Available online at www.sciencedirect.com

ScienceDirect

Procedia Economics and Finance 19 (2015) 364 – 372

Procedia
Economics and Finance

www.elsevier.com/locate/procedia

The Economies of Balkan and Eastern Europe Countries in the changed world, EBEEC 2014, Nis, Serbia

Statistical analyses of digital divide factors

László Várallyai*, Miklós Herdon, Szilvia Botos

University of Debrecen, Faculty of Economics and Business, Institute of Applied Informatics and Logistics,Böszörményi út 138.,Debrecen, 4032, Hungary

Abstract

The digital divide has become an extremely important issue for many international organizations and a major challenge for policy makers and academic researchers. We have to know the factors of digital divide to find solutions for eliminating disparities in ICTs.The first goal of our research is to measure or calculate the digital divide in Hungary. The digital divide is a complex and multidimensional issue, which requires taking into account diverse technologies, variables, and territories. In this context, factor analysis has revealed as a useful tool to capture the overall dimension of the digital divide. Therefore our research is based on different ICT indicators from Eurostat statistics and the Empirica survey results. Our research focuses on the digital divide circumstances in Hungary. The investigated fields are the followings: Percentage of households with access to the Internet; Percentage of households with a broadband connection; Percentage of individuals regularly using the Internet at least once a week; Percentage of individuals who have never used a computer; Percentage of individuals who ordered goods or services online for private use. The correlation matrix in our research (which comes from factor analysis) shows that all variables are closely related to each other, with correlation coefficients larger than 0.8. For instance, the percentage of individuals who have never used a computer is highly and negatively correlated with using the Internet and having access at home because most people are connected to the Internet through a computer. Furthermore, the high and positive correlations of broadband infrastructural and usage indicators show the increasing importance of high-speed connections: many of the latest online services, are only possible through fast networks. Given these strong correlations, factor analysis seems to be appropriate.Since the EU has been paying special attention to bridging the rural-urban digital divide the relationship between ICT factor and population density has also been analyzed. Furthermore, the percentage of population aged 65 and over is included to capture the potential influence of regional demographic differences on the extent of ICT adoption. In this sense, older people often face more barriers to use ICT than younger individuals. The highest correlations with ICT factor are found for GDP per capita, human resources in science and technology, in contrast to population density, which shows the lowest one among the considered variables. This article shows our research results on the field of digital divide factors using by statistical analyses.

* Corresponding author. Tel.: +36-52-508444; fax: +36-52-486255.
E-mail address: varal@agr.unideb.hu

Peer-review will be under responsibility of Department of Accountancy and Finance, Eastern Macedonia and Thrace Institute of Technology, Kavala, Greece.
doi:10.1016/S2212-5671(15)00037-4

Peer-review will be under responsibility of Department of Accountancy and Finance, Eastern Macedonia and Thrace Institute of Technology, Kavala, Greece.

Keywords: Digital divide, e-competences, e-skills, skills gap, ICT.

1. Introduction

Information and communication technologies (ICTs) have been revealed as key potential factors for economic growth and social development. The diffusion of ICTs drives access to information and knowledge; the uneven distribution of ICTs within or between societies may result in very uneven impact on their economic development and wealth (Brixiova, 2009).

Not only the U.S. government but also other developed and developing countries recognized the need to address this problem and were actively working towards finding solutions for eliminating disparities in ICTs, the so-called digital divide. The digital divide has become an extremely important issue for many international organizations and a major challenge for policy makers and academic researchers (Billon et al., 2009).

At the beginning of research, the definition of the digital divide was broad and the term was loosely used to express either the disparity between people in their access to ICTs or more specifically, the disparity in their access to the Internet. From the end of the 1990s onwards, it was attempted to accurately define the digital divide as terms both of access and use.(ICT OECD,2001). The digital divide is extended, which can exist in a particular country and also between countries (Norris, 2001).

Today, many countries seek to create a society in which all citizens can reach and share information by trying to form supportive policies that narrow the digital gap (the e-rate program reduced the digital divide in America's schools - schools and libraries can gain affordable telecommunications and Internet access) (Jakayar, 2004).

The European Union, the term "e-inclusion" was introduced in 2006 by the European Commission as a part of the third pillar of the 2010 policy initiative (i2010) with the commitment to halving the digital divide by 2010 (EIU, 2008).

The EU set four objectives, which included reducing the digital divide within and among the member countries. However, this has not been achieved yet, and there are still significant differences between individuals, groups, regions and countries in terms of reaching and sharing ICTs (Çilan et al. 2009).

2. The digital divide

The digital divide is a wide-range concept. It can exist between those living in rural areas and those living in urban areas, between the educated and uneducated, between economic classes, and on a global scale between more and less industrially developed nations (van Dijk & Hacker, 2003).

Since gender, age, racial, income, and educational gaps in the digital divide have lessened compared to past levels, some researchers prognostigate that the digital divide is shifting from a gap in access and connectivity to ICTs to a knowledge divide. A knowledge divide concerning technology presents the possibility that the gap has moved beyond access and having the resources to connect to ICTs to interpreting and understanding information presented once connected (Graham, 2011). There are several main factors of digital divide, which are the following ones.

The economic factor means that individuals and communities don't have access to a computer or an up-to-date Internet service (because of lack of money); many developing countries struggle to provide adequate telephone lines; PC hardware and software is simply too expensive for many people in the developing world.

The social factor originally, the digital divide was attributed to Internet Access. Now, most people have access to the Internet thanks to libraries, and Internet cafes etc. We now think about the digital divide as the gap between those who have the skills to use the internet appropriately and those who don't. Many of today's jobs require ICT skills and qualifications. People without an education in ICT are at a disadvantage and are unable to get employed (Benda et al., 2011).

The geographical factor means that the availability of the Internet throughout the world shows large differences between world regions. This can be a result of lack of internet access/infrastructure, language and culture.

In the case of the fear of technology factor many people do not use technology because they: are not confident about their own ability to use computer skills; fear that others will laugh at their attempts, therefore it is easier not to try; think they will cause a computer problem as they experiment and therefore prefer not to try; have heard or read news reports about computer fraud, Internet scams and identity theft (Waycott et al., 2010).

The lack of motivation factor exists for many people who are not willing to take their time and effort to learn something new. Some people link ICT with useless activities such as computer game playing, eyes damage, and other more sinister themes. Modern Operating Systems (Windows, MacOS) are much easier to use than they were 15 years ago, however they still require a certain amount of effort to grasp.

In the cultural factor we can find the attitudes (some groups of people feel that ICT is for particular groups of people: the young, the brainy, middle class) and cultural attitudes as oral culture, personal communication, kinship and strong family values.

2.1. The determinant factors of the digital divide

Three levels of factors was proposed(HELBIG et al, 2009)influencing the digital divide. The first level is the technology access approach, which is close to the idea of technological determinism. The digital divide, like any other technological divide, does not have a special ethical or political meaning. Based on this assumption, the important factors at this level should be the availability of the infrastructure and infrastructure investment, since once everyone has access the digital gap will be narrowed.

The next level is the multi-dimension approach. There are many dichotomous divides or multiple dimensions; it is not only a question of having access or not. These dimensions could be, for example, socio-economic status, skills, geography and education. The last level considers that the digital divide may be understood by examining the various ways that different factors (e.g. age, gender race, etc.) interact to shape the experiences of the users (Shirazi et al., 2010).

Technology access

- Availability of the infrastructure (including the availability of related technologies e.g. fixed phone, mobile phone and Wi-Fi (Middleton & Chambers, 2010)
- Infrastructure investment (A greater level of ICT infrastructure would lead to a greater diffusion rate and reduce the digital gap) (Struzak, 2010)
- Multi-dimensional approach
- Income/socioeconomic status/GDP per capita (An individual or country in a more privileged socioeconomic situation is expected to have a smaller digital gap)
- Skills and experience (A lack of ICTs skills and experience will widen the digital gap)
- Geography/rural-urban location and population density (Urban populations may benefit from easier and cheaper access to ICT infrastructure because adoption costs will decrease with population size and density increase)
- Education/literacy (People with higher education will be more prone to use and adopt ICTs than less educated people)(Hassler & Jackson, 2010)
- Family structure (Children’s current use of ICTs in the home will increase the probability of ICT use among other family members)(Hohlfield et al., 2010)
- Age (Elderly people show greater reluctance to adopt new technologies than teenagers)
- Cost of access/ price (A cheaper cost of access will increase the probability of the access and use of ICTs)
- Occupation (Professional, scientific and /or technical workers are more likely to access and use ICT tools than are other workers.)
- Marital status (it seems to have a highly significant effect on gaining access to ICTs)
- Multi-perspective approach (Salajan et al., 2010)
- Institution, structure and type of government (Public policies and regulation play a significant role in promoting or inhibiting ICT diffusion)
- Race (A major race in a given country is more likely to access and use ICT tools)
- Ethnic (ICT adoption and use varies by ethnic)

- Gender (Men are more likely to access and use ICT tools than woman)
- Culture (Persons belonging to different cultures may have different perceptions of ICT, which will lead to different ICT adoption rate.)
- Language (English is a potential predictor of digital divide, in particular for the Internet.)
- Psychological factors (A favourable attitude towards ICT will influence the adoption of ICT.)
- Direct network effect (The number of ICT users in a country in the previous year is a powerful determinant of the number of ICTs user in the current year)
- Content (Content suited to the preferences and needs of the user will decrease the digital gap)
- Speed and quality of service (A higher quality of service and a faster Internet connection speed will increase the adoption rate)

These factors can be summarized as shown in Figure 1. Interestingly, there are several factors (skill and experience, education, cost of access, institutional structure, race, ethnicity, culture, psychological factors, direct network effects, content and the speed and quality of service), that many scholars have been paying attention. These factors confirm that digital divide research has moved beyond the technological access concept.

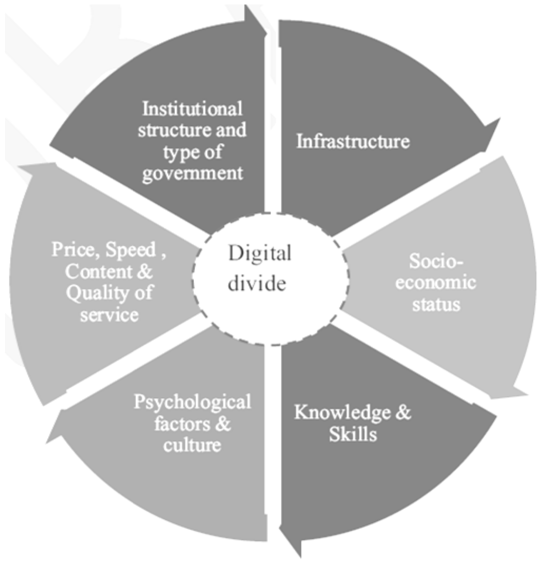

Fig. 1. Determinant factors of digital divide

The broadband gap can no longer be seen as a penetration divide. It is becoming more and more a quality and capacity divide, and therefore, a divide in the range of services people can access and use (Vicente & Gil-de-Bernabé, 2010). Detailed, reliable and up-to-date spatial data is needed to identify the gaps in broadband access coverage as well as in Internet knowledge and literacy (Schleife, 2010).

3. Methodology

The digital divide is a complex and multidimensional issue, which requires taking into account diverse technologies, variables, and territories. The first goal of our research is to measure the digital divide in Hungary and to determine the situation of Hungary among the European Union countries. For our research we used the latest ICT and socioeconomic indicators of Eurostat statistics.For some indicators and countries there was no data available for 2013. In these cases data of previous or subsequent years were used. At our descriptive statistics and correlation test broadband infrastructural and usage characteristics of individuals and enterprises (20 variables) and several socio-economic factors (9 variables) have been considered. The list of ICT indicators applied is given in Table 1. The analysis has been performed for the 28 member states of the European Union. The aim of the correlation test was the determination of economic and social factors which are or could be connected to the development of broadband networks. For the correlation calculation according to the data types of variables the Pearson's correlation coefficient was determined, by two-tailed test. The correlation was evaluated on 0.01 and 0.05 significance level.

Table 1. The list of applied ICT indicators and the used abbreviations in the Figures

IND 1	Enterprises with broadband access	**IND 11**	Individuals using the Internet for interaction with public authorities
IND 2	Enterprises using the Internet for interacting with public authorities	**IND 12**	Individuals using the Internet for ordering goods or services
IND 3	Households with broadband access	**IND 13**	Enterprises - mobile connection for business use
IND 4	Individuals regularly using the Internet	**IND 14**	Mobile Internet access with a handheld device: at least once a week
IND 5	Large enterprises who employed ICT/IT specialists	**IND 15**	Individuals using the Internet for selling goods or services
IND 6	Large enterprises who provided training to develop/upgrade ICT skills of their personnel	**IND 16**	SMEs that employed ICT/IT specialists
IND 7	Fixed broadband lines with at least 30 Mbps	**IND 17**	SMEs that provided training to develop/upgrade ICT skills of their personnel
IND 8	NGA lines as a % of total fixed broadband lines	**IND 18**	Enterprises selling via Internet and/or networks other than Internet
IND 9	Individuals using the Internet for Internet banking	**IND 19**	Individuals using the Internet for looking for a job or sending a job application
IND 10	Individuals using the Internet for finding information about goods and services	**IND 20**	Individuals using the Internet for doing an online course

4. Results

For countries of European Union a lag behind can be detected both for accessibility and usage. There is a great difference between countries of European Union. The most significantlack is in the case of online commerce, work- and education related indicators. Taking account the infrastructural and penetration indicators, there is no big difference between the EU Member States. Figure 2. contains the selected indicators with their maximum, minimum, average and deviation values.

The broadband penetration among enterprises is above 80% in almost all Member States, the average coverage is 90%. This is a very good result, since the basic broadband infrastructure is available to use the wide range of services. The deviation value of the household broadband penetration was 10.2%, which doesn't mean a high difference among the EU countries. In case of 19 countries the penetration rate was between 61-80%, the lowest penetration was 54% (Bulgaria), the highest was 88% (Finland) in 2013.

The regular Internet use shows a relatively high standard deviation (13.2%), but in half of theMember States more than 70% ofthe population are regularInternet users. The lowest value in use was 45% (Romania), the highest 93% (Luxembourg). For specific usage characteristics is much greater variation in the range of around 20%. In the case of individuals, the two e-commercial indicators are very different. Ordering is much popular then the sales, the average values are 42% and 15%. The highest percentage of individuals, who using the Internet for ordering goods or services is 77% in Great Britain and Denmark. The sales activity in the private sector is the highest in the Netherlands (48%), but Slovenia, Franceand Great Britain have good results too, more than 30% of the individuals aged 16-74 sold online. The average rate of users, who banking via Internet, was 44%. Using electronic banking services in the Nordic countries were widespread than in the Southern European countries.

In case of almost all usage indicators the samecountriesreached the highest(the Scandinavianand Western Europeancountries) and the lowest (Southern Europe)resultsfor bothindicators. The use of e-services regarding Italy, Greece, Romania, Bulgaria and in some cases in the Baltic States have very high lags.

The use of mobileinternetfor enterprisesis between21-74%,the enterprises of Finland (74%) andCzechRepublic (63%) are themost intensiveusers.The e-commercesectorhasnot been very successful, the proportion of enterpriseswhose income is at least 1% derived from e-business, the average is14.5%, but the rate is less than 30% evenin the best performingMemberStates. The e-commerce is especiallyimportantin the Nordic countries,a quarter of enterpriseshave e-commercial activity and CzechRepublicperformsextremelywell inEastern European region.E-commerce means a significant opportunity for economic growth, both at macro- and microeconomic level in the European Union.

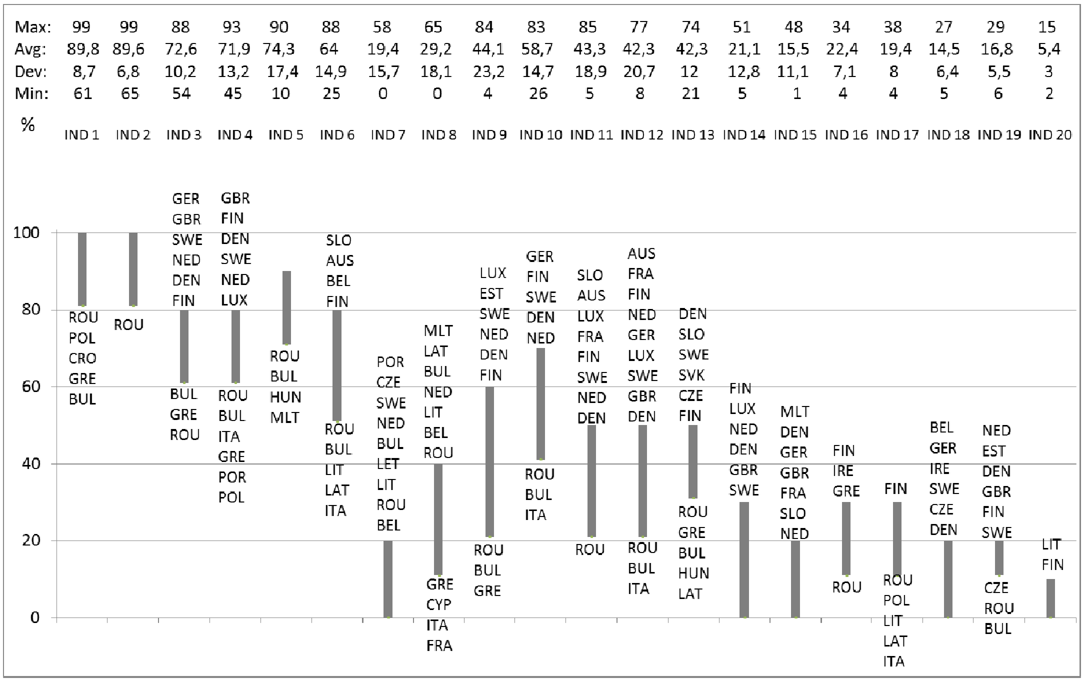

Figure 2. Selected indicators with their maximum, minimum, average and deviation values for EU Member States
(Data source: Eurostat, 2013; European Commission, 2013)

In the case ofusage characteristicswas foundwell-marked differencesbetween thetwogroups of activities. In the case ofofficialadministrationandfinancialtransactionsrelatedcharacteristics (product, serviceorders, internetbanking services,interactingthe public authorities), thevalues of deviation were around 20%, which meansverylargedifferencesbetween the countries.On average,one-thirdof individualshave usedthese servicesin 2013.The standard deviation of generalinternetusage characteristicswas muchlower, around 10%.The Internet has been least used for work or learning in the case of almost all countries. On average 90% of the enterprises used the Internet for banking or interacting with public authorities, which is much higher ratio than the value of 45% of the individuals. In the case ofindividualcharacteristicsthe lag is higher in the Southern andEastern European countries, the low intensity usage values of Romania, Bulgaria and Greece mainly affecting the values of deviation.

The biggest increase took place between 2008 and 2013 in Southern and Eastern Europe in the case of usage level of simple services and in Northern and Western European member states in the case of the more specific usage characteristics.Central European countries have performed average in terms of the indicators in the last five years.

The most recent information available (at the beginning of 2013) is that the share of NGA lines from the total fixed broadband lines is around 28% and the share of fixed broadband lines with at least 30 Mbps is just 18% on average. In Hungary these values are 26% and 14%, so we could follow the average level of EU.

For rural regions a lag behind can be detected both for accessibility and usage. Figure 3 clearly shows that there is a great difference between urban and rural areas in Next Generation Network coverage. In most countries the penetration of next generation infrastructure is 35-75%, the most developed countries are Belgium (98%), Malta (99.3%) and the Netherlands (100%). There are some countries of expressly low coverage, as Cyprus, Greece or Italy. For rural regions the average NGA coverage is 15%, 53.8% in Belgium and 100% in the Netherlands.In Hungary the additional aids wereand will be very important to reduce the differences between rural and urban regions, such as ECOP-4.4.2 or EDOP-3.1.1, and further projects in the future.

To check whether socioeconomic indicators are really correlate with the network we made correlation test. At our analysis the NGA coverage, the broadband infrastructural and usage characteristics of individuals and enterprises (20 variables) and several socio-economic factors (9 variables) have been considered. The analysis has been performed for 27 Member States of the European Union. Table 2. shows the result of the calculation.

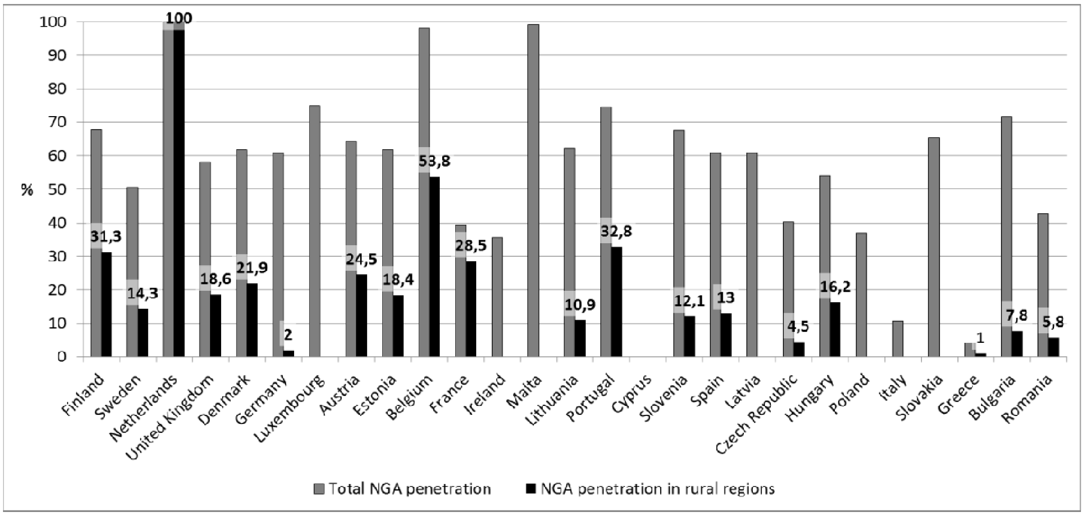

Figure 3. The NGA coverage of rural regions in EU-27 countries in 2011 (missing data: Croatia) (Data source: European Commission, 2011)

Based on our correlation calculations we made two conclusions. From infrastructural aspect a strong connection with socio-economic characteristics can be revealed mainly for broadband accessibility of households and enterprises. This is the result of the small difference between the Member States from this point of view, on an average the 90% of the enterprises has a broadband connection. 5 factors (unemployment rate, rate of graduates from tertiary education, GDP per capita, the rate of employment and the share of agriculture in the GDP) are strictly correlated with the concerned network characteristics. The rate of mainly urban population had no correlation with any network characteristics, furthermore the 2 NG indicators are not in correlation with any socioeconomic factors. 2 indicators (agriculture and the share of agriculture in the GDP) have negative connection with the values of network indicators. The indicators currently have negative correlation with the indicator of the weight of agricultural sector. It is problematic, since many new applications and services connected to agriculture are available or obligatory.

5. Conclusions

We evaluated and compared the EU Member States in terms of infrastructural and usage characteristics. The purpose of the comparison is to determine the actual development level and to determine the social and economic features that are connected to the characteristics of ICT.

In our opinion for Hungary there is no further lag expected for network indicators. Hungary is ranked in the middle class of Networked Readiness Index (NRI) ranking with its 44th place among 144 countries in the 2012-2013 survey (WEF). For network indicators in most cases there is a lag of only a few percentage points with respect to the EU average. This means that thanks to the continuous improvements inter alia we can develop with the average. We can maintain the current path in infrastructure development in rural regions, using additional EU funds. In relation to usage we can probably follow the average EU development in the following years. Based on our analysis we have concluded that the usage of eGovernment services is growing. This growing is caused by the obligation to arrange certain matter only online and the advantages of online procedures appeal the users. In respect of the infrastructure, the development can be considered efficient when it helps to avoid lagging, not causing an over-development because both can be significant problem. The lag behind from EU average means a competitiveness gap. At the same time, the demand of services requiring broadband network is growing gradually. According to the infrastructural indicators, development maintains the path of the previous years.

Table 2. The correlation matrix (Data source: Eurostat, 2013, World Bank, 2012)

	GDP per capita (in PPS)	Agriculture, value added (% of GDP)	Employment rate	Unemployment rate	Population with tertiary education attainment	Rural population (% of total)	Urban population (% of total)	R & D expenditure (% of GDP)	Employment in high-tech sectors (% of total)
IND 1	0,463*	-,499**	0,455*	-,194	0,559**	-,407*	,254	0,479**	0,497**
IND 2	,219	-,245	,351	-,161	0,381*	,155	,028	0,410*	,368
IND 3	0,423*	-,496**	0,770**	-,594**	0,389*	-,370	,353	0,769**	0,594**
IND 4	0,697**	-,428*	0,735**	-,497**	0,608**	-,312	,127	0,719**	0,582**
IND 5	0,384*	-,113	,282	,014	0,380*	-,132	,173	0,467*	,319
IND 6	0,497**	-,238	0,458*	-,285	,364	-,173	,111	0,722**	0,592**
IND 7	-,068	-,105	,245	-,263	,122	,009	,087	-,062	-,117
IND 8	-,201	-,143	,255	-,348	,004	-,021	,245	-,086	,098
IND 9	0,538**	-,414*	0,762**	-,514**	0,590**	-,252	,219	0,705**	0,516**
IND 10	0,605**	-,335	0,766**	-,452*	0,584**	-,291	,121	0,778**	0,538**
IND 11	0,575**	-,266	0,668**	-,302	0,552**	-,239	,110	0,818**	0,495**
IND 12	0,699**	-,389*	0,715**	-,493**	0,486**	-,410*	,217	0,733**	0,541**
IND 13	,323	-,400*	0,425*	-,320	,253	,043	-,223	0,598**	0,460*
IND 14	0,621**	-,335	0,570**	-,313	0,499**	-,399*	,214	0,638**	0,460*
IND 15	,331	-,331	0,539**	-,481**	,218	-,334	,305	0,480**	0,478*
IND 16	0,415*	,103	,136	,095	,324	-,053	,197	,306	,367
IND 17	,353	-,317	,267	-,155	,296	-,080	,016	0,591**	0,519**
IND 18	,357	-,318	0,441*	-,297	,271	,016	-,010	0,519**	0,480**
IND 19	0,398*	-,156	0,478*	-,182	0,517**	-,255	,349	0,679**	0,505**
IND 20	,324	-,139	,251	-,063	0,537**	-,162	,150	0,422*	,233

** correlation is significant at level p<0,01 (Two-tailed)
* correlation is significant at level p<0,05 (Two-tailed

References

Benda, P., Havlíček, Z., Lohr, V., Havránek M. (2011). ICT helps to overcome disabilities. AGRIS on-line Papers in Economics and Informatics Vol. 3. No. 4. pp. 63-69.

Billon, M., Marco, R., Lera-Lopez, F., 2009. Disparities in ICT adoption: A multidimensional approach to study the cross-country digital divide. Telecommunications Policy. Vol. 33. No. 10-11. pp. 596-610.

Brixiova, Z., Li, W. & Yousef, T., 2009. Skill shortages and labour market outcomes in Central Europe. Economic Systems, Vol. 33. No. 1. pp. 45-59.

Çilan, Ç.A., Bolat, B.A. & Coskun, E., 2009. Analyzing digital divide within and between member and candidate countries of European Union. Government Information Quarterly. Vol. 26. No. 1. pp. 98-105.

Economist Intelligence Unit (EIU), 2008. Closing Europe's digital divide. Retrieved 22 August, 2011 from http://graphics.eiu.com/upload/Intel_Digital_Divide.pdf

Gareis K., Hüsing T., Birov S., Bludova I., Schulz C., Korte W.B., 2014. E-Skills For Jobs in Europe: Measuring Progress and Moving Ahead - Final Report 2014 February. Empirica.

European Commission, 2011. Broadband coverage in Europe in 2011. Mapping progress towards the coverage objectives of the Digital Agenda. Research Report for the SMART 0027/2011 Project. Point Topic, London, United Kingdom. 167 p.

European Commission, 2013. Broadband indicators. URL:
http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?action=display&doc_id=2375

Eurostat Database, 2013. http://epp.eurostat.ec.europa.eu.

Graham, M., 2011. Time machines and virtual portals. The spatialities of the digital divide. Progress in Development Studies. Vol. 11. No. 3. pp. 211–227.

Hassler, B., Jackson, A.M., 2010. Bridging the bandwidth Gap: Open educational resources and the digital divide. IEEE Transactions on Learning Technologies. Vol. 3. No. 2. pp. 110-115.

Helbig, N., Gil-Garcia, J.R., Ferro, E., 2009. Understanding the complexity of electronic government. Implications from the digital divide literature. Government Information Quarterly, Vol. 26. No. 1. pp. 89-97.

Hohlfeld, T.N., Ritzhaupt, A.D., &Barron, A.E., 2010. Connecting schools, community, and family with ICT: Four-year trends related to school level and SES of public schools in Florida. Computers & Education. Vol. 55. No. 1. pp. 391-405.

Innovation Indicator. (2011). Retrieved 2012-05-27.

Jayakar, K.P., 2004. Reforming the e-rate. Info, Vol. 6. No. 1. pp. 37-51.

Middleton, K. L., and Chambers, V., 2010. Approaching digital equity: Is Wi-Fi the new leveler? Information Technology & People. Vol. 23. No. 1. pp. 4-22.

Norris, P., 2001. Digital divide: Civic engagement, information poverty, and the Internet worldwide. New York: Cambridge University Press.

Organisation for Economic Co-operation and Development (OECD), 2001. Understanding the Digital Divide. Paris: OECD. Online. Retrieved from: http://www.oecd.org/dataoecd/38/57/1888451.pdf (accessed 14 April 2009).

Shirazi, F., Ngwenyama, O., Morawczynski,O., 2010. ICT expansion and the digital divide in democratic freedoms: An analysis of the impact of ICT expansion, education and ICT filtering on democracy. Telematics and Informatics. Vol. 27. No. 1. pp. 21-31.

Struzak, R., (2010). Broadband Internet in EU countries – Limits to growth. IEEE Communication Magazine, pp. 52-57.

Salajan, F.D., Schonwetter,D.J., Cleghorn, B.M., 2010. Student and faculty inter-generational digital divide: Fact or fiction? Computers & Education. Vol. 55. No. 3. pp. 1393-1403.

Schleife, K., 2010. What really matters: Regional versus individual determinants of the digital divide in Germany. Research Policy. Vol. 39. No. 1. pp. 173-185.

Tas, A. & Tatnall, A., 2008. Using ICT to Improve the Education of Students with Learning Disabilities. In Learning to Live in the Knowledge Society: IFIP International Federation for Information Processing pp. 63-70. Boston, Springer.

van Dijk, J and Hacker, K., 2003. The digital divide as a complex and dynamic phenomenon. The information Society Vol. 19. No. 4. pp. 315-326.

Vicente M. R., Gil-de-Bernabé F. (2010). Assessing the broadband gap: From the penetration divide to the quality divide. Technological Forecasting & Social Change 77. pp. 816-822.

Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B., & Gray, K., 2010. Digital divides? Student and staff perceptions of information and communication technologies. Computers & Education, Vol. 54. No. 4. pp. 1202-1211.

World Economic Forum (WEF). www.weforum.com.