed above technologies for (i) breaking the friction of distance among the people, (ii) widening the perception of people, (iii) supplying the possibility of data transformation and (iv) stimulating the intellectual abilities of people(Jonscher, 2001). The changes just observed has been already foreseen by many explorers (Hall, 1998, Thurow, 1999, Rifkin, 2001, Castells, 2003). Present social and economic changes are related to the waves of industrial development, recognized and described initially by Kondratiev, Schumpeter and Mensch which as manageable point showed year 1989. (Hall, 1998).

Measures of Information Society

Assessment of accessibility to ICT services may be an exponent of the level of development of the information society, since it also contains an evaluation of cultural space. A necessary condition regarding accessibility to services is a defined state of the telecommunications network infrastructure. A sufficient condition is in turn people's

capacity to use the network and social acceptance of technological innovations. The supply of ICT services exists on the one hand, the recipient or user on the other, and it is on the latter's knowledge or level of development that the use of the accessible telecoms instrumentation will be dependent.

There are several indicators measuring ICT development. Most of them are the combination of different perspectives on social and economic development (including physical capacity, infrastructure, access, policy environment, usage, human capital) but all of them are post factum and they are based on averaged partial indices from different sectors. Among them there are Digital Access Index (DAI), Networked readiness, E-readiness, ICT development, ICT capability(UN, 2005). They are rather static and strongly localized, it means, that they are comprised of data collected from given spatial unit (usually at the state level) and compared to others. Some partial indices are very difficult to estimate and compared for the lower level of hierarchy of spatial units because of lack of data (e.g. NUTS 3,4,5).

The aim of this research study concerns the hypothesis that the spatial development ICT networks in Carpathian regions can be described as the development of digital network through the hierarchical spatial diffusion process and there are some specific factors influencing the above process coming from the other sectors of economy like for example tourism. On the other side there are specific conditions which rise from the environment, after all the fact that the core of the whole area are Carpathians Mountains. Next it must be stressed that the significant role plays the international frontiers zones between the countries.

The area of Carpathian region involves the parts following countries: Austria (AT), Czech Republic (CZ), Hungary (HU), Poland (PL), Romania (RO), Slovakia (SK), Ukraine (UA) and the Republic of Serbia (RS). Six of these states belongs to European Union (AT, CZ, HU, PL, SK, RO).

In 2003, the Market, Economics and Finance Unit of ITU[1] launched the Digital Access Index (DAI), the index which measures the overall ability of individuals in a country to access and use new ICTs. The DAI is built around four fundamental vectors that impact a country's ability to access ICTs: infrastructure, affordability, knowledge and quality and actual usage of ICTs. The Digital Access Index is calculated as the average of the set of variables, which are comparable, because each one is re-calculated to the range of <0;1>. The following variables have been taken and treated as the elements of the complex measure of the information society development level in the regions of Carpathian countries:

- Infrastructure (main fixed telephony lines per 100 inhabitants, subscriptions to cellular mobile services per 100 inhabitants)
- Quality (broadband penetration - subscribers per 100 inhabitants)

[1] International Telecommunication Union

- Usage (level of overall Internet access - %)
- Knowledge (tertiary school enrolment estimated as the ratio of the proportion of students - ISCED 5-6 over the proportion of the population)
- Affordability (GDP per capita)

Population Potential as the measure of accessibility

The proposed parallel measure of population potential is defined also as the accessibility measure according to the terms used in spatial interaction models. It describes the attraction of regions for network providers because of economies of the scale. The attraction of spatial concentrations of people give providers possibility to gain the more number of users in shorter time. It seems the widely used statistical measures of information society can be replaced with the measures of population potential in the case of lack of statistical data, especially at the lower level spatial units (e.g. NUTS 3,4,5).

Population potential is the measure of nearness or accessibility of a given mass of people to a point. The term is derived from social physics and the concept is closely related to that of the gravity model in that it relates mass (population) to distance but whereas the gravity model deals with the separate relationships between pairs of points, population potential encompasses the influence of all other points on a particular one (Johnston, 1985).

The new idea to use population potential as the measure of accessibility involves the Zipf's rule concerning the order and the magnitude of cities extended to the greater spatial units. The trial involves primarily the construction of the spatial population models at the NUTS level in the Carpathian regions. They are the following (Werner & Kozubek, 2008): classic - including only the friction of distance and the number of people (described with acronym VD) and modified (VDH, VDHF, VHF) including additionally the hierarchy of regions and the classes of height above the sea level in different combinations

Estimated total number of people in the Carpathian regions carries out 54,8 millions (in 2005). The most of them calculate Romania, Poland and Hungary. The predominant number of population lives in cities outside the mountains and along the border of the region.

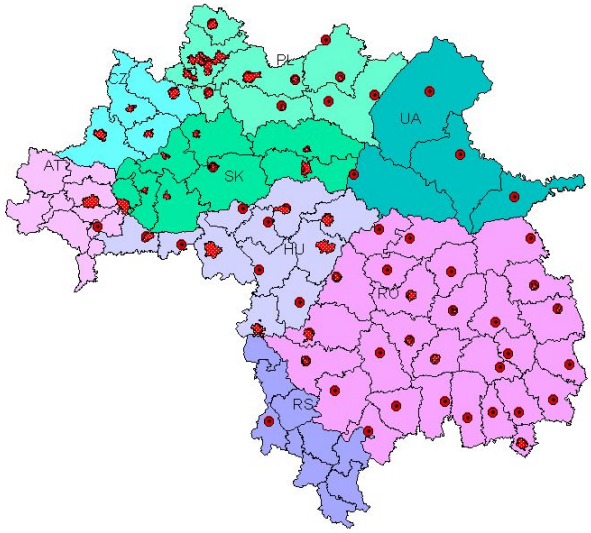

Fig. 1. Countries, urbanized areas and major cities in Carpathian region

Infrastructure of ICT in the states of Carpathian regions

The national networks are connected through the international links within the continental backbone networks (after all Terena project including Geant, Geant2) through the fiber optic links. The core of the Internet backbone is the Fiber Optic network. It is divided into the NRENs – National Research and Education Networks. There is no direct relation between the neighborhood of the states in the Carpathian region and the interconnections of NRENs Most of them are interconnected through the PanEuropean GEANT network.

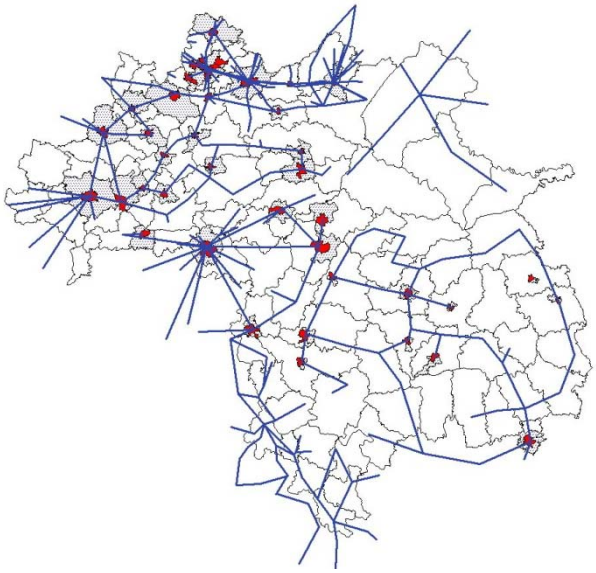

Fig. 2. Internet backbone in Carpathian states, 2007

The whole Carpathian region is in the range of cellular networks GSM 900/1800 (2nd generation). The GPRS and EDGE technologies (2.5) are also accessible, however there are regions with only 2nd generation of cellular telephony technology. The coverage of the 3rd generation technology i.e. UMTS are exactly the major urban regions. There are three international operators: T-Mobile, Orange and Vodafone in the Carpathian regions. However more including local and national operators.

FA analysis and geo-visualization

The partial coefficient of DAI for NUTS 3 regions in the Carpathian regions has been estimated, calculated and visualized. The recognition of the above elements: infrastructure, quality of services, usage, affordability and the level of knowledge potential should be made with comparison of the distribution of population. And in fact there is no straight relation between both the density and number of population and, on the other side, the above elements by NUTS 3 regions. There are pairs of the strong relations between: the level of Internet access and mobile cellular telephony (corr. coeff. +0,74), the level of internet access and broadband penetration (corr. coeff. +0,6), the level of internet access and GDP per capita (corr. coeff. +0,6).

For this situation Factor Analysis (FA) was primarily used for data reduction and/or structure detection. The first component of FA can be defined as the accessibility component (which includes usage, infrastructure and affordability elements of Information Society). The second component is correlated with such variables as density, number of population and number of students of higher schools. It includes the element of knowledge and can be termed as human resources component. The last one is only, very highly correlated with the infrastructure variable and can be exactly defined as the existing base of previous ICT generation infrastructure component.

For each NUTS 3 region and each component, the component score is computed by multiplying the case's original variable values by the component's score coefficients. The resulting three component score variables are representative of, and can be used in place of, the eight original variables with only a 25% loss of information.

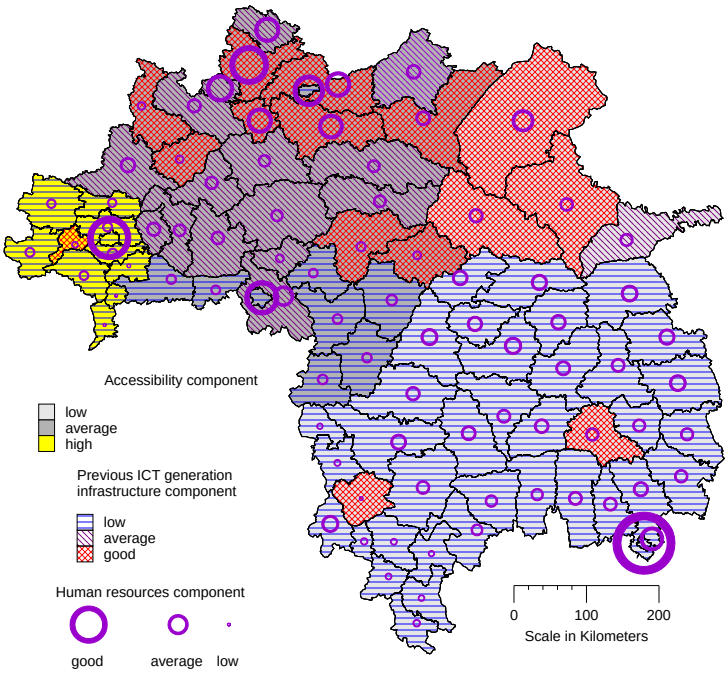

Fig. 3. Resulting three component score variables of PCA: Accessibility Component, Human Resources Component, Previous ICT Generation Infrastructure Components

Digital Access Index by NUTS 3 in Carpathian regions

Overall Digital Access Index has been calculated as the mean of the studied variables representing characteristics of infrastructure, quality, usage, knowledge of society and its affordability.

The map of DAI by 87 NUTS 3 regions of Carpathian countries shows that there are two obvious factors dividing the whole area: borders and relief. There are really the weakest regions (class A), along the main chain of Carpathians on the eastern and northern part of area. They belong to Romania and Ukraine. On the other side, the highest values of DAI characterize the regions in the west within the state frontier and these are only Austrian regions (classes F, G). Slovakia, eastern part of Poland and some central regions of Hungary represent the surroundings of median value (class D). This area is simultaneously the central and western part of Carpathians. The mountain-foot regions surrounding these areas and the west edge of Carpathian Mountains belong to Poland, Czech Republic and Hungary (class E). These areas are the ones of the most urbanized in their countries, but they reach only the one level above mean value of DAI.

There are relatively low values in the east and south part of area. Regions of Serbia and Bucharest (in Romania) characterize the values just below the mean (class C). The rest, inner part of Romania (class B) are the regions just above the lowest class.

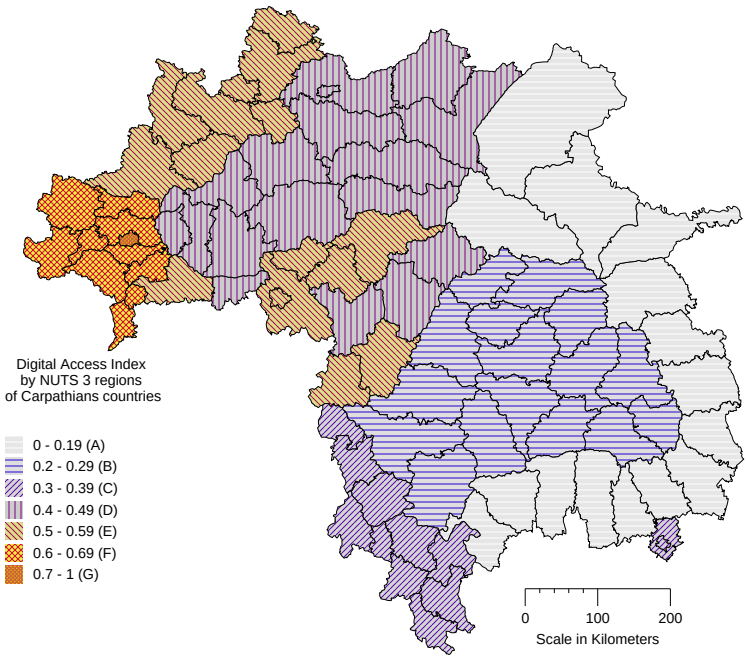

Fig. 4. Digital Access Index (DAI) by NUTS 3 regions of Carpathians countries (2005, see description in text).

It seems that the role of relief should be significant in spatial differences of the information society because affects on the distribution of population. The average height of the NUTS 3 regions over the level of sea (in meters) has been classified into the ranges and implemented as parameter into the equations of the population potential. The number and distribution of population, in turn, should be significant for the spatial differentiation of ICT technologies.

The first set of four (described earlier) models of spatial interactions, population potentials, classic and modified, based only on resident population correlated with the calculated, overall Digital Access Index did not show the positive, significant relations (maximal correlation coefficient +0,4), with one exception – with the knowledge element i.e. ratio of the proportion of students (ISCED 5-6) over the proportion of the population by NUTS 2 and NUTS 1 regions (0,67). The hypothesis of the relation between the population potential and the overall DAI measure in Carpathians has been rejected.

There has been constructed the similar set of models with the assumption that the numerators in the equations represent the sum of the number of resident people and the tourists (for 2005 year) by NUTS 3. All of them gave false results and has been rejected. Taking into account the previous results one can suppose that for the Carpathians regions the areas of the highest development of ICT are simultaneously the most attractive tourist regions. Again the set of models was constructed where the main element (numerator in the equation) was the number of tourists.

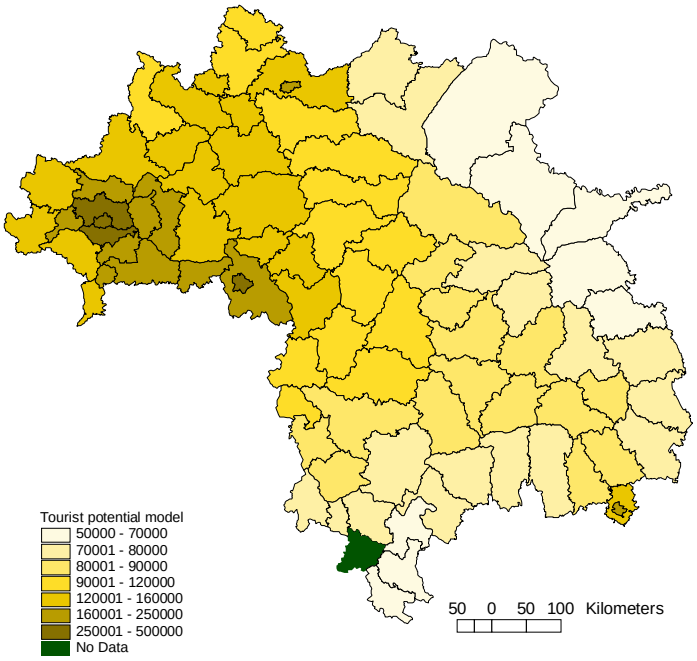

Fig. 5. Tourists potential (model VD) in Carpathians regions (2005)

In fact, only the classic model of population (the number of tourists) potential is relatively highly correlated with Digital Access Index (+0,716). The hypothesis of the relation among the tourist areas and the areas of higher level of development of ICT in Carpathians regions has been partly positively confirmed.

Conclusions

Broadband roll-out is a clear success story. The broadband connections are now available wider. There are, however, important exceptions to this in the sparsely populated regions. Driven by increased competition and lower prices, take-up has increased rapidly with high growth rates. However, most internet connections remained narrowband and few broadband connections in eastern and southern part of region offered more than 3 Mbps.

Disparities between the regions exist. The regions of the states joining EU (Poland, Slovakia, Czech Republic, Hungary and Romania) were generally behind but some are catching up but there is evidence that their intensity of use is high. The regions of the states which are out of EU (Ukraine, Serbia) are also growing but slowly.

Availability of online public services has continued to grow and many services are now available with full interactivity. Use of online public services has grown as availability has increased and a large majority of users report benefits in terms of time saving and more flexible access to administrations.

All regions are confronted with the challenge of extending the information society to people with little or no formal education, those not in employment and older people. These divides are less acute in countries which are more advanced in the adoption of ICT and in some new member states of EU. However, there is no sign that they reduce over time and an inclusive information society will not be achieved without policy support (Information Society Benchmarking Report, 2006).

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