A QUANTITATIVE ANALYSIS OF THE RESOURCES FOR E-LEARNING IN ROMANIA[1]

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ABSTRACT

Information and Communication Technologies have been the main drive behind changes within society and economy for more than a decade. A European Information Society for growth and employment is a strategic framework for the information society.

Widespread access to the Internet is essential for the development of advanced services in the field of e-business, e-government, and e-learning. The resources for the development of e-learning in Romania are very low compared to the other countries in the EU. Romania belongs in a cluster with Bulgaria and Greece, which group is last on almost all the indicators in the present study.

Keywords: Information and Communication Technologies, resources, e-learning, infrastructure.

1. INTRODUCTION

Information and Communication Technologies (ICT) are considered to be critical for the demands of the European society and economy. The i2010 initiative, "a European information society for growth and employment" became the policy framework for ICT, which seeks to increase the efficiency of the European economy by means of wider use of ICT[2]. The initiative is designed to promote a competitive digital economy, to research information and communication technologies, as well as their application in improving social inclusion, public services and quality of life. In this context, the use of IT in education is an important way of increasing economic growth and of reducing poverty, as it is well known that "education and training are the most important investments in human capital"[3].

As Peter Drucker said, "thanks to the Internet, adult education may become our[4] single largest industry"[5]. An e-learning system implies the development and integration of new technologies in the educational environment. In higher education, e-learning is the fastest-growing technology application. Thus, designing and implementing ICT policies and strategies requires proper knowledge of the state of ICT and its use by organizations and individuals. This is necessary mainly to identify the main barriers to the use of ICT in education. Consequently, the measurement of e-learning access and use enables assessment of the digital divide within a country and among countries.[6]

During the last decade, information and communication technologies have become widely available to most people. The study of the accessibility involves taking into consideration of both the infrastructure and the content. In terms of resources, the accessibility for individuals is measured by the following indicators: households with

broadband access, households having access to the Internet at home, level of Internet access, broadband access, broadband penetration rate, IT expenditure, computer skills and Internet skills, individuals regularly using the Internet, individuals doing specific online activities in the previous 3 months, reasons for not having Internet access at home, Reasons for not having broadband access at home, places for accessing Internet, computer use by individuals.

While ICT have become available to a wider public, there remains a gap between users and non-users, often referred to as the 'digital divide'. This may be attributed to a number of factors, including: a lack of infrastructure (particularly in rural areas), or a lack of computer and Internet skills necessary to take part in the information society, or a lack of interest in what the information society can offer. The present paper analyses the first two factors, which are resources for e-learning development in Romania according to the European Union framework.

2. DATA AND METHOD

The study is based on the data from the Eurostat 2009 survey on the use of information and communication technologies in households and by individuals. Survey on ICT usage in households and by individuals in Romania in 2009 was conducted by the National Institute of Statistics.

Households in this survey are defined in terms of those households with at least one member in the age group 16 to 74 years old. The instrument for collecting data was individual questionnaires for people 16-74 years old who use or have used internet and/or computer. From a population of 7 395 749 households a sample of 8332 households was selected. The household survey conducted by the Romanian National Institute of Statistics is based on the use of a master sample EMZOT. EMZOT is a Multifunctional Sample of Territorial Areas, made by the data registered from Population and Dwelling Census in 2002.[7]

In this study, we considered the following variables: percentage of households having access to the Internet at home, percentage of households having broadband access, broadband penetration rate, IT expenditure as percent of the GDP, computer skills, Internet skills, and the percentage of individuals who used Internet, in the last 3 months, for training and education. The values are for 2009. Data were analyzed using statistical methods, namely descriptive measures, inferential methods, and multivariate methods.

3. RESULTS

The access to the Internet of households is measured as percentage of households with at least one member aged 16 to 74, where any member of the household has the possibility to access the Internet from home. In Fig. 1, we can see that Romania is among the last three countries, with a value of Internet access of 38%, comparing with EU average of 63%. The highest value was registered in Netherlands, with a 90% level of Internet access.

Broadband[8] technologies offer users the possibility to rapidly transfer large volumes of data and to keep their access line open. They are considered to be of major importance

when measuring access and use of the Internet. Widespread access to the Internet via broadband is seen as essential for the development of advanced services on the Internet in the field of e-business, e-government, and e-learning. The availability of broadband is measured by the percentage of households that are connectable to an exchange that has been converted to support ADSL or xDSL-technology, to a cable network upgraded for Internet traffic, or to other broadband technologies. In almost all EU Member States, broadband was the most common form of Internet access (an average of 49 % of all EU-27 households in 2008 compared with 11 % of households that used dial-up access or ISDN access), the exception being Romania[9]. In Romania, only 24% of the households have broadband access, while in EU the average was 55%, and in Sweden, the value was 79% (Fig. 2).
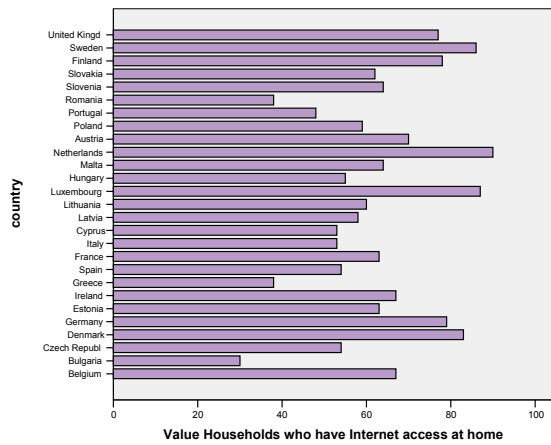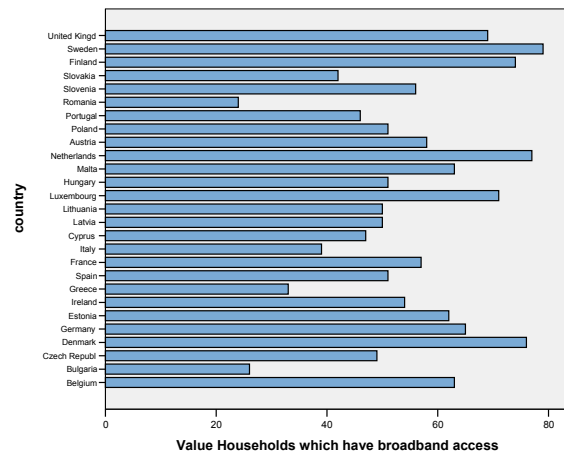
Fig. 1 Internet access

Fig. 2 Broadband access

The broadband penetration rate describes the number of high-speed connections per 100 inhabitants. The number of broadband access lines per 100 inhabitants in Romania was 12,30, while in the EU there were 23 broadband access lines per 100 inhabitants (Fig. 3).
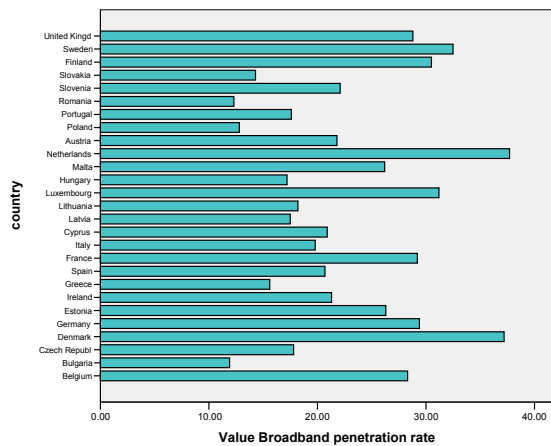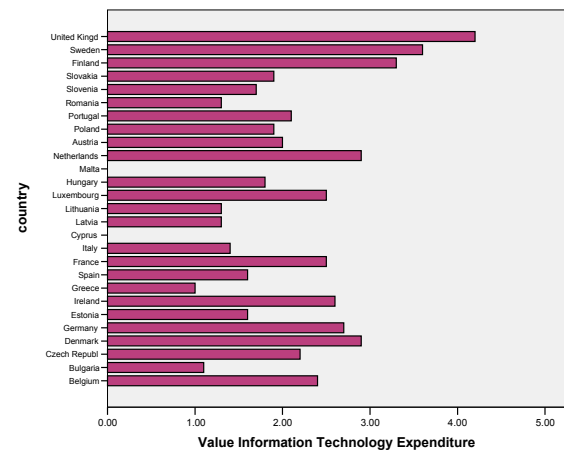
Fig. 3 Broadband penetration rate

Fig. 4 IT expenditure

Information Technology expenditure is expenditure for IT hardware, equipment, software and for other services as a percentage of the GDP. The lowest level was registered in Bulgaria (1.10%), followed by Lethonia, Lithuania, and Romania (1.30%), and Italy (1.40%). In UK the highest value of percentage of GDP of Information Technology expenditure was registered, of 4.20% (Fig. 4).

Beside the technical infrastructure, important resources for e-learning development are computer skills and Internet skills. The level of basic computer skills and that of Internet skills have been measured using a self-assessment approach, where the respondent indicates whether they have carried out specific tasks related to computer use and Internet use. The computer skills used are: copy or move a file or folder; use copy and paste tools to duplicate or move information within a document; use basis arithmetic formula (add, subtract, multiply, divide) in a spreadsheet; compress files; connect and install new devices, e.g. a printer or a modem; write a computer program using a specialized programming language. The computer-related items are: Low level of basic computer skills (Individuals who have carried out 1 or 2 of the 6 computer-related items); Medium level of basic computer skills (Individuals who have carried out 3 or 4 of the 6 computer-related items), and High level of basic computer skills (Individuals who have carried out 5 or 6 of the 6 computer-related items). We noticed that the lowest level was registered in Romania (10%), and the highest level was registered in Denmark and France (35%) (Fig. 5).
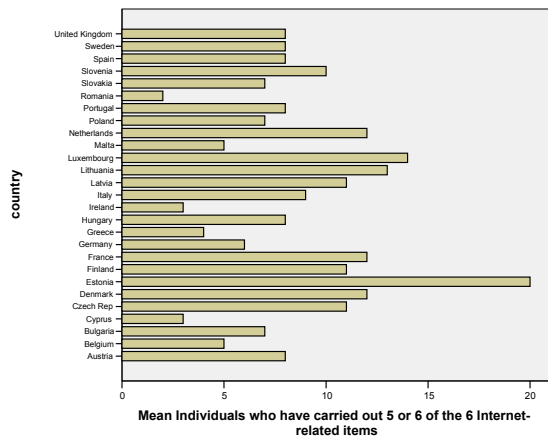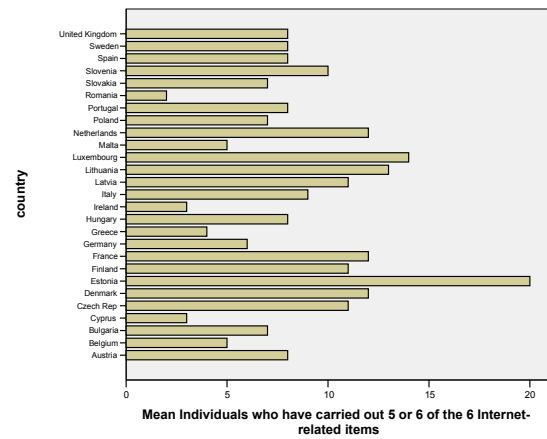
Fig. 5 High level of basic computer skills   Fig. 6 High level of basic Internet skills

The Internet-related items used to group the respondents into 3 levels of Internet skills are: use a search engine to find information; send an e-mail with attached files; post messages to chat rooms, newsgroups or any online discussion forum; use the Internet to make telephone calls; use peer-to-peer file sharing for exchanging movies, music etc.; create a web page. The levels of Internet skills are: Low level of basic internet skills (Individuals who have carried out 1 or 2 of the 6 Internet-related items), Medium level of basic internet skills (Individuals who have carried out 3 or 4 of the 6 Internet-related items), High level of basic internet skills (Individuals who have carried out 5 or 6 of the 6 Internet-related items). Data reveals that the highest value was registered in Estonia - 20%, and the lowest one in Romania,- 2% (Fig. 6).

Another indicator of the e-learning resources is the frequency of Internet use; it has been measured by the percentage of individuals who accessed the Internet every day or almost every day within the last three months on average. Romania is on the last position,

with a value of 31% of individuals who accessed the Internet every day or almost every day within the last three months on average, while the European average was 60% (Fig. 7).
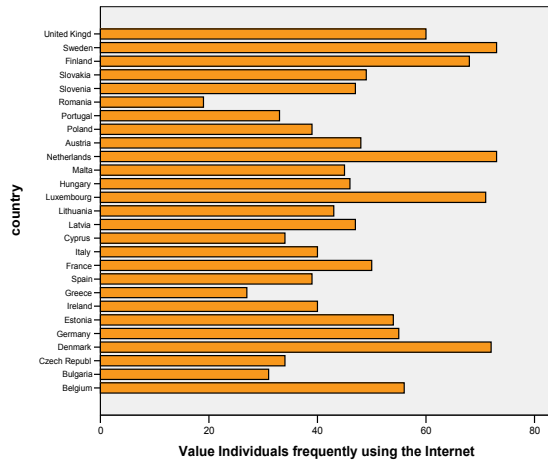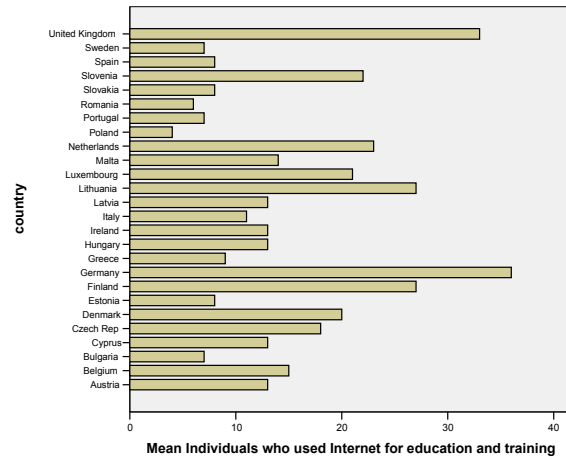

Fig. 7 The frequency of Internet use

Fig. 8 Individuals who used Internet for training and education

There are also important differences among countries regarding the percentage of individuals who used the Internet for training and education in the past 3 months, from 4% in Poland, 6% in Romania, to 36% in Germany[10] (Fig. 8).

Hereinafter, we aim to allocate the set of EU-27 countries to a set of mutually exclusive, exhaustive groups with cluster analysis. We measured five variables on each country: percentage of households who have Internet access, percent of individuals who frequently use the Internet, percent of GDP of IT expenditure, percent of individuals who have carried out 5 or 6 of the 6 Internet-related items, and percent of individuals who have carried out 5 or 6 of the 6 computer-related items. Five groups of homogenous countries were identified concerning the resources for e-learning development. The group with the lowest values for all the indicators under study is cluster 2 and it contains the countries: Bulgaria, Greece, and Romania. The group labels may provide a concise description of patterns of similarities and differences in the data. This cluster is characterized by the following average values: 35% of households have Internet access, 26% of individuals frequently use the Internet, 1.13% of GDP is for IT expenditure, 4% of individuals have carried out 5 or 6 of the 6 Internet-related items, 14% of individuals have carried out 5 or 6 of the 6 computer-related items (Table 1). Also, the countries that form cluster 2 are characterized by high unemployment rate (Bulgaria – 7.8%, Greece – 10.2%, Romania – 7.6%), low values of the percentage of the population aged 25 to 64 having completed at least upper secondary education (Bulgaria – 77.5%, Greece – 61.1%, Romania – 75.3%). At the other end are countries that form cluster 4, with the highest levels. This cluster contains the following countries: Denmark, Luxembourg, Netherlands, Finland, and Sweden.

Table 1 Final Cluster Centers

	Cluster				
	1	**2**	3	4	5
Households who have Internet access at home	62	**35**	56	85	73
Individuals frequently using the Internet	49	**26**	39	71	55
Information Technology Expenditure	1.80	**1.13**	1.86	3.04	2.83
High level of basic Internet skills	12	**4**	8	11	7
High level of basic computer skills	26	**14**	19	30	29

Source: author's calculations

For the validating of cluster solution we performed a discriminant analysis. For finding the variables that have significant contributions to group differences, we used F statistic (Table 2). The F statistic is a ratio of between-groups variability to the within-groups variability. Small values of Wilks' Lambda and also small significance value indicate strong group differences.

Table 2 Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
Households who have Internet access at home	.076	60.595	4	20	.000
Information Technology Expenditure	.207	19.142	4	20	.000
Individuals who have carried out 5 or 6 of the 6 Internet-related items	.614	3.140	4	20	.037
Individuals who have carried out 5 or 6 of the computer related activities	.152	27.931	4	20	.000

Source: author's calculations

Table 3 displays eigenvalues, the percentage of variance, the cumulative percentage, and canonical correlations for each canonical discriminant function. An eigenvalue indicates the proportion of variance explained. A large eigenvalue is associated with a strong function.

Table 3 Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	39.245(a)	95.8	95.8	.987
2	1.211(a)	3.0	98.7	.740
3	.492(a)	1.2	99.9	.574
4	.029(a)	.1	100.0	.168

a First 4 canonical discriminant functions were used in the analysis.
Source: author's calculations

The first canonical variable accounts for 95.8% of the total dispersion. The canonical correlation measures the association between the discriminant scores and the groups. The value of .987 indicates a strong correlation between the discriminant scores and the groups. The discriminant function classifies correctly all the UE-27 countries. We can conclude that the variables selected differentiate the five clusters significantly, from the point of view of the e-learning resources.

5. CONCLUSIONS

Data revealed that, in Romania, the accessibility to computers and the Internet is very low compared to the other European countries. Poor infrastructure raises the problem of the access to education through e-learning. Widespread and affordable broadband access is one of the means of promoting the knowledge based society.

Romanian education institutions began to include new technologies in their development agenda 15 years ago. Several initiatives are trying to keep up with the European and global eLearning trends, principles and actions, focusing on the acquisition of IT equipment and their administrative usage and shifting towards appropriate education software integration and human resource training[11]. The Internet became an addition to the education process. Nowadays, most of Romania's efforts in the area of e-learning are directed towards the educational use of ICT.[12]

In Romania, the improvement of school infrastructure and the connection of educational institutions to the Internet have been the goals of two major programs: SEI (Education IT-based System) and RoEduNet (extending the Romanian educational information network). Beside these programs, initiatives and projects aiming to support the innovation in education were undertaken by various institutions and individuals. In higher education the level of implementing the new learning technologies and up-to-date ICT infrastructure is quite high, mainly due to the involvement of Romanian higher education institutions within European and international projects in the field of technology-enhanced learning. 58% of Romanian universities use e-learning solutions in their activity.

The information technology will have a stimulating role for education only if it is rationally introduced[13]. Is has to be understood that the introduction of new cyberspace technologies requires a special approach, which is inter-disciplinary par excellence.[14] But, in Romania, education and the training systems are not yet adequately prepared. Their readiness must be considered in terms of institutional capacity, properly trained staff and access to technology. Using e-learning systems means that more individuals are able to use ICT, and they have access to the technical infrastructure to do it.

The social and economic potential of the Internet in the future is based on the premise of Internet available to all. IT resources are key dimensions of an e-learning framework. The real impact of evolving technologies upon education and training systems, as most of the researches envisage, refers to the shift in considering education for all, consisting in the empowerment of individualized instruction, stimulation of creative potential and cognitive skills for future knowledge-builders, development of competences and skills for life-long learning[15].

ACKNOWLEDGMENT

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