THE MEASUREMENT OF TERRITORIAL DIFFERENCES IN THE INFORMATION SOCIETY[58]

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1. Introduction

The information and the info-communication technologies have got a central role in the socio-economic process of the last 2-3 decades by the permanently developing technology and faster communication opportunities. The social and economic environment has been determined by the growing measure of the information and the technological innovations more and more. The accelerated communication between organizations and individuals has speeded the stream and change of the information (Lengyel I., 2010). The diffusion of information opened new opportunities in the business and economic processes as well as in the social life and communication (for example social media). Information has added to the economic processes and it has become a crucial factor in them. Thus, the so called information society has been become an important research question for scholars of social sciences in the recent decades. Our recent research, which is a part of a broad scientific project at University of Pécs, would like to capture the territorial differences of the information society on the one hand. On the other hand our project attempts to give some suggestions for development policy on the basis of our analysis about the information society. Therefore, the theoretical findings about the information society have been already summarized and an indicator system which may help to determine these differences will be created. The first results of this indicator system are interpreted in this paper.

First of all it should be clarified shortly, what does "information society" exactly means. The definition of the "information society" concept depends largely on the point from where it has been approached. The information society can be approached from infrastructural, technological or social aspect. According Masuda, who was one of the first scholars dealing with this concept, information society is such kind of the society which has been built on the exploitation of information resources and this kind of society replaces progressively the model of industrial and mass-production society. The information society possesses a high-level intellectual creativity as well (Masuda, 1980; Szépvölgyi, 2008). The handling and application of information has been

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stressed by the definition of Farkas (2002). The approach of OECD underlines also that much of the employees deal with handling, production and distribution of information in the information society (OECD, 1996). The infrastructural aspect can be observed for example in the description of the information society by Fodor (2000)[59] or Erdősi (2002). They have emphasized that a new lifestyle, the stream of information have been realized through the technological development and innovations in info-communication technologies.

The wider the phenomenon of information society is used, the more factors should be taken in account. Therefore, the concept of information society will be more and more complex. The infrastructural approach may be the narrowest concept of the information society. Approaches like "knowledge society" or "post-industrialist society" connect more or less to the information society (Jakobi, 2007). The information and knowledge have also a crucial role in them, but there are also other factors, which influence these concepts, so they have broader frames than the information society. The (territorial) inequalities can be also observed in the information society. The networks and the use of technologies play an important role in these processes. The lack of the adequate infrastructure may exclude the underdeveloped territories from the stream of information and knowledge and it may cause big differences between the central and peripheries.

In the next section the frames of the measurement of these inequalities will be shortly summarized in general. A European regional analysis will be highlighted in the third part and a South Transdanubian regional analysis will be outlined in the fourth part. Conclusions and further orientations of our research will be summarized in the closing part of the paper.

2. The measurement of territorial inequalities in the information society

The territorial analyses of the information society are determined by the approach what the scholars use (Jakobi, 2007). Therefore, the approach may determine those factors what are taken into consideration if the information society is analysed. There are factors which would be out-of-date during the last years and others will be taken into consideration. These processes have formed the data and the indicators as well. Some indicators have got more attention, and new data sources have been discovered by the use of smart phones or social media (Jakobi, 2014).

The information society is characterized by many indexes which measures the info-communication technologies, attitudes or infrastructure globally. These indexes have been created by different organizations like the International Telecommunication Union (ITU). There are indexes which indicate the available infrastructure (for example networks, phone lines, tools)

[59] The approach of Fodor (2000) is accepted by most of those Hungarian researchers who deal with socio-economic aspects of information society (Jakobi, 2007).

and the fact where people use this infrastructure (at home, at public places or at workplaces). The so called readiness indexes (like E-readiness index) measure the preparedness of individuals and the society (Vajkai, 2008). There are indicator systems that focus on the digital literacy of individuals as well as the society, if this is seen aggregated. Other indicators measure the attitudes which characterize the use of the ICT tools. One of the most used indexes to measure the information society is the ICT Development Index (IDT). This indicator captures three sub-indexes: the Access sub-index (ICT readiness – infrastructure, access), the Use sub-index (intensity) and the Skills sub-index (ICT capabilities). Thus, the ICT Development index characterizes the dimensions of information society in the countries of the world. The IDT have been computed for 157 countries in the 2013 edition (ITU, 2013).

Several measurements about the information society have been already carried out by Hungarian scholars in the recent years. Nagy and his colleagues have created one of the first expansive researches about the regional performance of information society in Hungary. They analysed statistical data, guidelines, national and regional strategies. The county level dispersion of the domain names have been involved in the analysis as well. (Kanalas–Nagy, 2002). Szépvölgyi (2008) applied some data from Kanalas and Nagy as well as his own surveys and statistical data as he composed an indicator system. The information attributes of Hungarian small regions have been characterized by this indicator system. Jakobi has analysed the national competitiveness of information society and the regional footprint of information society in Hungary. The regional footprint of information society indicates how the infrastructure, the experiences and skills contribute to the development and growth of knowledge-based economy (Jakobi, 2007). A recent analysis about the territorial differences of a Hungarian social network website (iWiW) has created by Lengyel and Jakobi (2013). That paper makes for a good example as the use of new type of data to characterize the territorial differences of the information society.

These researches analyse either general measurement about the performance of information society of Hungarian territories or special processes regarding the use of information society or the attitudes of people. Therefore the applied indicators have depended on the type of the measurement. Our research has focused on the infrastructural approach of the information society, because the parts of infrastructure are measured by statistical data mostly. It means that the infrastructural aspects of households have been analysed and this analysis has been supplemented by data about the use (attitudes) of this infrastructure. We have two goals:

- determining the readiness of Hungarian regions in the information society in European context;

- characterizing how the information society has evolved in Hungary in the last years and what kind of territorial differences can be observed regarding it.

Thus we have been attempt to collect all the statistical indicators on the different subnational levels which measure the different parts of infrastructure (like computers, internet, cable TV, phone lines) and users' attitudes. We have leant on the European statistical databases and on the county level statistical yearbooks of the Hungarian Statistical Office.

3. The regional analysis of the information society in Europe

The analysis of the European regions based on the regional information society indicators of the Eurostat. Five indicators are measured regarding the information society:

- households with access to the Internet at home (% of households);
- households with broadband access (% of households);
- individuals who regularly using the Internet[60] (% of individuals);
- individuals who have never used a computer (% of individuals);
- individuals who ordered goods or services over the Internet for private use[61] (% of individuals).

It can be observed that there are three indicators which indicate the different attitudes of individuals and two indicators which show the Internet infrastructure what the households have. Data have been accessed from the period 2008-2013. We have attempted to measure these indicators in all of the NUTS 2 EU regions, but only NUTS 1 or NUTS 0[62] level data were available in some countries (Table 1).

[60] Regularly using means that one uses the Internet at least once a week.

[61] Who purchased online at least once for private use in the last 12 months.

[62] We have got NUTS 0 level data where the NUTS 2 level involves the whole country.

Table 1: The availability of data in the EU countries

NUTS level	Countries
NUTS 0 (6 countries)	Cyprus, Estonia, Latvia, Lithuania, Luxemburg, Malta
NUTS 1 (7 countries, 45 regions)	Finland, France, Germany, Greece, Poland, Slovenia, United Kingdom[63]
NUTS 2 (15 countries, 129 regions)	Austria, Belgium, Bulgaria, Croatia, Czech Rep., Denmark, Hungary, Ireland, Italy, Netherlands, Portugal, Romania, Slovakia, Spain, Sweden

Source: author's edition

Some regions have been excluded from the analysis due to the lack of data. 180 regions have been included in our analysis on the whole. As it could be observed we have had five regional indicators, but we would like to characterize the information society in these regions by one indicator. This has been nominated as "Regional index of information society".

Firstly, we created by multiplying two main indicators from the five starting variables: "households" (two indicators) and "individuals" (three indicators). It can be seen that among the individual indicators there is one indicator which shows a negative attitude ("who have never used computer"). Thus, we have used the reciprocal of the original value. If a region had high value in this indicator, the value of "individuals" main indicator has been reduced in this way.

After multiplying, the descriptive statistics[64] and correlation coefficients of the original indicators and main indicators have been checked. The correlation coefficients have shown a very strong positive correlation between the indicators. Negative and strong correlation has been indicated in the case of "never used computers". It means that it was good decision to use the reciprocal of the indicator. The main indicators (households and individuals) have shown strong correlation with each other as well. We have paid attention to the skewness of the original indicators and especially the new main indicators (Table 2).

[63] Northern Ireland, the overseas region of France and the African part of Spain should be excluded due to lack of data.

[64] The detailed table can be found in the appendices of the paper.

Table 2: Skewness statistics of the two main indicators

	2008	2009	2010	2011	2012	2013
Households	0,517	0,349	0,094	0,058	0,036	-0,086
Individuals	*1,995*	*2,786*	*1,907*	*1,853*	*1,983*	*2,053*

Source: author's computation and edition

If the skewness of an indicator has fall out of the [-1;1] range, then this indicator should be transformed. We have had one main indicator which was out of this range ("individuals"). To transform this indicator we have used Box-Cox transformation. This method transforms the data of the original indicator normal distribution-like.

$$y_i = \begin{cases} \text{if } \lambda \neq 0, \text{ then } \phi(y_i) = \dfrac{y_i^{\lambda} - 1}{\lambda} \\ \text{if } \lambda = 0, \text{then } \phi(y_i) = \ln(y_i) \end{cases}$$

We have followed the application of the Box-Cox transformation by the EU Regional Competitiveness Index (Annoni – Kozovska, 2010) and the REDI (Regional Entrepreneurship and Development Index) (Szerb et al., 2014). According them $\lambda=2$, if skewness is negative, left-handed ($\kappa < -1$) and $\lambda=(-0,05)$, if skewness is positive, right-handed ($\kappa > 1$). The skewness of "individuals" main indicator has become normal distribution-like after the transformation. The values of "households" and new values of "individuals" have been normalized.

$$z_i = \frac{x_i}{\max(x_i)}$$

The Box-Cox transformation has created some negative values mainly in those cases where the original value of the "individuals" main indicator was too low. It should be paid attention to these cases because a negative value might cause difficulties in the normalization and the aggregation of the main indicators as well. This problem has been solved with the use of a technical minimum values. The original values should be higher than 1 by these cases, because the transformed value would higher than 0. As these technical minimum values have been used, the original rank of the regions has been taken into consideration as well. The maximum value of each indicators have been 1 in every year, and the other values have been counted to the [0;1] scale. Obviously the minimum value haven't been exactly 0, because this opportunity has been excluded with the applying a technical minimum.

After normalization, the aggregated index has been composed which measures the information society in European regions on a scale from 0 to 100. The weighted values of the two main indicators have been used and two versions of this index have been counted. In the first version the "households" main indicator has got a weight 60 and "individuals" 40. It has been decided to apply these weights because households are characterized by only two indicators. In the second

version both of the main indicators have got 50-50 weight. The index has been counted with both weighting, and we have compared the results. Spearman rank correlation coefficient has been used to compare the two versions and it has shown very high level of correlation, so the two rankings are almost the same[65]. Therefore, the first version of the index (60-40 weighting) has been used and analysed. The regions have been ordered in five groups according to the 80th, 60th, 40th and 20th percentiles. Thus, the groups have almost the same number of regions. The best regions ("Outstanding") are in the first group, the worst performing regions have been placed in the last group ("Underdeveloped") (Table 3).

Table 3: The main values of the five groups

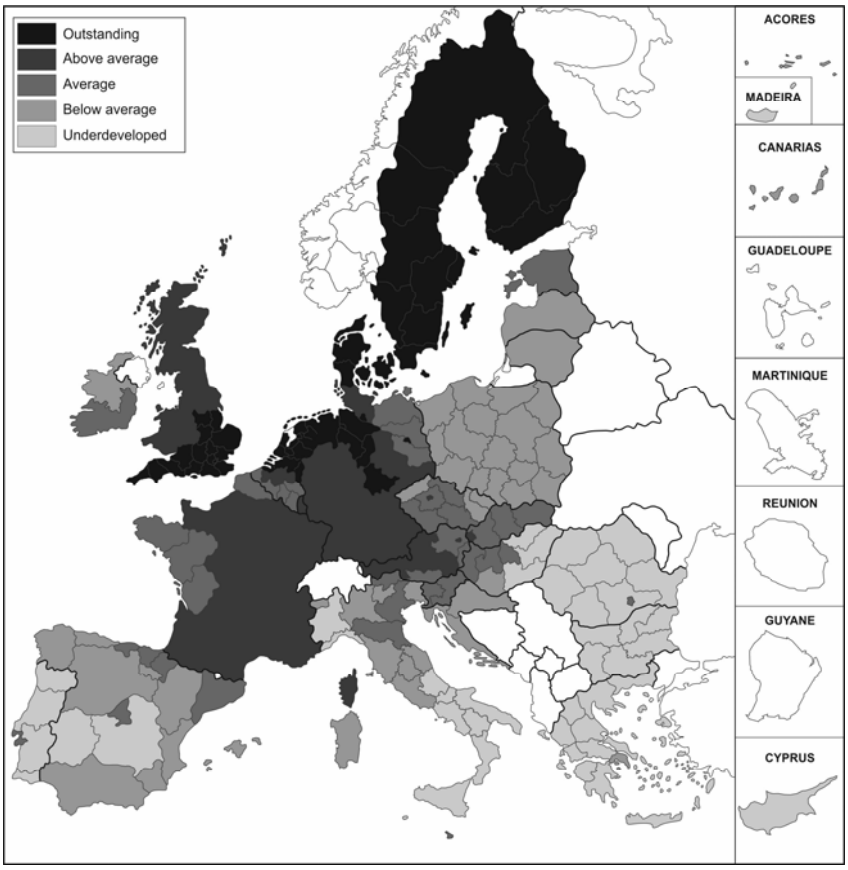
Group	Maximum value	Minimum value	Average score value	Standard deviation
Outstanding	98,57	85,10	90,44	3,35
Above average	83,94	70,29	76,97	4,26
Average	69,61	58,00	63,97	3,84
Below average	57,99	49,58	53,61	2,64
Underdeveloped	49,37	24,39	38,55	8,2

Source: author's computation and edition

The results show significant differences between Western European regions and Southern as well as Eastern European regions (Figure 1). All the Dutch, Swedish, Danish regions and Finland can be found on the best positions. There are some regions from the United Kingdom and Germany which place among the so called outstanding regions. It can be observed that the indicators which characterize the information society have higher values in the city-regions or in capitals as in other (non-capital) regions in a country. This statement may explain for example the rank of Berlin, Vienna, but the rank of the Central and Eastern European capital cities as well. The Central and Eastern European regions perform significantly worse than the Western or Northern European ones.

[65] The results of Spearman rank correlation coefficients can be found in the appendices.

Figure 1: The values of "Regional index of information society"

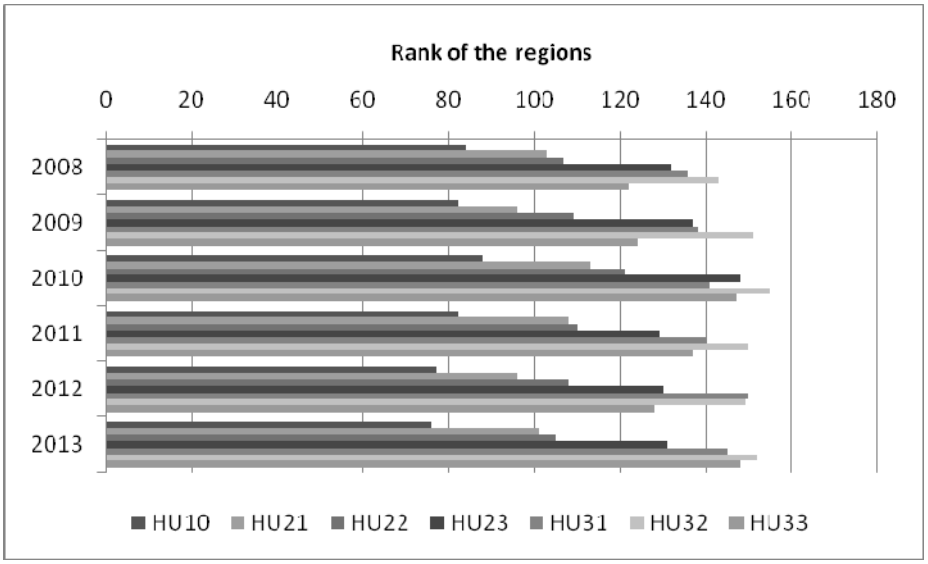


Source: author's edition

Some differences can be observed between the Central and Eastern European regions as well. The best performing countries and regions are Slovenia, Estonia, the Slovak and Czech regions from Central and Eastern Europe. Bratislava and Prague regions are outstanding among them, because they have been counted to the "Above average" group. Slovenia, Estonia, all of the Slovak and most of the Czech regions can be found in the "Average" group. Latvia, Lithuania and the Polish macro regions counted to the "Below average" group, the Romanian regions (except Bucharest) and the Bulgarian regions to the "Underdeveloped" regions.

The Hungarian regions have been divided between three groups according to the results of 2013. Central Hungary (HU10) and the two Transdanubian regions (Central and Western Transdanubia – HU21 and HU22) can be found among the "Average" regions, while Southern Transdanubia counted to the group of "Below average" regions and the Eastern Hungarian regions (Northern Hungary – HU31, Northern Great Plain – HU32 and Southern Great Plain – HU33) are among the "Underdeveloped" regions (Figure 2). It can be observed that the groups according the ranking haven't shown much difference in the analysed years.

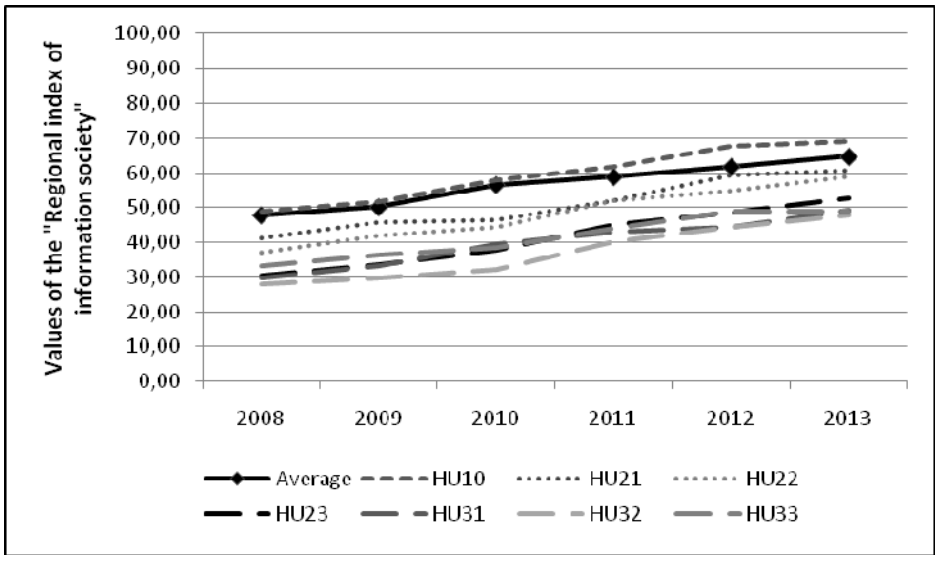
Figure 2: The ranking of Hungarian NUTS 2 regions (2008-2013)



Source: author's computation and edition

However if the scores of the regions are compared, it can be observed a bit other grouping of the Hungarian regions (Figure 3). Central Hungary is significantly above the other regions, and its scores are higher than the average score value of the European regions. Central and Western Transdanubia regions have lower scores than Central Hungary but these regions show better performance than the four other non-capital regions (South Transdanubia and the regions of Eastern Hungary). These regions show similar scores and performance in the indicators of information society.

Figure 3: The scores of Hungarian NUTS 2 regions (2008-2013)



Source: author's computation and edition

4. Territorial differences of information society in Hungary

Our research attempt to determine the territorial differences of information society in Hungary, as it has been interpreted in introduction. The NUTS 2 analysis of the European regions may offer a good starting point in our view. It has already shown some differences among the regions. However our goal would be to find the lowest territorial level, where the indicators of information society are measured. Therefore the Hungarian statistical and regional statistical yearbooks have been reviewed to find the most relevant indicators. The Hungarian Statistical Office measures the following factors as indicators of information and communication:

- the attributes of national postal service;
- the number of main phone lines and the attributes of the phone services;
- the number of the flats and houses with cable TV connection and the number of the subscribers for cable TV services;
- the number and the type of Internet connect and the number of the Internet subscribers;
- the IT services and the use of ICT tools;
- the attitudes of Internet use and the e-commerce.

Not all of these indicators are measured in the different territorial levels as well, so those indicators have been chosen which have data on the regional, county, small regional or settlement level as well. Many of these indicators are measured at regional and county level, but only few indicators can be found on the small regional or settlement level. As our analysis attempt to capture the lowest sub-national level where the information society can be characterized, we have decided to choose the settlement level.

The settlements of South Transdanubian region have been analyzed in this paper. Firstly the results of Regional index of information society have been reviewed (Table 4).

Table 4: Comparison of the Hungarian average (HUN) and South Transdanubian regional (STR) performance (2008, 2011 and 2013)

Indicator	HUN08	HUN11	HUN13	STR08	STR11	STR13
Households (Internet access)	47	63	70	42	59	67
Households (broadband access)	40	59	69	33	56	66
Individuals (regularly use the Internet)	55	64	69	52	60	66
Individuals (never used computer)	33	28	25	34	31	27
Individuals (purchased online in the last 12 months)	13	22	28	13	26	32
Value of "Regional index of information society"	35,56	48,32	55,31	30,59	44,99	52,56

Source: author's computation and edition

The region performs below the Hungarian average. It can be seen that South Transdanubia has lower values in the Regional index of information society in the analysed years. There is only one indicator, the online purchase, in which the South Transdanubian region shows better performance than the Hungarian average. The dynamics of the development in information society are almost the same in South Transdanubian region and Hungary as well.

After the review of regional data, the settlement level data have been collected. The settlements of the three South Transdanubian counties have been categorized by their population, and 6 groups have been created. Two indicators regarding information society are measured by the Hungarian Statistical Office on the settlements level: the percentage of flats which have phone lines on the one hand and the percentage of flats which have cable TV connections on the other hand (Table 5). Although these indicators don't represent the information society exactly, but parts of the infrastructural aspect can be measured from these data. Furthermore one subscribes for the phone and/or cable TV services, then one may know (or at least hear) about the Internet offers as well. Therefore it can be assumed that a higher percentage of phone lines or cable TVs show a better infrastructural situation regarding the information society.

Table 5: The information infrastructure of the South Transdanubian settlements

Population category	Baranya county			Somogy county			Tolna county		
	Nr. of settlements	Phone lines	Cable TV	Nr. of settlements	Phone lines	Cable TV	Nr. of settlements	Phone lines	Cable TV
–500	207	30,8	31,4	119	29,4	31,3	119	46,6	47,3
501–1000	50	43,5	36,1	62	31,2	37,8	62	49,9	52,4
1000–2000	24	48,7	42,7	42	36,2	37,9	42	50,5	52,8
2000–5000	13	53,7	58,7	15	40,6	38,5	16	52,4	38,5
5001–10000	3	49,8	40,3	2	44,0	39,0	3	48,9	58,0
10000–	4	54,4	56,1	5	44,1	53,6	5	60,5	73,6

Source: author's computation and edition

It can be observed that the percentage of the flats supplied with phone lines or cable TV is decreasing with the shrinkage of the population of the settlements. Most of the cities are average in the most populated category. Settlements which have a functional role (for example touristic centres) have better conditions than others. The percentage of phone lines are above average but the percentage of cable TV connections are below average in the settlements which located at the shore of Balaton. It might mean that many of the summer houses have phone connections but their owners don't subscribe for the cable TV or use satellite television. Those settlements which located in poorer parts of a county have worse conditions regarding the information infrastructure. For example Komló, Sellye (Baranya) or the northern part of Somogy have shown much lower values than the average of their groups. However there are some smaller cities which grow dynamically and their information infrastructure follow this growth (like Kozármisleny in Baranya). The third of the houses have phone connections in the smallest villages averagely, but there are many small settlements which don't have any cable TV connections. There are 113 villages in Baranya, 67 villages in Somogy in this situation. In Tolna almost all of the settlements have at least few houses which have phone line and/or cable TV connections.

In sum the differences can be seen clearly between the central and periphery territories of the counties. There are some exceptions but the bigger a settlement the better its infrastructure and opportunities regarding the access of new information. The economically underdeveloped territories have worse infrastructural conditions. Thus, their opportunities to cut in the stream of information are exiguous. Therefore it can be assumed that less information get to these

settlements and it may cause disadvantageous situation. However the proving of this fact would require an analysis about for example the incomes on these territories.

5. Conclusion

This paper has had two aims. The readiness of Hungarian regions in the information society has been determined in European context on the one hand. Our second aim was determining how the information society has evolved in Hungary in the last years and what kind of territorial differences can be observed regarding it. It could be seen that most of the Hungarian regions are below the European average in the indicators which measure the information society. The best performing European regions are the Western and Northern Europe. Thus, it can be assumed that there could be a relatively strong correlation between the economic development and the development level of information society. Therefore we would like to continue the creation of the Regional index of information society. The development level of information society in Hungary has been analysed by those indicators which measure the infrastructural aspects of the information society. The Hungarian cases have shown that the poorer and less populated territories have more disadvantageous position than the richer or more populated ones. It could be seen that if a settlement has a functional role it has influenced positively the information infrastructure. We would like to expand our research to the other parts of Hungary, because the comparison of the different territories can be fulfilled in this way. Indicators which measure the economic and social inequalities (like income or higher educated people) will be involved as well to explain what could cause the measured territorial differences in the information society.

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Appendix

Appendix 1: Descriptive statistics of indicators and main indicators

	Min. value	Max. value	Mean	Std. Dev.	Skewness
Acc_08	17,00	90,00	57,38	17,556	-0,116
Acc_09	24,00	95,00	62,39	16,690	-0,161
Acc_10	26,00	96,00	66,77	15,699	-0,330
Acc_11	35,00	98,00	70,58	14,399	-0,222
Acc_12	38,00	98,00	73,29	13,596	-0,211
Acc_13	41,00	98,00	76,01	12,701	-0,345
Bband_08	9,00	79,00	45,83	17,557	-0,068
Bband_09	18,00	84,00	53,11	16,392	-0,189
Bband_10	15,00	87,00	59,14	16,400	-0,577
Bband_11	17,00	91,00	64,56	15,369	-0,579
Bband_12	38,00	92,00	69,38	13,083	-0,324
Bband_13	40,00	94,00	73,27	11,559	-0,456
Regusei_08	22,00	90,00	55,37	17,581	-0,027
Regusei_09	25,00	93,00	59,79	16,874	-0,061
Regusei_10	28,00	94,00	63,54	16,440	-0,181
Regusei_11	33,00	94,00	66,97	15,807	-0,256
Regusei_12	36,00	96,00	69,09	15,054	-0,241
Regusei_13	39,00	97,00	71,22	14,511	-0,228
Nevusec_08	5,00	63,00	28,91	16,140	0,433
Nevusec_09	3,00	61,00	27,19	15,252	0,441
Nevusec_10	4,00	58,00	24,32	14,431	0,522
Nevusec_11	3,00	55,00	22,63	14,116	0,559
Nevusec_12	3,00	56,00	20,81	13,373	0,577
Nevusec_13	2,00	51,00	19,34	12,781	0,562
Onlinep_08	1,00	69,00	28,37	19,095	0,391
Onlinep_09	1,00	73,00	33,03	21,088	0,274
Onlinep_10	2,00	77,00	35,91	21,774	0,209
Onlinep_11	3,00	82,00	38,99	22,289	0,163
Onlinep_12	1,00	78,00	41,14	22,052	0,064
Onlinep_13	4,00	84,00	43,79	22,432	0,117
Household08	204,00	7110,00	2915,73	1793,523	0,517

Household09	500,00	7896,00	3568,29	1862,904	0,349
Household10	442,00	8064,00	4191,93	1914,481	0,094
Household11	663,00	8624,00	4766,38	1926,381	0,058
Household12	1444,00	9016,00	5255,59	1845,773	0,036
Household13	1640,00	9016,00	5710,41	1740,175	-0,086
Individual08	0,38	1056,00	153,35	219,874	1,995
Individual09	0,41	2208,00	206,68	313,350	2,786
Individual10	1,00	1679,00	259,33	352,231	1,907
Individual11	1,96	2475,33	330,02	440,989	1,853
Individual12	0,79	2438,33	416,61	590,193	1,983
Individual13	3,83	3901,00	514,92	739,506	2,053

Legend:

Acc – households with access to the Internet at home;

Bband – households with broadband access;

Regusei – individuals who regularly using the Internet;

Nevusec – individuals who have never used a computer;

Onlinep – individuals who ordered goods or services over the Internet for private use.

Appendix 2: The Spearman rank correlation coefficients between the two weightings which have been applied by computing the final index

Spearman rank correlation coefficient					
2008	2009	2010	2011	2012	2013
0,9992	0,9993	0,9994	0,9995	0,9993	0,9991