dr inż. Colin F. Hales
Zakład Metod Ilościowych
Uniwersytet Rzeszowski

Second-level Digital Divide (DD2): An investigation into online users' skills[1]

INTRODUCTION

It is a universally accepted fact that media can potentially bring people together and to an extent even help reduce disproportions in social and even economic standing[2]. However it is also common knowledge that the access or non-access to information can also lead to a widening of the gaps between different segments of a society. This is moreover evident with respect to the use of the Internet in rural societies wherein the risk exists that, as the Internet increasingly becomes regarded as the default communication medium, a minority becomes progressively disadvantaged, first in relative and then in absolute terms[3]. In an attempt to gauge the real digital divide one needs to consider, not only the fact as to whether one has or doesn't have access to digital tools in the place of abode but also access to the aforementioned information superhighway. It should also be noted that there exists the possibility of a so-called "second-level" digital divide, which can be caused by several other factors associated with information access and use.

As Dragomirescu et. al stated "The digital divide can also be interpreted in terms of the gap between information literacy and information illiteracy…" the latter being especially evident within underprivileged communities e.g. the poor[4]. The aim of this paper is to try to assess the current status of the digital divide in the podkarpackie region. To do this the author has decided to look not only into whether residents have a computer but also to investigate whether the type (quality) of access to the Internet. Furthermore, an attempt was made to assess users' digital skills as well. Many researchers have tried to measure ICT

[1] Publikacja opracowana w ramach grantu badawczego MNiSW „Określenie wewnątrzregionalnego zróżnicowania poziomu rozwoju społeczeństwa informacyjnego" NN114 190837.

[2] M. Prior, *Post-broadcast democracy: How media choice increases inequality in political involvement and polarizes elections*, Cambridge, NY: Cambridge University Press, 2007.

[3] M. Warren, *The digital vicious cycle: Links between social disadvantage and digital exclusion in rural areas*, "Telecommunications Policy", Vol. 31, Issues 6–7, pp. 374–388, July–August 2007.

[4] H. Dragomirescu, Z. Szabo, L. Pook, *From information literates to knowledge workers: challenges and endeavours for Romania*. Paris 2008.

competency. Such efforts can be divided in two large categories. One is to set up a standard and subcomponents that are able to measure ICT competency. The other is to develop a measuring tool that can actually measure the competence level[5].

While the majority of research available on the Web concentrates on the matter of determining whether people possess or not digital tools or examine the existence or the level of access to the Internet the concept of the ability to use digital tools has not been so widely examined or reported. As more people start using the Web for communication and information retrieval, it becomes less useful to merely look at binary classifications of who is online when discussing questions of inequality in relation to the Internet[6].

The assumption adopted in this paper is that there are three different stages/manifestations of the Digital Divide.

- Stage 1 is lack of access to a computer in the household.
- Stage 2 is lack of (broadband) access to the Internet therein.
- Stage 3 is lack of competence in the use of technology.

The aim of this study is to gain insight into the state of the digital divide in the Subcarpathia region with particular emphasis being shown to the competence levels of residents with and without access to digital tools including the Internet.

THE STUDY DETAILS

Research was carried out with the use of a sample of households from the Subcarpathia (Podkarpackie) region in south-eastern Poland during 2012. Respondents were requested to fill in a survey questionnaire about their use of the Internet and other digital tools against the background of basic demographic data about themselves and their households.

The sample was obtained using a random sampling method[7] wherein individual households were arbitrarily selected from one of the 21 districts within the podkarpackie region in south-east Poland. Four metropolitan districts in this region were excluded from the survey since their characteristics significantly differed from that of the less urbanised districts which were the subjects of interest for this study. One of the objectives of this study was to examine characteristics relating to access to and use of information and communication tools by individuals within non-urban areas in south-eastern Poland. The main objective

[5] W.G. Lee, *Measuring achievement of ICT competency for students in Korea*, "Computers & Education", Volume 56, Issue 4, pp. 990–1002, May 2011.

[6] P. DiMaggio, E. Hargittai, *From the 'digital divide' to 'digital inequality': Studying Internet use as penetration increases*, Princeton: Center for Arts and Cultural Policy Studies, Woodrow Wilson School, Princeton University, 2001.

[7] D.S. Yates, D.S. Moore, D.S. Starnes, *The Practice of Statistics, 3rd ed*. Freeman 2008.

was to try to examine the competency level of inhabitants with respect to the use of basic information society applications and general competencies involving everyday use of information and communication technologies. This was carried out against the background of their access to information society tools.

Table 1. Characteristics of the sample

Households	
Household size	1 person 2 persons 3 persons 4 persons 5 persons 6+ persons
Children under 16/household	none 1 2+
School age children / Students per household	none 1 2 3+
Av. monthly income	Less than 500 zl. Under 1000 zl. Under 1500 zl. Under 2000 zl. Above 2000 zl.

Individuals	
Sex	Female Male
Agglomeration type/size	Village Small town up to 5000 Town up to 20 000 Town up to 50 000 Town up to 50 000
Education level	Primary school Profiled high school Secondary school College University
Age group	16–25 26–35 36–45 46–55

Source: own research.

POSSESSION OF DIGITAL TOOLS

Digital access divide has been found to exist among both developed and developing countries, different social groups, different generations and different genders. Researchers have paid considerable attention to the causes of ICT access inequalities and have found that unequal income, social status, gender, age and ethnicity lead to the digital divide[8]. In the light of the concept that the digital divide, first of all, exhibits itself as a result of the lack of access to computers, it was pertinent to examine this phenomenon within the survey group. Information about possession/access to digital tools, especially computers – desktop and portable computer at home, were among key data that was collected. To gaining an insight into the phenomenon of the digital divide, survey participants were required to indicate which basic ICT equipment they possessed in the household.

[8] J. Van Dijk, *A framework for digital divide research*, "Electronic Journal of Communication", 12 (1) 2003.

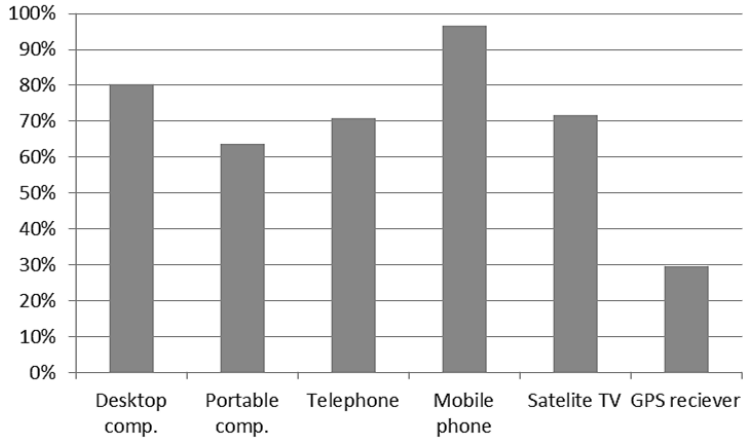

Figure 1. Possession of basic ICT

Source: own research.

The results show that a vast majority of the sample claimed to be in possession of a mobile phone (97%) while a GPS receiver (30%) was the least common equipment in households. These results were comparable to date resulting from other studies conducted in this field[9].

Table 2. Non-possession of computers

	No. of persons	Percentage of sample
Have neither computer nor laptop	596	5%
Have a computer	8881	80%
Have a laptop	7065	64%
Have BOTH	5436	49%

Source: own research.

In the sample which consisted of 11106 respondents, just about 80% had access to a standard desktop computer in the home while almost two-thirds of the sample claimed to be in possession of a portable computer. These figures were closely correlated with the results obtained in a country-wide survey sample[10]. Almost half of the persons who took part in the survey had access to both types of computers while only a mere 5% of the sample group acknowledged to a lack of access to computers in the home. Somewhat alarming was the fact that among the rather small group of households declaring non-possession of computers,

[9] In the fourth quarter Polish operators increased their sales by 1168 million SIM cards, mostly on PTC and P4 networks. telepolis.pl 2013.

[10] *Information Society in Poland. Statistical results from the years 2008–2012*, GUS, Warszawa 2012.

almost 20% comprised families with school-age children. The abovementioned situation was mainly due to this group's rather low levels of household income – 61,5% of those without a computer in the household declared having a disposable income of less than 1000 zł/person.

It should be mentioned as a backdrop to these data that over 90% of the computers in primary and lower secondary schools in Subcarpathia have access to the Internet and ca. 60% of those are through a broadband connection[11]. The incidence of non-access to a computer in the home was universally independent of the size of the administrative area where the survey was conducted. Those persons declaring no access to any type of computer at home were evenly distributed among respondents from both rural and urban areas – approximately 5,38% (village residents) and 5,35% (town dwellers) within the sample. An in-depth examination, however, showed that the situation varied depending on the size of the townships in which respondents resided with a lack of physical access to a computer being more prevalent in smaller townships.

Table 3. Motive for non-possession of computer

Costs	Lack of Skills	Access in other place	No need
21,1%	27,0%	6,9%	45,0%

Source: own research.

The lack of access to a computer at home was attributed to various reasons, among which the most often cited was that there was no need for such "equipment", while just over one quarter of those without a computer or laptop claimed to lack the skills necessary to use one.

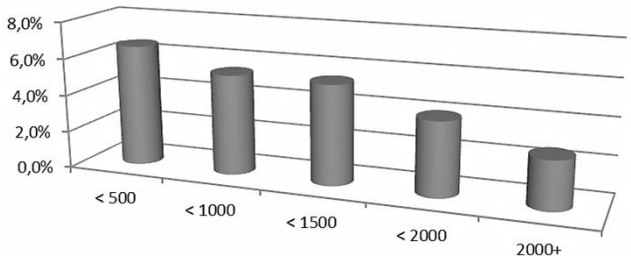

Figure 2. The non-equipped in the light of their income

Source: own research.

Naturally, income levels also had an influence on the possession of computers in the household. In comparison, among those without access to a computer

[11] Local Data Bank, Polish Central Statistical Office (access 16.12.2012).

at home, the number of lower-income families was almost thrice as much as that of the highest income group. Seven percent of the lowest earning families – those having an income of less than 500 zł/person, did not possess a computer at home while only just over two percent of those with incomes of 2000 zł and above, were not in possession of such digital equipment at home.

In accordance with previous studies in this area[12] and common knowledge, research showed that the presence of children in the household had a positive influence on the prevalence of a computer in the home. Three quarters (76,3%) of those households which possessed at least one computer were characterized as having at least one child of school age i.e. aged 16 and younger.

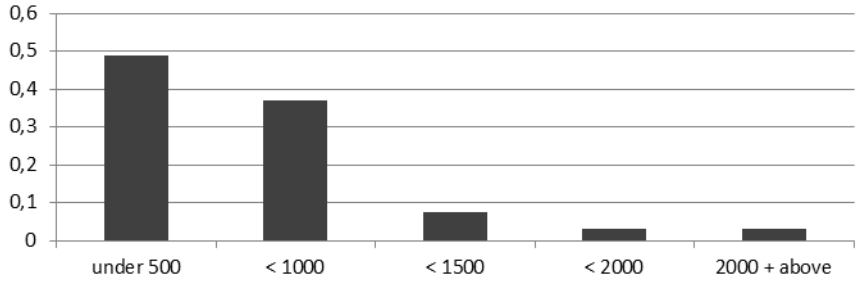

Figure 3. Income levels among the non-equipped households with school-age children

Source: own research.

The above figure further illustrates the financial situation of those households declaring no access to a computer and with school-age children in the family. It is safe to assume that the low level of income is probably the main reason why these families did not possess any type of equipment allowing for the free use of the Internet.

Age was also another factor influencing the decision to have a computer in the home or not. It is of no real surprise that the majority of the persons who declared not having access at home to any type of computer were among the older age groups. The group of the younger respondents (aged 16–35) accounted for less than 20% of those without access to digital tools, while more than 50% of those without access to such equipment belonged to the group above 55 years of age. This state of affairs is in line with other studies wherein it has been proven that the incidence of children and students in the household determines the need to be in possession of such equipment[13].

[12] *Information Society in Poland. Statistical results for the years 2008–2012*, GUS, Warszawa 2012.

[13] *Information Society in Poland. Statistical results from the years 2008–2012*, GUS, Warszawa, 2012.

CHARACTERISTICS OF INTERNET ACCESS

In keeping with the thesis earlier presented, a further manifestation of the digital divide is demonstrated by the lack of access to the Internet and especially an absence of a broadband connection to the network. In light of this conviction, an attempt was made to analyse the quality of Internet connections available and used by residents of the region under observation.

Transfer speed	<=256KB/s	256KB/s	512KB/s	1Mb/s	2Mb/s	6Mb/s	>=6Mb/s	Don't know/ No answer
% households	1,59%	3,21%	12,69%	27,17%	26,96%	9,60%	3,74%	15,05%

Figure 4. Table distribution of transfer speeds

Source: own research.

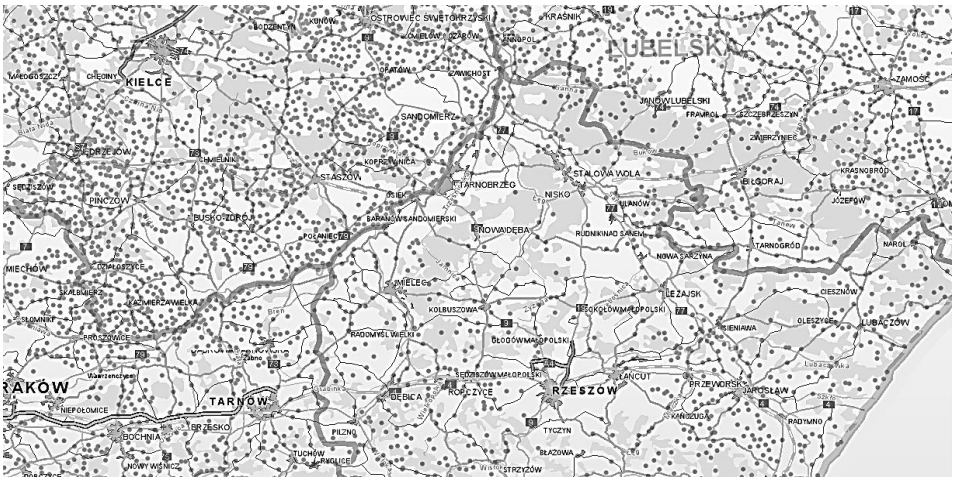

Figure 5. Areas in need of possible intervention[14]

Source:http://www.polskaszerokopasmowa.pl/mapy/infrastruktura-telekomunikacyjna-na-terenie-rp-2012.html.

The results of the survey conducted among households in the Subcarpathian voivodeship led to the following conclusions about the state of Internet access therein. Of the 3,670 households surveyed nearly 87% claimed to have regular access to the Internet. This percentage significantly surpasses the rate published by the Central Statistical Office which puts the level of Internet access in urbanized regions of the country at 71% and 61,6% in less developed areas[15]. Their

[14] Coverage by existing telecommunications infrastructure and public telecommunications networks prepared by the Office of Electronic Communications in 2012.

[15] *Ibidem.*

results also indicate that the level of access to the Internet was significantly lower in the eastern parts of the country in comparison with the western regions, where the rate was 78% for urban areas.

It is very evident that the majority of the sampled households (63%) had Internet access at transfer speeds of 1 Mbps and above. However, it must be noted that many households in rural areas make use of non-regulated local Internet providers who operate on very low margins while at the same time providing good levels of service to their communities.

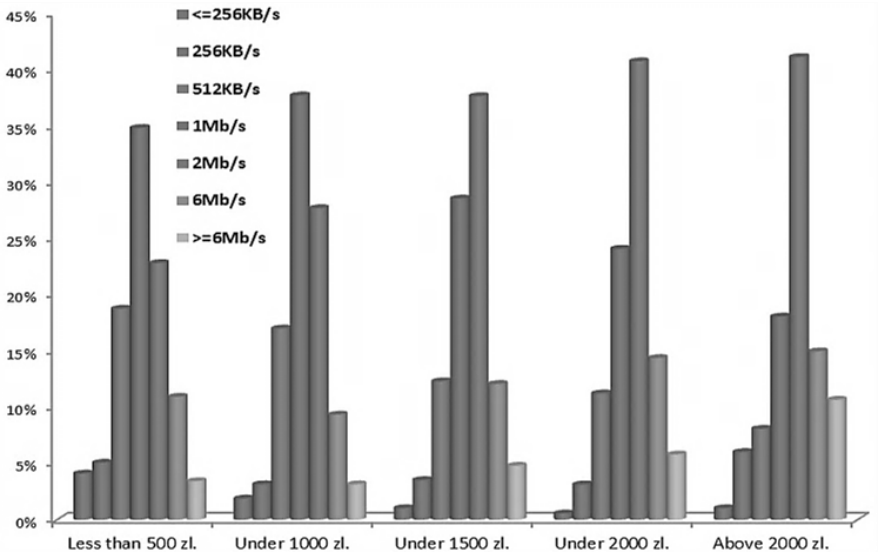

Figure 6. Quality of Internet access in income groups

Source: own research.

The map displays the sites earmarked for possible projects to be financed through Action 8.4 of the European Union's Operational Programme *'Innovative economy'* (POIG). The marked areas represent those communes in which the level of saturation with broadband access services of a 2Mb/s minimum transfer rate is below 30%. It goes to show that there are fewer locations in need of improvement within the Subcarpathia region.

It was quite evident that the level of income had a real effect on the type of Internet access a household could afford. As the levels of income rose, so did the number/percentage of a given income group who could afford a better Internet connection. However, it should be noted that even among the lowest earning group the most popular Internet access speed was at least 1 Mbps. This trend was evident in each income group where the quality of Internet access improved with the income levels of the groups.

There was also no marked differences in the type of access enjoyed by residents of differing sizes of communes. It can be said that the size of the area does not have any real influence on the type of Internet access enjoyed by its inhabitants.

	<=256KB/s	256KB/s	512KB/s	1Mb/s	2Mb/s	6Mb/s	>=6Mb/s
Village	1,92%	3,39%	17,08%	33,42%	31,56%	9,24%	3,39%
Town up to 5 000	3,78%	1,98%	6,13%	33,15%	38,02%	12,25%	4,68%
Town up to 20 000	0,64%	5,16%	13,97%	26,93%	32,45%	15,90%	4,94%
Town up to 50 000	3,17%	6,65%	7,70%	26,89%	29,31%	16,47%	9,82%
Town up to 50 000	0,00%	3,08%	3,46%	31,92%	25,38%	23,46%	12,69%

Figure 7. Table size of community and Internet access

Source: own research.

EXAMINATION OF COMPETENCE LEVELS

In an attempt to evaluate competence levels among the population, respondents were asked to make a judgement on a scale from 0 to 5 about their general self-perceived proficiency in the use of digital tools. The most frequent assessment level indicated by persons in the sample was 4 (27,13%) while 25,66% of the sample judged their competence at a level of 3 on the 6 point scale. The percentage of persons in a given age group declaring a lack of knowledge in the use of digital tools gradually increased with age whereas a shocking 84% of persons above 65 years of age declared a complete lack of competence with digital tools. The largest percentage of proficient users of digital tools was found among the youngest members of the survey sample, i.e. the 16–25 year age group – 2/3 declared a competence level of 4 and above.

An important aspect of the survey was to determine the factors that influence the level of competence exhibited by different sections of the population depending on demographic and other factors.

In an attempt to make a judgement as to the influence of gender on the level of competence, a t-test was performed on the appropriate data from the survey.

Table 4. Influence of gender on the level of competence

Average Males	Average Females	t	df	p*	p – Variance	Levene's – F(1,df)	df – Levene's	p – Levene's
2,99229	2,73413	8,62881	9800	0	0,21026	0,6346	9800	0,42569

Source: own research.

The "p" statistic obtained when the t-test was carried out indicates that there is a statistically significant difference between the means of the two groups examined while the Levene test "p" value of >0,05 allows us to treat the result as statistically correct in that there is homogeneity of variance in the sample which authenticates the validity of the method of computing the p* value. There is a clear difference in the self-claimed abilities of men and women in the area of use and competence with digital tools. These results were in keeping with the general opinions of the society which were presented in previous publications[16].

An attempt was made to compare the self-appraised levels of competence of the group of respondents who declared not having access at home to either type of computer.

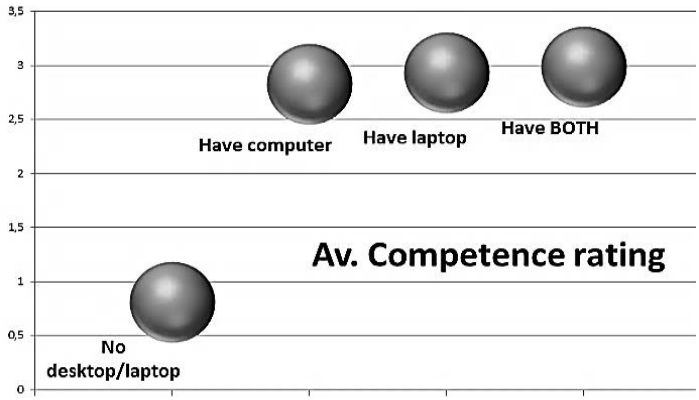

Figure 8. Possession of computers and competence levels

Source: own research.

Table 5. Comparisons of means with respect to computer ownership

	Mean – No_ computer	Mean – Has_ computer	t – separate est. var.	df	Levene's – F(1,df)	df – Levene's	p – Levene'a
Digital competence	2,817385	0,810169	35,419	677,15	15,1062	10965	0,000102
Word-processing	2,885156	0,765112	35,45	686,44	100,8436	10965	0,000000
Specialist apps.	0,621885	0,090909	9,4208	279,71	107,2721	2932	0,000000
Database	0,983026	0,183246	23,162	831,44	589,6253	10822	0,000000
Presentations	2,036832	0,438811	31,363	747,08	707,38	10887	0,000000
Work-sheet	2,206136	0,474783	34,76	742,87	553,4528	10906	0,000000

Source: own research.

[16] *Information Society in Poland. Statistical results from the years 2008–2012*, GUS, 2012, p. 132, GUS, Szczecin, 2012.

Results show that in assessing their digital skills, this group placed themselves significantly well behind the general average of the survey sample (2,71) and well below the average competence levels of the remaining groups of computer owners. An investigation carried out into the self-declared competences in using digital tools by inhabitants of rural and urban areas showed that there exists a statistically significant difference in the levels of ability between the two groups. This was confirmed to be similar in the case of specific types of applications, including spreadsheet software, word-processing programs and presentation software

Table 6. Average competence levels for rural and urban residents

	Means – rural	Means – urban	t	P value
Digital competence	2,655481	2,838213	-5,61233	0,000000
Specialist apps.	0,539667	0,724970	-3,20036	0,001387
Database	0,926755	0,974605	-1,59142	0,111544
Presentations	1,919680	2,031970	-2,90954	0,003627
Worksheets	2,057147	2,251765	-5,23461	0,000000
Word-processing	2,704055	2,937901	-6,24222	0,000000

Source: own research.

Respondents taking part in the survey professed to having the highest levels of proficiency in the use of word-processing applications, with urban dwellers claiming to be more proficient in all areas than counterparts from village surroundings. Both urban and rural dwellers unanimously considered database programs to be their weakest areas of competence and as consequently there was no statistically significant difference between the means of the two groups.

Table 7. Spearman rank correlation between competency areas

	Digital competence	Word-processing	Work-sheet	Presenta-tions	Database	Specialist apps.
Digital competence	1	0,859517	0,8230	0,7898	0,599075	0,431198
Word-processing	**0,859517**	1	0,8620	0,8206	0,594381	0,386841
Work-sheet	0,822972	**0,861983**	1	0,8495	0,660500	0,412949
Presentations	0,789786	0,820580	0,8495	1	0,668138	0,394731
Database	0,599075	0,594381	0,6605	0,6681	1	0,450743
Specialist apps.	0,431198	0,386841	0,4129	0,3947	0,450743	1

*Correlation coefficients valid p <0,05
Source: own research.

The correlation between all of the examples of digital activity were significant with very strong correlations between the possession of general digital skills and the ability to use both word-processing, spreadsheet and presentation software.

The Pearson Chi-square test is 68,29763 with a p-value of 0,00000. Since the p-value is less than alpha=0,05, the null hypothesis (The possession of a computer is not related to the owner's ability to connect it to a network) is rejected. This result can be interpreted by stating that there is a statistically significant relationship between the possession of a computer and the owner's ability to configure his/her computer's network connection.

Table 8. Chi-squared test for independence

Statistic: Possess a computer x Ability to setup an internet connection		
	Chi-square	df
Pearson Chi-square	68,29763	df=1
Chi^2 NW	71,20273	df=1
Spearman Rank R	0,0784195	t=8,2890

Source: own research.

Further tests show that the possession of a computer also was related to the ability to create a web-page. Results confirm a statistically significant relationship between these two variables.

As would be expected in the everyday life our hypothesis about the owner's ability to send an e-mail with an attachment being associated with the fact that he/she had a computer at home: *n*=11 106, *df*=1, *Chi-square*=139,5404, *p*=00000 was confirmed through the test. Additionally the Spearman R value of 0,1120911 further confirms that this observation could be extended as being true of the whole population.

Here again the assumption that a computer at home has an influence upon the user's ability to find information on the Internet, has been confirmed through the use of the Spearman R co-efficient which exhibits a value of 0,1652308 with a p-value of 0,000.

CONCLUSIONS

An attempt was made to analyse the state of the digital divide in the Subcarpathia region taking into consideration the assumptions that the second-level divide is best shown by the lack of appropriate digital competencies among residents of this region.

These competencies were analysed against the background of the ownership of the major digital tool – a computer. Non-ownership of a computer had a negative influence on the level of competency while this was not the case in relation to place of residence.

Furthermore analysis was carried out into the level of access to the Internet among residents of this area and in relation to the type of environment in which

people resided – urban or rural. Results obtained from the examination of the digital divide in the have shown that the region is characterized by quite favourable levels of Internet access independent upon the fact as to whether it was a rural or urban area. Income levels did indeed have some influence upon the speed of access in households while age levels strongly influenced the propensity to possess higher levels of competence with digital tools and applications.

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Summary

In the light of the universally accepted fact that information and communication technologies can serve towards the development of a society and a region, it was considered necessary to examine the state of the information society in the Subcarpathia region of Poland. An important aspect of this development is the levels of digital readiness and competence among its members. This is especially important in rural societies where the population may become increasingly disadvantaged, first in relative and then in absolute terms. In an attempt to measure the actual digital divide one should consider, not only access to digital tools but also access to the information superhighway, i.e. the Internet. It should also be noted that the so-called "second-level" digital divide, caused by several other factors associated with information access and use may be prevalent.

Streszczenie

W świetle faktu, że powszechnie przyjęte technologie informacyjne i komunikacyjne mogą służyć rozwojowi społeczeństwa i regionu, uznano za konieczne zbadanie stanu społeczeństwa informacyjnego w regionie podkarpackim. Ważnym elementem tego procesu jest ocena poziomu gotowości i kompetencji cyfrowych wśród mieszkańców regionu. Jest to szczególnie ważne w społecznościach wiejskich, ze względu na ich peryferyjne lokalizacje. W dążeniu do zmierzenia rzeczywistego podziału cyfrowego należy rozważyć nie tylko dostęp do cyfrowych narzędzi, ale również dostęp do autostrady informacyjnej, jaką jest Internet. Należy również zainteresować się kwestią tak zwanej przepaści cyfrowej „drugiego stopnia", spowodowanej przez kilka innych czynników związanych z jakością dostępu do informacji oraz skalą jej wykorzystywania.