PETÁKNÉ BALOGH Anikó

E-LEARNING SKILL AND USE IN EU COUNTRIES – A STATISTICAL ANALYSIS

The article investigates the division between member states of the European Union considering the aspect of their level of information and communication technology (ICT) development focusing on e-learning. With the help of discriminant analysis the countries are categorized into groups based on their ICT maturity and e-learning literacy level of development. Making a comparison with a benchmarking tool, the ITU (International Telecommunication Union)'s ICT Development Index (IDI) the results are confirmed partly correct. The article tries to find economical explanations for the re-grouping of the countries ranking. Finally the author examines the reliability of Hungary's ranking results and the factors which may affect this divergence from the real picture.[1]

Keywords: **European Union, e-learning literacy, statistical analysis**

The Digital Agenda, Europe's roadmap to utilise the results of a digital society states that "the digital era is about empowerment and emancipation; background or skills should not be a barrier to accessing this potential" (Digital Agenda, 2010: 25). As more and more actions are carried out online, using the internet has become an integral part of daily life for many Europeans. In addition, Europe is suffering from a growing professional ICT skills shortage and could lack the competent experts to fill as many as 700,000 IT jobs by 2015 (Digital Agenda, 2010).

These weaknesses are excluding many citizens from the digital society and economy and are holding back the positive impact that ICT can have on productivity growth. The chosen subject of this article is to provide further insight to these problems. I examine the connection between some education-related output and performance of the 27 EU countries by means of statistics.

EU Action Plans

The European Commission always put an emphasis on the development of the information society and has launched subsequent programs to support this idea.

eEurope

The European Commission launched the eEurope initiative in 2000 with the goal of speeding up Europe's transition towards a knowledge based economy and to accomplish the benefits of higher growth, more jobs and access for all citizens to the new opportunities of the information age. The phases of the eEurope Action plan focused on exploiting the advantages of the Internet, increasing connectivity, utilising broadband technologies to deliver online services in both the public and private sector. The eEurope initiative ended in 2005 and was followed by the i2010 initiative.

The Lisbon Strategy

European Union leaders decided on a new strategy in March 2000 at the Lisbon summit. The goal was to make Europe more dynamic and competitive. The programme became known as the "Lisbon Strategy". It was re-started in Spring 2005 after proving unproductive after five years and became more focused on expansion and jobs.

i2010: a policy response to the challenges

The subsequent i2010 program is a strategic framework for the information society and a key

element of the renewed Lisbon Strategy, and it offers a strategy for the ICT and media sector. It concentrates on establishing a Single European Information Space to promote an open and competitive internal market for electronic communications and digital content, innovation and ICT R&D promotion to stimulate ICT take-up by businesses and finally on digital inclusion, better public services and quality of life based on sustainable development.

The Digital Agenda

The Digital Agenda 2010, Europe's strategy for a successful digital economy, outlines policies and actions to utilise the benefits of the digital revolution. Some of the main issues are enhancing digital skills, literacy and e-inclusion. The Digital Agenda also considers eLearning as an important element of the digital society.

Literature review – Information Society

The notion of information society dates back to the 1930s when Austrian-born economist Fritz Machlup (Machlup, 1962) published his book The Production and Distribution of Knowledge in the United States. With this work he established the new field of information economics. The transformation to a knowledge economy has become even more significant especially after the spreading of the internet. The next important author is Peter Drucker (Drucker, 1969) who claimed that there is a transition from a material goods based economy to a knowledge-based one. Marc Porat (Porat, 1977) defines a primary and a secondary sector of the information economy. Porat uses the total value added by the primary and secondary information sector to the GNP as an indicator for the information economy. Based on these indicators, the information society has been defined by as a society where more than half of the GNP is produced and more than half of the employees are active in the information economy (Deutsch, 1983).

Digital Economy

The concept of a digital economy emerged in the last decade of the 20th century. According to Nicholas Negroponte's (Negroponte, 1996) allegory, society changes from processing atoms to processing bits. In Richard Barbrook's definition (Barbrook, 1999), the digital economy is characterized by the emergence of new technologies (computer networks) and new types of workers (the digital artisans), which is strongly similar to the notion of Drucker's knowledge worker (Drucker, 1993).

E-learning literacy

E-learning has been a great promise of the 2000s but like other ICT-related phenomena e.g. the dotcom companies, it also proved to be overhyped. After the period of disappointment, e-learning started to reach the level of enlightenment. The e-learning maturity model described by Marshall and Mitchell (Marshall – Mitchell, 2002) refers to corporate and educational institutions so it is only party applicable for our purposes

To define e-learning literacy the definition of digital literacy needs to be expanded to a broader context. Glister (Glister, 1997) defines digital literacy as the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers. Jones-Kavalier and Flanigan (Jones-Kavalier – Flannigan, 2006) expands the term to a person's ability to perform tasks effectively in a digital environment. Literacy also includes the ability to read and interpret media, to reproduce data and images through digital manipulation, and to evaluate and apply new knowledge gained from digital environments. At its broadest definition, e-learning includes instruction delivered via all electronic media including the Internet, intranets, extranets, satellite broadcasts, audio/video tape, interactive TV, and CD-ROM (Govindasamy, 2002). Buckingham argues about the extension of digital literacy to a broader term of information literacy that goes well beyond some of the approaches that are currently adopted in the field of information technology in education (Buckingham, 2010).

This definition can be used as a starting point to define e-learning literacy: *e-learning literacy is the extent and use of skills and competences, an individual applies to use online resources for the purpose of learning.*

To assess the e-learning literacy level of population in different countries I will examine certain statistical data describing use and skills related to activities which can be linked to e-learning in general.

A Benchmarking Tool: The ITU (International Telecommunication Union)'s ICT Development Index (IDI).

ITU (International Telecommunication Union) is the United Nations specialized agency for information and communication technologies – ICTs. The publication "Measuring the Information Society" has been issued since 2007 capturing the level of ICT advancement of 159 countries worldwide. The two indices, the ICT Development Index (IDI) and the ICT Price Basket are two benchmarking tools to measure Information Society. It also calculates the global digital divide and observes how it has developed in recent years. For our

purposes the ICT Price Basket was not as relevant as the ICT Development Index, as the Price Basket focuses on tariff of mobile and fixed line telephony, so will use the IDI.

The ICT Development Index (IDI) is a composite index made up of 11 indicators covering ICT access, use and skills. It has been constructed to measure the level and evolution over time of ICT developments.

In defining the IDI, ITU uses the following three-stage model referring to the level of ICT development of the different countries:

Stage 1: ICT readiness (reflecting the level of networked infrastructure and access to ICTs),
Stage 2: ICT intensity (reflecting the level of use of ICTs in the society),
Stage 3: ICT impact (reflecting the result/outcome of efficient and effective ICT use).

The actual development level of a country depends on the combination of three components: ICT infrastructure/access (stage 1), ICT intensity/use (stage 2), and ICT skills (ITU, 2010). Thus, the first two stages are reflected in the first two components of the IDI. Reaching the third stage, and hence maximising the impact of ICTs, essentially depends on skills, which is the third component. According to ITU, ICT skills determine the effective use that is made of ICTs and are the key to maximizing the possible impact of ICTs on socio-economic development. Most countries in Europe, and in particular the EU members, have progressed from the first stage of ICT development (access) to the second stage (use). Key success factors include the adoption of a harmonized legal and regulatory framework and common technological platforms among EU member states (IDI, 2010).

The indicators ITU uses to define the IDI are the following

Access indicators:
1. Fixed telephone lines per 100 inhabitants,
2. Mobile cellular telephone subscriptions per 100 inhabitants,
3. International Internet bandwidth (bit/s) per Internet user,
4. Proportion of households with a computer,
5. Proportion of households with Internet access at home.

Use indicators:
6. Internet users per 100 inhabitants,
7. Fixed broadband Internet subscribers per 100 inhabitants,
8. Mobile broadband subscriptions per 100 inhabitants.

Skills indicators:
9. Adult literacy rate,
10. Secondary gross enrolment ratio,
11. Tertiary gross enrolment ratio.

IDI values are much higher in developed than developing countries. Similar observations can be made about the three IDI sub-indices (access, use and skills), with higher index levels in the developed countries, and higher annual growth rates in developing countries.

Based on their IDI value, countries are grouped according to ICT development (or IDI) levels: high, upper, medium, and low levels. Most countries in Europe, and in particular the EU members belong to the first two groups (high and upper), only Albania falls into the medium category. It means that EU member countries have progressed from the first stage of ICT development (access) to the second stage (use).

- High (IDI values above 5.67): Economies in this group have high levels of ICT access and use and high ICT skills. Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Malta, Netherlands, Norway, Portugal, Slovenia, Spain, Sweden, UK.
- Upper (IDI values between 3.64 and 5.64): Economies in this category have achieved a prominent level of access to and use of ICTs, and ICT skills. Bulgaria, Cyprus, Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic.

Methods

The hypotheses are the following:

1. Based on the geographical and geopolitical categorization of the UN, European Union member states are classified into four groups. These groups significantly differ from each other based on their development level of ICT and e-learning literacy.
2. There is a connection between the level of e-learning literacy and expenditure on public and private education in the EU member states.
3. Estonia as the flagship of post-socialist countries concerning ICT however may protrude from this group of new member countries in an ICT maturity point of view. Estonia is a positive example well-known for its quick development especially in the field of e-government (Ifinedo, 2005).

Data characteristics

Tables and data were used exclusively from the Eurostat database concerning information society indicators: (http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/data/main_tables). These statistics track the usage of Information and Communications Technologies (ICT). In some cases where no information was available, data was used from 2008. The aspects of choice for the countries were the following:

- they should be the members of the European Union,
- there is a reasonable amount of data available.

Although Norway is not a member of the EU it was included in the analysis as almost all data was provided in the corresponding tables. Concerning the second aspect Luxembourg was omitted due to little data being available in several tables. No distinction was made between the countries within and out of the Euro zone.

For the discriminant analysis I use a grouping system based on the United Nation's composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings (United Nations, 2011), not counting those countries which are not part of the EU. Thus, dependent variables (grouping variables) are defined as follows, see Table 1.

Table 1

Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings

Northern Europe	Western Europe	Southern Europe	Eastern Europe
Denmark	Austria	Cyprus	Bulgaria
Finland	Belgium	Greece	Czech Republic
Iceland	France	Italy	Hungary
Ireland	Germany	Malta	Poland
Norway	Netherlands	Portugal	Romania
Sweden		Slovenia	Slovakia
UK		Spain	Estonia
			Latvia
			Lithuania

Source: The United Nations (edited by the author)

Thus the dependent variables for the analysis will be as follows:

- High Top 1 (Northern Europe) = Group 1,
- High Top 2 (Western Europe) = Group 2,
- High Medium (Southern Europe) = Group 3,
- Upper (Eastern Europe) = Group 4.

As the ITU IDI index describes access, use and skills indicators, we also use similar Eurostat ones but with a different set of data. I focus on access indicators like broadband penetration and level of internet access, two financial indicators of education expenditure and eight indicators referring to the level of e-skills of individuals and enterprises. Similarly to the IDI indicators I have divided the Eurostat indicators into three categories. For the detailed explanation of each indicator see Appendix 1.

The following variables are used to measure the ICT development level of the EU member countries and their level of e-learning literacy.

Indicators on education finance and employment

1. Annual expenditure on public and private educational institutions compared to GDP per capita (EXP_COMP_GDP),
2. Public expenditure on education (PPE),
3. Employment rate by gender, age group 15-64 (EMPL).

E-skills and use of individuals

4. Enterprises using e-learning applications for training and education of employees (ENT_TR),
5. Individuals' level of computer skills (COMP_SKILL),
6. Individuals' level of Internet skills (INT_SKILLS),
7. Individuals using the Internet for doing an online course (COURSE),
8. Individuals using the Internet for seeking information with the purpose of learning (SEARCH_LEARN),
9. Individuals using the Internet for training and education (TRAINING),
10. Most recent training course on computer use (COMP_TR).

Indicators on Education Finance: I assume that expenditure on education significantly increases digital and e-learning literacy level. The annual expenditure on public and private educational institutions per student compared to GDP per capita relates the resources (e.g. expenditure for personnel, other current and capital expenditure) being devoted to education in public and private educational institutions to the overall economic welfare of a country. It is based on full-time equivalent enrolment. The use of GDP per capita allows the

comparison of levels of economic activity of different sized economies (per capita) irrespective of their price levels (in PPS). Public expenditure on education is expressed as a percentage of GDP. Generally, the public sector funds education either by bearing directly the current and capital expenses of educational institutions or by supporting students and their families with scholarships and public loans as well as by transferring public subsidies for educational activities to private firms or non-profit organisations. Piroska Szalai statistically proved (Szalai, 2010) that an extremely strong correlation exists between lifelong learning and employment rate. Thus I use the employment rate indicator from the 2010 Eurostat tables.

E-skills of individuals: Eurostat has been assessing the e-skills of individuals since 2005. Their definition of e-skills is quite broad: it is a compound indicator of computer skills (use a mouse to launch programs such as an Internet browser or word processor, copy or move a file of folder, use copy and paste tools to duplicate or move information on screen.

Use basic arithmetic formulae (add, substract, multiply, divide) in a spreadsheet, compress files, write a computer program using a specialised programming language) and internet skills (use a search engine to find information, send an email with attached files, post messages to chatrooms, newsgroups or an online discussion forum, use the Internet to make phone calls, use peer-to-peer file sharing for exchanging movies, music, etc., create a web page).

My choice of data is more specific. It outlines the uptake of ICT skills and as such it gives a profile of the e-learning potential of the different countries. The data referring to enterprises using e-learning applications for training and education of employees, individuals using the Internet for doing an online course, individuals using the Internet for seeking information with the purpose of learning, individuals using the Internet for training and education, most recent training course on computer use give a specific idea on the activities, which are connected to e-learning literacy. This finding is crucial as there is little data available concerning e-learning activities in different statistical databases (Eurostat, OECD and ITU) so the results show a general maturity level of e-learning in the observed countries.

Results

In this paper the SPSS statistical software was used to perform factor analysis and discriminant analysis (DA). With the assistance of this statistical software such relationships are discovered, which could not be examined any other way. The different matrices are used to establish the mutual relations and connections. With the help of these methods the extent of ICT maturity and identify will be defined in the different groups of EU countries.

Discriminant analysis

H1: Based on the geographical and geopolitical categorization of the UN, European Union member states are classified into four groups. These groups significantly differ from each other based on their development level of ICT and e-learning literacy.

For the examination of the first hypothesis (H1) I have applied discriminant analysis (DA). It is such a multivariate method which allows the grouping of the different cases based on the values of the independent variables (Tryfos, 1989). By using DA those coefficients (the characteristics of independent variables) may be identified, which significantly differentiate the groups and the linear combinations of independent variables justify. I examine in the hypothesis, whether in what extent does the linear combination of the chosen explanatory variables prove the difference between the groups. There are some limits and distorting features of this method. The numbers of independent variables should be smaller than the numerical values of the smallest group. In this case it equals with the High Top2 country group, namely 5. The number of independent variables is 11. Also the full sample size ideally is 10 times bigger than the number of independent variables. In this case the ideal sample size should be 121, but as there is only 28 countries in the EU this is an unachievable goal.

Normality

The variable "Individuals using the Internet for doing an online course (COURSE)" had to be eliminated as it did not stand the proof of the analyses' main criterion, the normality test (Shapiro-Wilks and Kolmogorov-Smirnov table). "Individuals using the Internet for training and education" was also on the borderline with Sig. 0,269, but I kept it.

For the full details of the discriminant analysis performed see Appendix 3.

Significance

Using the analysis of variance (ANOVA) the Wilks' lambda distribution and the significance (Sig.) value shows, that the effect of "Individuals using the Internet for training and education" (Sig.: 0,000), "Individuals'

level of Internet skills" (Sig.: 0,000), "Individuals using the Internet for seeking information with the purpose of learning" (Sig.: 0,001), "Public expenditure on education" (Sig.: 0,006) and "Individuals' level of computer skills" (Sig.: 0,093) are significant.

Based on the Standardized Canonical Discriminant Function Coefficients "Individuals using the Internet for training and education", "Individuals using the Internet for seeking information with the purpose of learning" and "Annual expenditure on public and private educational institutions" have a considerable effect on the discriminant functions. According to the multicorrelation matrix, there is no correlation between the independent variables.

In our case there are three discriminant functions. The first function explains the dependent variable in 73,4%, the second function in 16,6% and the third function in 10%. Based on Wilks' Lambda the first and the second functions are significant and strong. The third function is neither strong, nor significant, so I will not take it into consideration.

According to the Structure Matrix (Pearson correlation coefficient matrix) the first discriminant function underlines the importance of "Individuals' level of computer skills," and "Individuals' level of Internet skills", while the second function refers to of "Individuals using the Internet for training and education", "Individuals using the Internet for seeking information with the purpose of learning", "Public expenditure on education" and "Annual expenditure on public and private educational institutions compared to GDP per capita". These are the grouping variables.

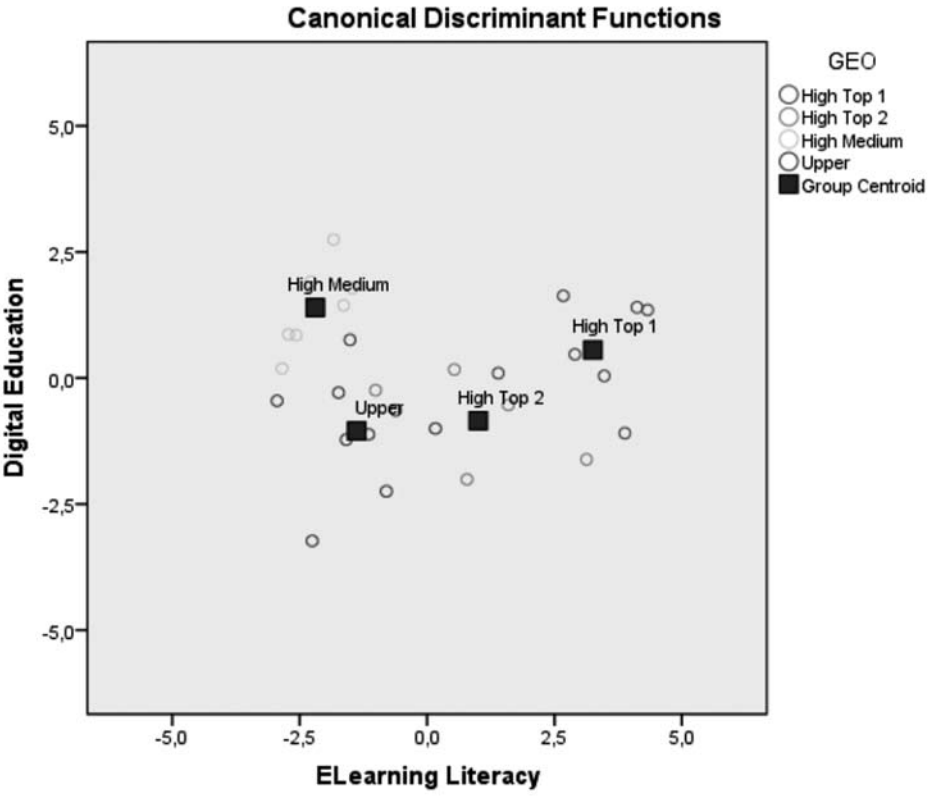
In Group 1 (Northern Europe) and Group 2 (Western Europe) the first discriminant function is the representative, because its value is the biggest (3,253 and 1,005). In Group 3 (Southern Europe) the second discriminant function is represented, the highest value being 1,397. In Group 4 it is the third function, but it is not significant, see above. Thus within the groups the characteristics defined by the functions describe the groups themselves.

As a simplified explanation it could be said that in Northern and Western European countries individuals' have good Internet skills and competences to use the Internet for training and education. Thus the first function refers to the level of eLearning literacy.

In Southern Europe the expenditure on public and private educational institutions encourages individuals to use the Internet for seeking information with the purpose of learning, and for training and education, though their internet and computer skills may not be as high, so they are still in a developing phase. E.g. Europe's Digital Competitiveness Report 2010 states about Italy that "ICT for teaching and learning is one of the sectors where the government is investing, thus stimulating innovation in the education system and opening up a market for digital education. "(European Commission, 2010: p. 190.) The second function refers to the extent on digital education. Figure 1 represents the clusters EU member states form. The groups overlap, but they form definite clusters. These findings support the second hypothesis well.

Figure 1

EU countries grouped by the discriminant analysis



Source: SPSS analysis result, edited by the author

Factor analysis

H2: There is a connection between the level of e-learning literacy and expenditure on public and private education in the EU member states.

For the examination of the second hypothesis (H2) I have applied factor analysis by defining the factors with principal component analysis.

Factor analysis is a method for investigating whether a number of variables are linearly related to a smaller number of unobservable factors (Tryfos, 1998). For the factor analysis I have applied principal component analysis. When describing the factors, the results of *Rotated Component Matrix* were used.

The factor analysis confirms, that computer and internet related skills are connected with each other. Naturally this is not a simple cause and effect causality. It is also noteworthy, that employment rate and public expenditure on education are also placed on this factor. "Annual expenditure on public and private educational institutions" and "Enterprises using e-learning applications for training and education of employees" form another factor. There is a strong correlation between "Public expenditure on education" and "Individuals using the Internet for training and education" (r = 0,652). Also „Individuals using the Internet for training and education" and "Individuals using the Internet for seeking information with the purpose of learning" has a strong and significant connection (r = 0,978). "Individuals' level of Internet skills" and „Individuals using the Internet for seeking information with the purpose of learning" also has a significant and good medium (r = 0,617) strength correlation.

There is no evidence for correlation between "Public expenditure on education" and "Individuals' level of computer skills". (Sign.: 0,474) There is also no significant verifiable connection between "Annual expenditure on public and private educational institutions" and the all the other variables described above, see the Correlations table in Appendix 3.

Results

After completing the DA my first hypotheses is true as 24 countries out of 28 stayed in the group they hypothetically were put into. Based on the classification results 85,7% of the original grouped cases were correctly classified, so it can be accepted as a good value. Thus the independent variables chosen significantly define the four groups analysed. Nevertheless this result is a bit optimistic.

In cross validation, each case is classified by the functions derived from all cases other than that case. Cross validation is done only for those cases in the analysis. 64,3% of cross-validated grouped cases were correctly classified. 64,3% is a bit pessimistic though, so the truth is somewhere between the two results. The independent variables define the groups, so statistically it is worth examining the 11 variables by country groups.

Thus the results of the discriminant analysis slightly reordered the groups of countries, see Casewise Statistics in Appendix 3. The countries moving up from the Upper group to High Top2 is Estonia, from High Medium is Bulgaria and Latvia. Finally the UK falls back from the High Top 1 group to High Top 2. *(Table 2)*

Table 2

Countries re-ordered after DA

High Top1	High Top2	High Medium	Upper
Group 1	Group 2	Group 3	Group 4
Denmark	Austria	Cyprus	Czech Republic
Finland	Belgium	Greece	Hungary
Iceland	France	Italy	Poland
Ireland	Germany	Malta	Romania
Norway	Netherlands	Portugal	Slovakia
Sweden	**UK**	Slovenia	Lithuania
	Estonia	Spain	
		Bulgaria	
		Latvia	

Source: Edited by the author

Comparison with the ITU IDI

When matching the statistical results with the ITU IDI index of 2010 the two tables complement each other well. The Scandinavian countries (except Norway) take up the first 5 places on the top of the list. Netherlands, UK, Norway, Germany and Austria come. This result proves our discriminant analysis as the UK is among the High Top 2 countries. The next countries are France, Belgium and Ireland which are also members of the Western European countries group. The following cluster is Slovenia, Spain, Portugal, Italy, Malta and Greece, which are all Southern European countries. Finally Estonia, Hungary, Lithuania, Cyprus, the Czech Republic, Poland, Slovakia, Latvia and after some gap Bulgaria and Romania close the line. These countries are all post-socialist ones except Cyprus.

Discussion

The discriminant analysis did prove that Estonia is more developed, than the rest of the Easter European countries concerning e-learning literacy. The European

Commission's Europe's Digital Competitiveness Report (European Commission, 2010) gives an outline on the member states. Matching these descriptions with the Eurostat data our results can be explained in more detail.

Bulgaria

Bulgaria is still near the bottom of the rankings for most Information Society indicators compared to the EU-27, but in 2009 made consistent progress in all sectors. Multi-annual modernisation initiatives launched in previous years began to deliver results in 2009. Modern IT infrastructure has been implemented and ICT solutions are partly active in both the public and private sectors, including government sites, portals for accessing online services and information. The expenditure on education compared to GDP per capita is relatively high, 27,4%. Also Bulgaria has quite a good level of lifelong learning, 16,5% of individuals who received education or training in the four weeks preceding the survey. Thus it explains why Bulgaria has been promoted from the Upper group to the High Medium group.

Estonia

Estonia is the highest ranking country in Central and Eastern Europe in terms of network readiness. EGovernment facilities are among the best in Europe, but the take-up of these services is not as high (European Commission, 2010: p. 150.). 6% of the population has done an online course in the past 3 months which is an average number in Europe, but definitely higher than the rest of the post-socialist countries. Also individuals seeking information on the Net for learning purposes is 26% which places Estonia in the lower third of the EU member states in this aspect. Estonia has higher extent of regular and frequent internet users than the average for the EU, and only about 25% of the population has never used the internet, compared to around a third for the EU. Estonia records above-average use of most internet services (European Commission, 2010: p. 150.).

Latvia

The Information Society in Latvia is at an early stage of development but is making significant improvements to bridge the gap with the EU average. Rates of internet use and non-use in Latvia are close to the EU average. Take-up of internet services is also reasonably high. Participation in looking for information about goods and services is close to the EU average and for a number of other services even higher. Particularly, Latvia records remarkably large above-average numbers using the internet for reading online newspapers, internet banking, uploading self-created content, and doing online courses (European Commission, 2010: p. 166.).

UK

The United Kingdom keeps its position as one of the leading European countries in the Information Society, with most indicators above the EU average. The UK ranks 6th in the number of regular and frequent internet users among the population and also records some of the highest take-up ratio for numerous internet services (European Commission, 2010: p. 190.).

Hungary

Hungary was not re-classified by the DA. Nevertheless I argue for Hungary's better position that it shows from the results. According to the EU country report ICT represent about 6% of the total Hungarian economy thus being one of its most dynamic sectors. Broadband internet is widely available in Hungary, mainly in the capital and other cities. Despite the fact that internet penetration is still relatively low, the percentage of internet users has already reached the EU average level. As for internet usage categories, an increasing trend is detected for the past few years. Hungary is close to the average, or in a number of cases already above it. The percentage of households using a broadband connection is close to EU average and definitely higher than Italy, Spain and Portugal. The percentage of internet users who have used the internet to find information about goods and services and behaviour related to buying in the last 3 months is also increasing.

To find more explanation to the results let's examine the statistical data closely related to e-learning *(see Figure 2),* namely the percentage of individuals using the Internet for doing an online course.

Here the explanation can be found for some country results. The UK is in the top third of the countries' list, but definitely lagging behind the Scandinavian countries. Estonia and Latvia are also on the upper part of the list, while Hungary is somewhat lower than the average with 3%.

Conclusions

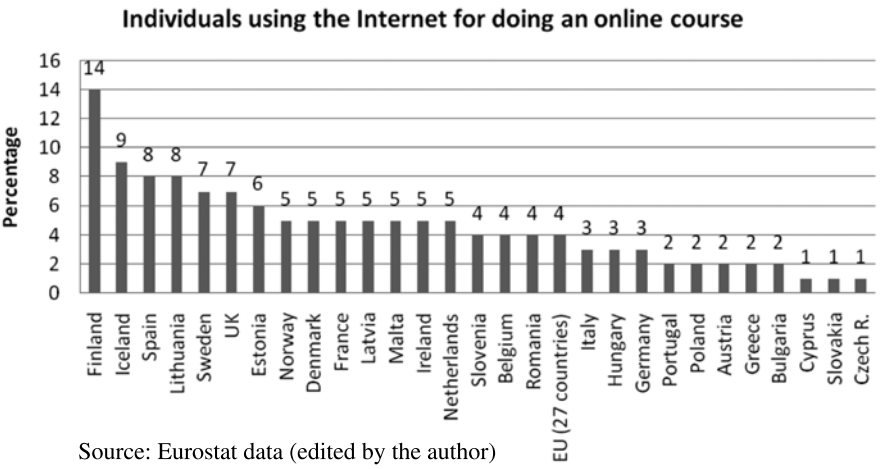
The first hypothesis, that European Union member states are classified into four groups significantly different from each other based on their development level of ICT and e-learning literacy is verified by the results of the discriminant analysis.

The second hypothesis, whether there is a connection between the level of e-learning literacy and expenditure on public and private education in the EU member states is partly verified as there is a strong correlation between public expenditure on education and individuals' skills on using the Internet for seeking information. Nevertheless the analysis did not find a connection between expenditure and other variables related to e-learning skills, so this hypothesis is only partly true.

The third hypothesis stating that Estonia as the flagship of post-socialist countries concerning its e-learning literacy level is verified. The discriminant analysis re-grouped Estonia, so it moved up to the High Top 2 group with the rest of Western Europe. Estonia is a positive example well-known for its quick development especially in the field of e-government, but its results related to e-learning literacy are not above the average, see the comparison above in Figure 2.

Figure 2

Percentage of the population in EU member states using the Internet for doing an online course in 2010



Source: Eurostat data (edited by the author)

As a starting point for further research it must be noted, that the concept of a "country" within the EU is not a strict definition either. With free movement and employment of workers between the member states (Directive 2004/38/EC), which is an essential element of the European Union legislation, country borders are becoming less definite. Also by the introduction of new IT solutions, which are comprised of best-of-breed components, offer clients the ability to select vendors with the experience needed to address their unique business needs. The customer employs international teams often working in different countries, thus the definition of a single country loses its meaning.

Nevertheless these results may also be a starting point for further economic analyses and explanations.

Footnotes

[1] Research was supported/subsidized by the TÁMOP-4.2.2.B-10/1 „Development of a complex educational assistance/support system for talented students and prospective researchers at the Szent István University" project.

Bibliography

Barbrook, R. (ed.) (1999): The Digital Economy. Brooklyn, N.Y.: Autonomedia

Buckingham, D. (2010): Defining Digital Literacy; What Young People Need to Know About Digital Media. Medienbildung in neuen Kulturräumen

Burton-Jones, A. (1999): Knowledge Capitalism. Oxford: Oxford University Press

Deutsch, K. (ed.) (1983): Soziale und politische Aspekte der Informationsgesellschaft. Frankfurt am Main: Economy, Compuscript

*Directive 2004/38/*EC of the European Parliament and of the Council of 29 April 2004 on the right of citizens of the Union and their family members to move and reside freely within the territory of the Member States

Drucker, P. (1969): The Age of Discontinuity. London: Heinemann

Drucker, P. (1993): Post-Capitalist Society. New York: Harper Business

Egri Z. – Ménes A. – Tánczos T. (2007): A tudásbázis és a munkaerő-piaci jellemzők regionális összehasonlító elemzése az európai térségben a Lisszaboni stratégia tükrében. Humánpolitikai Szemle; XVIII., p. 17–28.

European Commission (2000): eEurope Initiative. Feira

European Commission (2000): The Lisbon Strategy. Lisbon

European Commission (2005): i2010 – A European Information Society for growth and employment. Brussels

European Commission (2010): A Digital Agenda for Europe. Brussels

European Commission (2010): ICT Country Profiles. Brussels: European Commission

European Commission (2010): European Digital Competitiveness Report. Brussels: European Commission

Eurostat (2010): Information society statistics. European Commission. http: //epp.eurostat.ec.europa.eu/portal/page/portal/information_society/introduction. Dowloaded on. 2012.03.20.

Fehér P. (2007): Tudás és menedzsment – Tudásmenedzsment. Vezetéstudomány; 38., p. 2–5.

Gilster, P. (1997): Digital Literacy. New York: Wiley and Computer Publishing

Govindasamy, T. (2002): Successful implementation of e-learning: pedagogical considerations. Internet and Higher Education 4, p. 287–299.

Ifinedo, P. – Davidrajuh, R. (2005): Digital divide in Europe: assessing and comparing the e-readiness of a developed and an emerging economy in the Nordic region. Electronic Government: An International Journal; 2

International Telecommunication Union (2011): ICT Development Index (IDI). Geneva

Jones-Kavalier, B.R. – Flannigan, S.L. (2006): Connecting the Digital Dots: Literacy of the 21st Century. Educause Quarterly

Machlup, F. (1962): The production and distribution of knowledge in the United States. Princeton, NJ.: Princeton University Press

Marshall, S. – Mitchell, G. (2002): An e-learning maturity model? 19th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education. Auckland, New Zealand

Negroponte, N. (1996): Being digital. New York: Vintage Books.

Nonaka, I. – Takeuchi, H. (1995): The Knowledge-Creating Company. Oxford: Oxford University Press

Noszkay E. (2006): Új utak, új módszertani megoldások a felsőoktatásban – O & TUMEN, a kompetenciaalapú képzés tudásmenedzselési módszere. Vezetéstudomány; 10., p. 50–62.

Noszkay, E. – Kende, G. – Seres, G. (2007): Role of the knowledge management in modern higher education – the e-learning. Academic and Applied Research in Military Science, Miklós Zrínyi National Defence University; 6, p. 559–573.

OECD (2005): E-learning in Tertiary Education: Where Do we Stand? Paris: OECD

Polanyi, M. (1966): The Tacit Dimension. Garden City, N.Y.: Doubleday & Co.

Porat, M. (1977): The Information Economy. Washington, DC: US Department of Commerce

Sveiby, K. E. (2003): Szervezetek új gazdagsága: a menedzselt tudás. Budapest, KJK Kerszöv

Szalai, P. (2011): Rendszeres edzés = a foglalkoztatáshoz szükséges kompetenciák karbantartása. Magyarország társadalmi-gazdasági helyzete a 21. század első évtizedeiben. Kautz Gyula Emlékkonferencia. Győr

Szűcs I. (2004): Alkalmazott statisztika. Budapest: Agroinform Kiadó

Tryfos, P. (1989): Business Statistics. Whitby: McGraw-Hill Ryerson

United Nations (2011): Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings. New York: UNO

Article provided: 2011. 9.
Article accepted: 2012. 5.

APPENDICES

Appendix 1

Explanations of indicators and metadata from the Eurostat website data tables

- EXP-COMP: The annual expenditure on public and private educational institutions per pupil/student compared to GDP per capita relates the resources (e.g. expenditure for personnel, other current and capital expenditure) being devoted to education in public and private educational institutions to the overall economic welfare of a country. It is based on full-time equivalent enrolment. The use of GDP per capita allows the comparison of levels of economic activity of different sized economies (per capita) irrespective of their price levels (in PPS).

- PPE: Public expenditure on education: This indicator is defined as total public expenditure on education, expressed as a percentage of GDP. Generally, the public sector funds education either by bearing directly the current and capital expenses of educational institutions or by supporting students and their families with scholarships and public loans as well as by transferring public subsidies for educational activities to private firms or non-profit organisations. Both types of transactions together are reported as total public expenditure on education.

- EMPL: Employment rate by gender, age group 15-64: This employment rate is calculated by dividing the number of persons aged 15 to 64 in employment by the total population of the same age group.
- ENT_TR: Enterprises using e-learning applications for training and education of employees: All enterprises, without financial sector (10 persons employed or more): Percentage of enterprises. Enterprises using e-learning applications for training and education of employees

- COMP_SKILL: Individuals' level of computer skills: Level of basic computer skills are measured using a self-assessment approach, where the respondent indicates whether he/she has carried out specific tasks related to computer use, without these skills being assessed, tested or actually observed.

- INT_SKILLS: Individuals' level of Internet skills: Level of internet skills are measured using a self-assessment approach, where the respondent indicates whether he/she has carried out specific tasks related to internet use, without these skills being assessed, tested or actually observed.

- COURSE: Individuals using the Internet for doing an online course: Percentage of individuals aged 16 to 74, within the last three months before the survey.

- EARCH_LEARN: Individuals using the Internet for seeking information with the purpose of learning: Percentage of individuals aged 16 to 74, within the last three months before the survey.

- TRAINING: Individuals using the Internet for training and education: Within the last 3 months before the survey. Derived variable: Individuals having used the Internet for at least one of the following activities: consulted Internet for learning, searched information on courses, followed e-learning course.

- COMP_TR: Most recent training course on computer use: the percentage of individuals doing a computer course in the last 3 months.

Appendix 2

Data table

COUNTRY	EXP_ COMP_ GDP	PPE	INT_ SKILLS	COMP_TR	ENT_TR	LLL	COURSE	TRAINING	COMP_ SKILL	SEARCH_ LEARN	EMPL	GEO
Austria	28.4	5.46	74	5	28	13.7	2	35	13	27	71.7	2
Belgium	27.2	6.46	76	6	24	7.2	4	39	18	31	62	2
Bulgaria	27.4	4.61	45	7	18	16.5	2	13	11	5	59.7	4
Cyprus	35.2	7.41	54	10	23	25.2	1	23	7	22	69.7	3
Czech R.	22.4	4.08	68	7	32	17.8	1	22	14	21	65	4
Denmark	28.5	7.75	87	9	28	1.2	5	64	15	56	73.4	1
Estonia	25	5.67	69	4	37	5.3	6	33	10	26	61	4
Finland	23.8	6.13	85	6	41	7.7	14	70	18	67	68.1	1
France	26	5.58	79	5	23	7.5	5	53	10	48	63.8	2
Germany	23.4	4.55	82	4	16	32.8	3	38	16	29	71.1	2
Greece	21.7	4.04	46	6	49	6.7	2	28	13	24	59.6	3

Hungary	26.7	5.1	66	7	17	5.8	3	33	14	30	55.4	4
Iceland	27.5	7.57	92	4	19	10.9	9	75	16	71	78.2	1
Ireland	19.4	5.62	60	9	39	23	5	44	12	35	60	2
Italy	25.9	4.58	54	3	18	6.2	3	38	9	35	56.9	3
Latvia	30.3	5.71	69	10	31	1.3	5	42	11	39	59.3	4
Lithuania	23.3	4.91	63	11	55	2.8	8	25	8	20	57.8	4
Malta	32.7	6.01	62	7	30	5	5	43	17	38	56.1	3
Netherlands	24	5.46	89	3	16	5	5	38	12	19	74.7	2
Norway	21.3	6.51	89	3	42	7.7	5	63	13	57	75.3	1
Poland	23.8	5.09	61	11	25	16.2	2	35	16	33	59.3	4
Portugal	25.3	4.89	52	2	29	4	2	42	11	39	65.6	3
Romania	18.3	4.25	39	5	47	10.8	4	20	17	17	58.8	4
Slovakia	19.5	3.59	70	8	45	24.5	1	27	17	21	58.8	4
Slovenia	28.6	5.22	69	8	39	19.4	4	47	12	42	66.2	3
Spain	27	4.62	65	5	33	5.7	8	39	10	29	58.6	3
Sweden	26.3	6.74	88	11	25	3	7	50	23	44	72.7	1
UK	27.3	5.36	80	8	24	2.8	7	42	15	29	69.5	2

CONTENTS