

e-SKILLS IN EUROPE

HUNGARY

COUNTRY REPORT

JANUARY 2014

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1 Overview

The structure of demand for ICT practitioner skills has changed in the last few years. In the past, a very strong demand for system developer was in evidence. Currently, demand appears to be stronger for applications, service provision and security questions, which is in line with world-wide trends in the ICT sector, such as the continuing growth of social media; cloud computing and related innovations; wide-spread application of open source software in education.

During the Hungarian Presidency of the EU in 2011, the country's government announced its continued commitment to implementing the EU 2020 strategy and the European Digital Agenda; a so-called Digital Assembly was set up to discuss the implementation of the action plan in Hungary among all stakeholders interested.

A key emphasis of the current Hungarian government is information security. More and more attention is being to be paid to network security to prevent the perceived threat of attacks that threaten the operation of the national ICT networks. One of the priorities of the Hungarian Presidency was therefore modernisation of the European Network and Information Security Agency.

At a conference in April 2012, the deputy state secretary responsible for info-communication declared that the most important aims of the government in the area are addressing digital illiteracy and completing roll-out of broadband access.

According to some critics the government's information society strategy has suffered since the Orbán government came to power in 2010.

Some of the government's decisions in the education area have also been controversial, such as the cutbacks in state-funded university degrees included in the new **Higher Education Law** from end of 2011. The law cut the number of fully state-funded degrees by 40% while adding a smaller number of places funded at 50% by the state, with the Prime Minister personally deciding the numbers of students and the distribution of places among faculties and universities. The legal and economics fields have been the main losers, while science and technology were much less affected. Importantly, students on government scholarships now have to sign a contract in which they promise they will work in Hungary (within a period of 20 years) for as many years as they spend on the study course; state-subsidised students who do not oblige to the prescribed length of availability on the Hungarian labour market may leave the country, in this case they have to repay their tuition fees. The logic behind the regulation is that Western European salaries tend to be much higher than Hungarian salaries, which means Hungarian tuition fees, modest in European comparison, may easily be paid back from the difference in wages received.

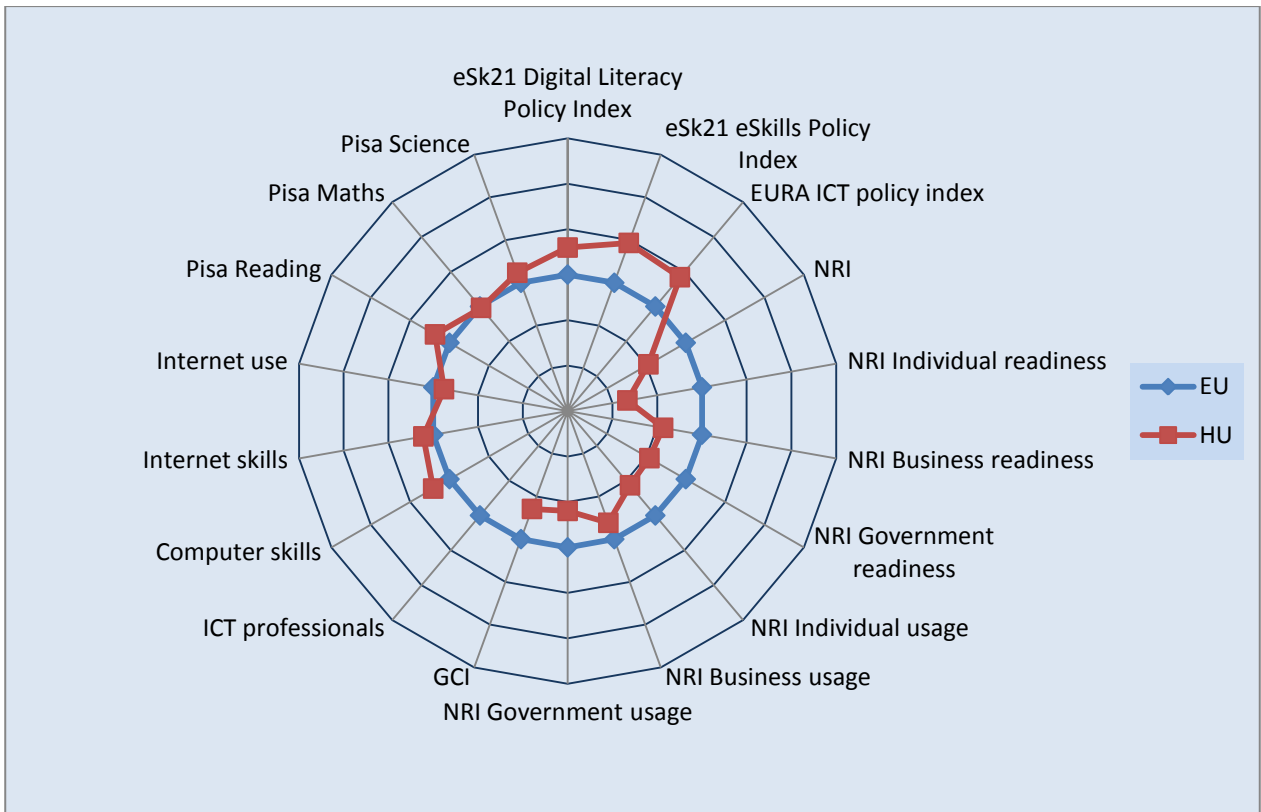
These decisions have met strong resistance from within the Hungarian higher education system¹, and have reportedly contributed in a 25% drop in the number of higher education applicants between 2011 and 2012, although the drop was mainly due to demographic trends². At the end of 2012, a further sharp cut in state funded university places was announced, but apparently the number of places in computer sciences and other ICT-related fields has been increased. As from 2013, the number of state-subsidised places is no longer regulated centrally.

¹ <http://www.eurofound.europa.eu/eiro/2012/02/articles/hu1202021i.htm>

² <http://www.universityworldnews.com/article.php?story=20130220151416428>

2 Indicators on innovation, competitiveness and ICT skills

Hungary						
	Score 2009/2010	Rank 2009/2010	Score 2011/2012	EU27 Rank 2011/2012	Change (Rank)	Comment
eSkills21 study: 'e-skills' index 2010	3.5	6				Max.: 5.0
eSkills21 study: 'Digital literacy' index 2010	3.5	7				Max.: 9.0
EuRA e-skills index	4.2	6				Max.: 5.0
ICT practitioners in % of total employment 2012			2.72%	19		EU average: 3.43%
Digital literacy skills of the population 2009/11:						
• Individuals with high level of computer skills	27%	15	32%	6	↑	EU average: 28.52%
• Individuals with high level of Internet skills	8%	17	15%	9	↑	EU average: 13.67%
• Individuals using the Internet (last three months)	59%	18	68%	9	↑	EU average: 71.33%
Global Competitiveness Index (GCI) 2010/12	4.2	23	4.36	19	↑	Max.: 5.61 EU median: 4.52
Networked Readiness Index (NRI) 2010/12	4.3	20	4.03	20	↔	Max.: 5.6. EU median: 4.5
• Individual readiness	5.58	20	4.36	25	↓	
• Business readiness	4.64	19	4.05	21	↓	
• Government readiness	4.03	20	3.68	20	↔	
• Individual usage	3.44	19	4.48	23	↓	
• Business usage	4.69	21	3.54	15	↑	
• Government usage	4.03	20	3.62	19	↑	
PISA scores (2009) in:						
• Mathematics	490	15				EU median: 493
• Science	503	10				EU median: 498
• Reading	494	11				EU median: 489

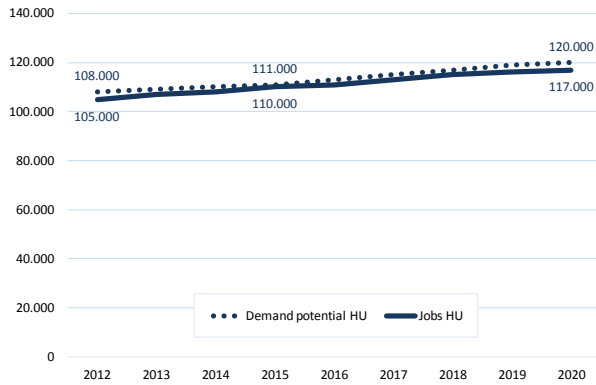


3 E-skills demand and supply forecasts 2012 – 2015 - 2020

Hungary			
	HU	Rank EU27	EU27
ICT practitioner workforce 2012	105,000	15	7,403,000
ICT practitioner workforce 2012 as percent of total workforce	2.7%	19	3.4%
Assumed excess demand 2012	2,200	17	274,000
Forecast excess demand 2015	900	19	509,000
Forecast excess demand 2020	1,200	19	913,000
Forecast ICT practitioner jobs 2015	110,000	15	7,503,000
Forecast ICT practitioner jobs 2020	117,000	15	7,950,000
Workers 2012 - Management, business architecture and analysis level	8,300	19	1,477,000
... as percent of total workforce	0.2%	26	0.7%
Workers 2012 - ICT practitioners, professional level	64,000	11	3,393,000
... as percent of total workforce	1.7%	11	1.6%
Workers 2012 - ICT practitioners, technician and associate level	33,000	16	2,532,000
... as percent of total workforce	0.8%	20	1.2%
Growth core ICT workforce 2001-2010	3.9%	15	3.0%
Growth core ICT workforce 2008-2010	1.0%	17	2.6%
Growth core ICT workforce 2011-2012	19.0%	3	3.9%
Growth broad ICT workforce 2011-2012	19.7%	2	1.8%
ISCED 5A/B first degree graduates in Computer Science, 2011	1,972	11	113,000
... graduates per 1000 population aged 20-24	3.1	18	3.6
... graduates 2011 as percent of 2006 (= peak EU)	69%	22	88%
Vocational training graduates in Computer Science, 2011	3,494	5	67,000

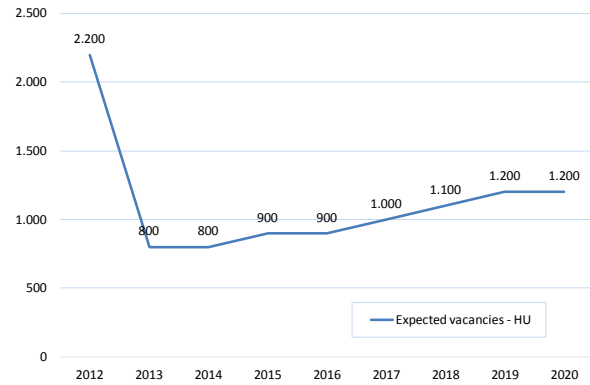
Sources and notes: see annex.

ICT workforce: Demand and Jobs in Hungary 2012-2020 (Main Forecast Scenario)



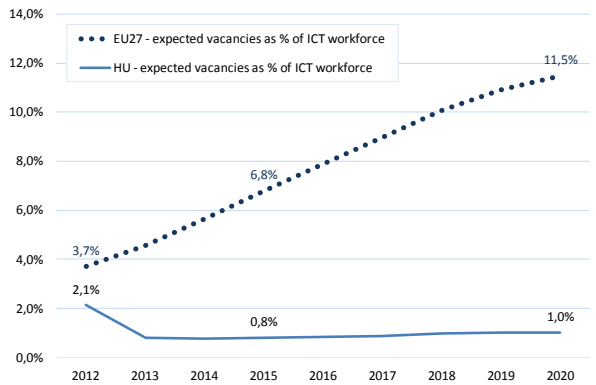
Source: empirica 2013

e-Skills shortage: Potential vacancies in Hungary 2012-2020 (Main Forecast Scenario)



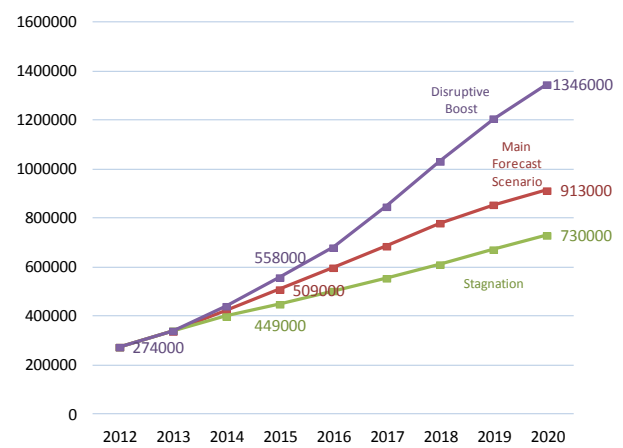
Source: empirica 2013

Potential vacancies as percent of ICT workforce Hungary 2012-2020 (Main Forecast Scenario)



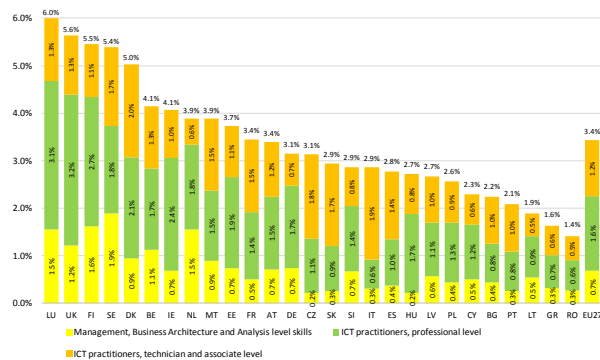
Source: empirica 2013

Potential vacancies in Europe (EU27) by scenario 2012-2020



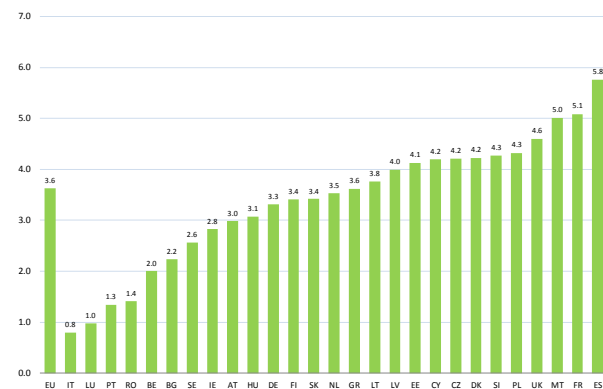
Source: empirica 2013

ICT practitioner workforce as percent of total workforce in EU Member States in 2012



Source: empirica 2013

First degree graduates in Computer Science (ISCED 5A/B) per 1000 population aged 20-24, 2011



Source: empirica 2013

4 Policy and major stakeholders initiatives

Most of the activity in Hungary has so far focused on the **digital literacy** domain. The **Digital Literacy Action Plan** launched in 2007 by the Hungarian government had the main objective to increase the digitally literacy of the population in Hungary. Its three main targets were:

- to increase e-inclusion with an employability focus, to support training of digitally illiterate employees and potential employees or those with basic IT skills, to assist them in getting better jobs and positions, to foster start-up e-businesses;
- to support the digital economy and the strengthening of the SME sector, improving the competitiveness of the Hungarian SME sector by providing decision-makers in the sector with ICT-focused training in business and more up-to-date skills in e-business;
- to increase competitiveness of ICT-intensive business in Hungary by training IT-Professionals in line with the market demand and high standards.

Some of the **Operational Programmes** included in the "New Hungary Development Plan" for the programming period 2007-2013 had a priority on ICT human resources:

- Social Renewal Operational Programme 4.1.2.A1/A2 – Teacher Training: These measures aimed at improving the overall quality of teacher training, the propagation of ICT tools in teaching and development of instructional materials, with a special focus on ICT. The measure had an overarching goal of improving the standard of Hungarian trainings in STEM subjects.
- Social Renewal Operational Programme 4.2.2.C – Promoting research in innovative ICT, and training the new generation of ICT experts: The measure aimed at promoting high-quality research in the field of ICT, in order to improve Hungary's visibility in the European Research Area.
- Social Renewal Operational Programme 4.2.5/ 4.2.5.B – Developing a system of digital content providing in higher education: The measure has the aim of obtaining scientific databases for the use of the Hungarian academic sphere, and the training of ICT personnel .

The latest action plan in the area is the **Digital Renewal Action Plan** (Digitális Megújulás Cselekvési Terv) 2010–2014, unveiled by the Ministry of National Development in December 2010. The Plan including programmes for enhancing business competitiveness through stronger take-up of ICT and action plans for the support of innovation, education and training initiatives. Specific goals with relevance to the e-skills topic are:

- 'Intelligent Community Squares', comprising the eHungary programmes 2.0 and 3.0 and the eHungary programme 2.0 for Hungarians living outside the country's borders;
- A motivation programme to increase the number of digital literates;
- Measures for enhancing of ICT user skills in primary and secondary education;
- Introduction of distance teaching with multimedia tools in secondary and higher education.

The government has also provided financial assistance (grants) to projects operated by national and local non-profit organisations through its **NetReady programme**, aimed at ICT user skills development.

Since the Orbán government came to power in 2010, Hungary has put renewed emphasis on rolling out broadband across all parts of Hungary as a means to improve competitiveness and to boost economic growth. Within the context of the **New Széchenyi Plan** launched in 2011, high speed broadband Internet access is to be rolled out to 200,000 households, 15,000 SMEs and 2,000 public sector offices which are currently excluded from this service. With this the government hopes to reach the aim, originally stated in the National Broadband Strategy 2005-2013, of covering the whole country with broadband Internet access by 2013.

The New Széchenyi Plan also announced an additional financial support as part of the **TÁMOP 2.1.2.** scheme for boosting digital literacy and foreign language skills. The project is to reach 100,000 persons, 85,000 of which should finish the course. **TÁMOP 2.1.3.** provides financial support for ICT training at the workplace to all types of companies. A particular target group are business leaders and managing staff. The total budget of TÁMOP 2.1.3. is about € 100 million. In addition IKT 0-1, a programme to motivate business managers for investing in ICT training, has been set up recently. The recent **Law on Higher Education** (2011) of the government has cut down the number of state-subsidised places in university education, but some sources suggest that the number of funded places in informatics, engineering and natural sciences have actually increased, while the losses were most pronounced in social sciences and economics³ (the number of state-subsidised places is no longer regulated centrally as from 2013). The law also stipulates that students to benefit from state funding must enter into a contract with the state according to which they must be available for a period the same length as their study course to the Hungarian labour market; they remain of course free to go to work abroad, in which case they however must pay back for the tuition fees previously covered by the state. This measure can be seen as a way to convince ICT graduates to remain within the country rather than to leave in search of higher wages abroad.

Outside of the public sector, a major attempt in the area of e-skills development, the "Training Framework Programme for Increased Adaptability to the Information Society" (**TITAN**), did not produce the results expected. It was designed as an EU-cofunded training initiative covering a range of levels of ICT competences with a focus on strengthening employability and competitiveness, to be realized by a multi-stakeholder partnership under leadership of HELB (Hungarian EUGA Leadership Board⁴) Foundation and involving stakeholders from the public sector and the ICT industry. Scheduled for implementation in the period 2009 to 2012, the scheme sought to train 10,000 ICT professionals, 25,000 SME Managers and 200,000 basic ICT users per year. Available information indicates that The TITAN initiative was discontinued after the change of government in 2010; its general objectives (if not all of its ambitious targets) were integrated in the TÁMOP 2.1.2 and 2.1.3 schemes (see above).

Summary Assessment of Hungarian e-Skills Activities: ●●●

Hungary has little in terms of a master strategy for e-skills, but the Digital Literacy Action Plan includes the objective to "increase competitiveness of ICT-intensive business in Hungary by training IT-Professionals in line with the market demand and high standards". In practice the focus of policy-making has been mainly on infrastructure development in the education system.

Summary Assessment of Hungarian Digital Literacy Activities: ●●●●

Hungary has a master strategy for digital literacy, the Digital Literacy Action Plan from 2007. The extensive network of PIAPs called eHungary points has been cleverly used as the basis for provision of e-skills to large parts of the population, with a focus on employability. The NetReady scheme has been important for supporting non-profit initiatives targeting disadvantaged communities.

Summary Assessment of Hungarian e-Leadership & Digital Entrepreneurship activities: ●●

The Digital Literacy Action Plan (2007) as well as the Digital Renewal Action Plan (2010) include measures for helping raise the competitiveness of Hungarian SMEs by providing training in ICT-focused business skills. The process of identifying e-leadership skill requirements and developing initiatives for promoting them is still in its infancy, though.

³ http://www.infoter.eu/cikk/felsooktatas_2013-to1_uj_allami_tamogatasi_rendszer

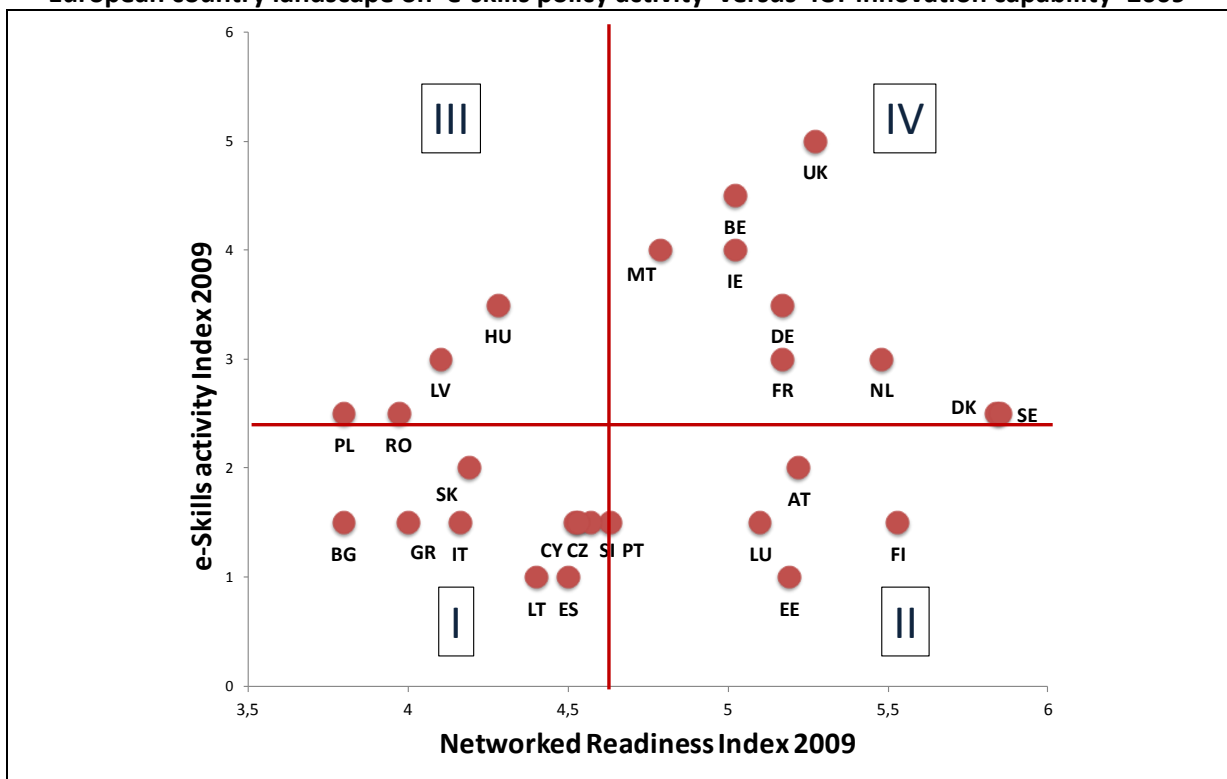
⁴ EUGA was the European Union Grants Advisor program, an initiative by Microsoft, HP, Intel and other partners to help SMEs and local or regional government bodies to increase their awareness and understanding of EU and national funding opportunities, and assist with the application process.

Like in the precursor study⁵ the assessment of the information gathered resulted in two activity indices, one for digital literacy and one for e-skills computed for each country. These were computed based on data from 2009 and 2013. The e-leadership skills activity index was computed only for 2013, as no data had been collected on this topic in 2009. In the following the focus will be on the e-skills activity index; we first mapped the e-skills activity index values against the Networked Readiness Index (NRI)⁶ for each of the 27 Member States.

This allows for putting the results of the e-skills policy and activity analysis in the different countries in the wider context of each country’s propensity to exploit the opportunities offered by ICT using data which can be obtained from the country values on the Networked Readiness Index (NRI).

The following figure allows a comparison of the results from this exercise for 2009 and 2013. In the graphical illustrations four quadrants are shown which are built by using the European averages on the NRI and those on the e-skills policy activity index for the respective years in order to group the countries into four main clusters.

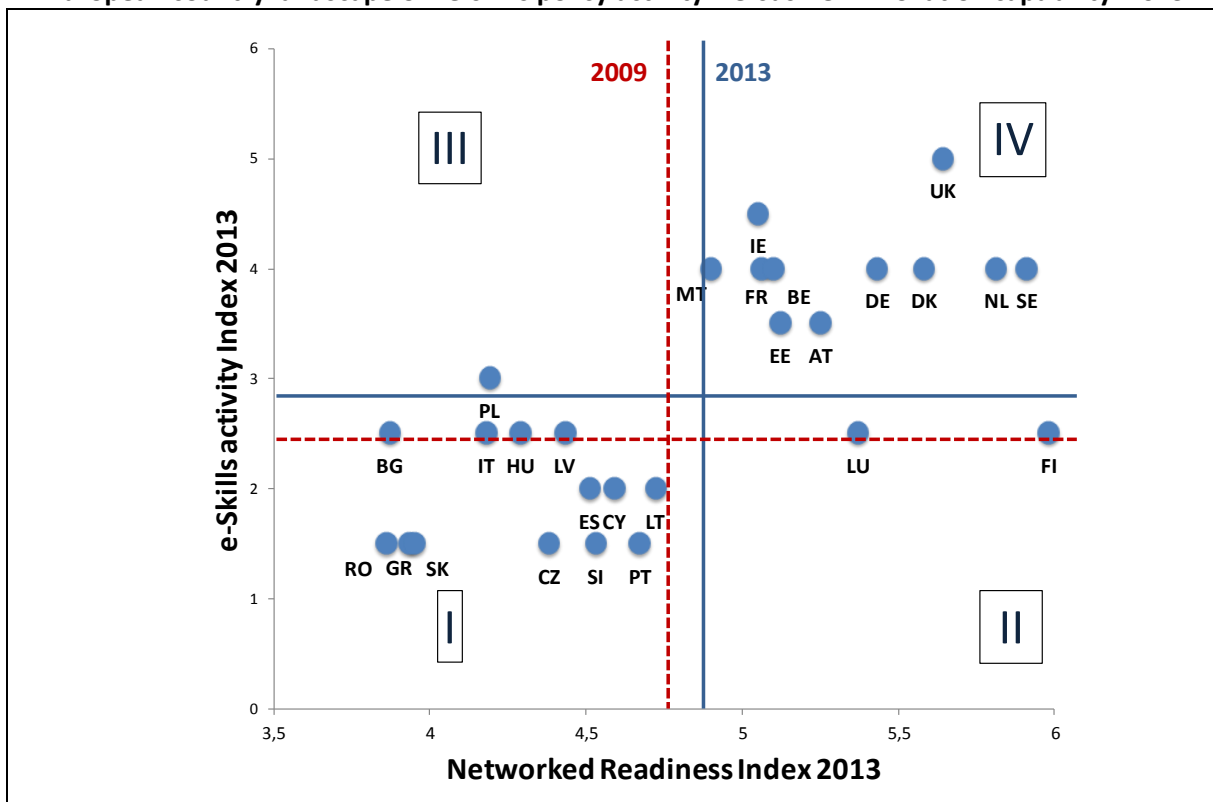
European country landscape on ‘e-skills policy activity’ versus ‘ICT innovation capability’ 2009



⁵ Hüsing, T. and Korte, W.B. (2010) "Evaluation of the Implementation of the Communication of the European Commission 'e-Skills for the 21st Century'", URL: http://ec.europa.eu/enterprise/sectors/ict/files/reports/eskills21_final_report_en.pdf

⁶ The World Economic Forum's Networked Readiness Index (NRI) measures the propensity for countries to exploit the opportunities offered by ICT. It is published annually as part of the Global Information Technology Report. The NRI is a composite of three components: the environment for ICT offered by a given country (market, political and regulatory, infrastructure environment), the readiness of the country’s key stakeholders (individuals, businesses, and governments) to use ICT, and finally the usage of ICT amongst these stakeholders. For further information on the NRI see www.weforum.org/issues/global-information-technology.

European country landscape on 'e-skills policy activity' versus 'ICT innovation capability' 2013



Overall and for e-skills related policies and initiatives a strong increase of activity levels over the five-year time span can be identified. The unweighted average e-skills policy index score increased from 2.4 to 2.9 between 2009 and 2013. This is encouraging news.

Our analysis revealed that in 2009 three of the four quadrants are well populated by different countries with only 7 countries belonging to the group of top performers both, in terms of e-skills policy index as well as NRI, and 11 Member States constituting those best described as low activity countries (bottom left quadrant).

Five years later the situation has changed significantly; we are now faced with a situation which can be described as a dichotomy in Europe on these indicators: top performing countries as opposed to countries with low activity levels and NRI performance, with only three countries (Poland, Luxembourg and Finland) in transition phases between these clusters.

The group of top performers has grown from 7 to 11 with Sweden, Denmark, Austria and Estonia entering this cluster to which the United Kingdom, the Netherlands, Belgium, Ireland, Malta, Germany and France already belonged in 2009. However, the group of low activity countries is still substantial in terms of numbers of countries with 13 EU Member States – almost 50% showing a below average performance on the NRI and on the e-skill skills policy activity index.

EU Member States fall into two very distinct groups: 41% of the Member States are top performers, almost 50% are low activity countries, and 11% located between these two clusters.

While the former have been successful on the e-skills front and capable of exploiting ICT to become innovative and more competitive the latter group of low activity countries still has a rather long way to go to achieve both.

A look at the Member States' positions in the NRI ranking (Networked Readiness Index) reveals that again, those countries with high NRI positions also show high e-skills policy activity levels. The countries moving up in terms of migrating into the 'top performers' cluster include Sweden,

Denmark, Austria and Estonia, as well as the Netherlands and France which managed to further increase their e-skills policy activity level.

Countries at the risk of losing ground include Hungary, Latvia and Romania which dropped down into the first cluster of countries, i.e. those lagging behind.

European country clusters on 'e-skills policy activity' versus 'ICT innovation capability' 2013

I : low NRI + Low level of e-skills policy activity	II : High NRI + low level of e-skills policy activity
Romania, Greece, Slovakia, Czech Republic, Slovenia, Portugal, Spain, Cyprus, Lithuania, Bulgaria, Italy, Hungary, Latvia	Luxembourg, Finland
III : Low NRI + high level of e-skills policy activity	IV : High NRI + high level of e-skills policy activity
Poland	United Kingdom, Ireland, Sweden, Netherlands, Denmark, Germany, Belgium, France, Malta, Austria, Estonia

5 Selected multi-stakeholder partnerships

The following is a list of multi-stakeholder partnerships of major relevance to the e-skills issue:

- **e-Hungary Programme:** In 2003 already Hungary introduced a series of eGovernment instruments as well as, as a complementary measure, initiatives for changing citizens' attitudes to ICT. The primary focus of the eHungary programme was to increase digital literacy nationwide and thus to reduce the e-skills gap. The eHungary programme, implemented in 2007, rolled out ICT infrastructure across the country in the form of a network of 1,600 so-called **eHungary Points** (three-quarters of which are located in peripheral or otherwise disadvantaged parts of the country). eHungary Points are public Internet access points (PIAPs) providing free of charge Internet access to anybody. It was soon realised that human assistance needs to be provided at eHungary Points for them to achieve their goal. A training programme was started to provide 1,400 people with the required IT expertise to work as **eCouncillors**. These are employed at eHungary Points and provide free of charge personalised help and IT support, organise trainings for local citizens, help find job opportunities and provide all type of administrative help according to local needs. As a result of the activity more than 300,000 citizens had acquired basic ICT user skills at an eHungary Point by 2009. The e-Hungary programme provided the foundation for the more recent initiatives listed below.
- **TÁMOP 2.1.2. Project:** The scope of the project, which began in 2012, is to improve digital literacy and knowledge of foreign languages in the population, to help them improve their employability and escape from unemployment, respectively. Stakeholders involved are training institutions such as foreign language schools as well as the so-called e-Hungary Points (PIAPs). The project's target is to reach out to 100,000 persons, of which 85,000 are expected to finish the course. These figures are to include 10,000 people from disadvantaged groups. The project is led by the Executive and Justice Office and the Ministry for National Development.
- **Digital Community Miskolc and Agglomeration:** The aim of the project (2012-14) is to develop the disadvantaged region of Miskolc by means of improving digital literacy and e-skills, which are seen as preconditions for better education, employment and regional competitiveness. The programme is expected to significantly update Internet and broadband internet access in Miskolc and its agglomeration. Moreover, online public services will be implemented in the areas local governance and administration, public health, education, transport and energy. The programme comprises initial ICT training measures at Tűr István Képző Intézet, followed by a "Complex Instruction Program", an extensive training measure to boost teachers's skills in organising high-level teamwork in classes with varying level of pupil knowledge and skills.

6 Success of e-skills policies and activities in meeting the objectives of the EU e-skills agenda and other relevant European initiatives

The extent to which policies, initiatives and multi-stakeholder partnerships have been successful in helping meet the objectives of the EU e-Skills agenda and other relevant European e-Skills initiatives as seen by national experts is further described below along key actions and action lines of the EU e-Skills strategy and other relevant EU initiatives.

“Longer term cooperation”

Those initiatives that exist usually represent cooperation between the state, market and civil societies, but overall the level of activity is limited. Financing has come mostly from EU funds, with the Ministry of Human Resources supervising programmes. In the higher education domain, willingness to cooperate has suffered from the current government's Higher Education Law (2011) and related policy-making, which has cut down state funding of university education and resulted in strong resistance from within the higher education system. This, however, changed in 2013, since when the number of state-subsidized places is defined by the capacities of higher education institutions rather than by central regulation.

“Human resources investment”

As the OECDs STI Outlook 2012 states, "Hungary's skills levels and human resource indicators are low. Only 20% of the adult population is tertiary-qualified and PISA science scores of 15-year-olds rank Hungary 27th in the OECD."

The New Széchenyi Plan aims to improve the quality of human resources in the academic sector. The government has increased support for PhD study, corporate scholarships, and post-doctoral job opportunities. The aim of the National Excellence Program (NEP), which is being realised under the framework of Social Reform Operative Project (SROP), is to support outstanding teaching and research activities from which results that are significant from national and European economy point of view can be expected. The Campus Hungary Programme, meanwhile, supports international student mobility in higher education, both in terms of attracting foreign students to Hungary and to enable more Hungarian students to spend part of their studies abroad. Other initiatives to improve the education system include funding for Momentum (“From Brain Drain to Brain Gain”) targeting talented young researchers.

Cut-downs in state funding for higher education have not much affected the STEM area, as the sector is singled out as of core relevance for competitiveness.

“Attractiveness of ICT jobs”

Most of development resources are directed towards ICT tools and towards improvement of human resources at all educational levels. The number of informatics classes in the curriculum had gone down until recently, but the governments intends to reverse this trend. Recommendations concerning teaching informatics at schools were already given to 10% of facultative classes. In regards to higher education, the state has announced plans to train more engineers and computer scientists by increasing the number of engineering and informatics programmes.

“Employability and e-inclusion”

The overall development strategy of ICT sector in the period from 2014 to 2020 is under development. The main goal is the development of digital competency. Informatics competency is

not going to be differentiated between public and private sphere. General development programmes are planned for both citizens and entrepreneurs.

The level of digital literacy among Hungarian individuals aged 16-74 is poor, according to the Eurostat. In 2011, more than three quarters of those aged 16-74 in the EU27 had used a computer, while this share was 96% amongst those aged 16-24. The share of those aged 16-74 having used a computer was 74% in Hungary, the highest observed shares were in Sweden (96%), Denmark, Luxembourg and the Netherlands (all 94%), and the lowest in Romania (50%), Bulgaria (55%) and Greece (59%). In most Member States the share of young people who had used a computer was above 95%.

Measures are being taken to make sure that primary and secondary education equips all young citizens with the ICT user skills required for successful performance on the labour market. The Klebelsberg Centre (Klebelsberg Kunó Intézményfenntartó Központ, or KLIK), the state body that manages the country's schools, reports that the number of the independent ICT has increased markedly in recent years.

“Lifelong acquisition of e-skills”

The country's ICT strategy calls for lifelong acquisition of e-skills. However, the relatively low funding available for developing the infrastructure for lifelong learning works as an inhibitor of fast progress. The main source of funding is financial support from the European Union in the framework of the Social Infrastructural Operational Program (SIOP) Hungary. Moreover, lifelong learning also requires having the necessary capacities, methodologies and good practices available. Here, tangible improvements are taking place. Non-governmental organisations, professional associations and higher educational institutions already offer a range of course programmes for further education.

“Closing the e-Skills gap”

A number of approaches are being used to address the challenge of insufficient availability of ICT practitioners in the country today and in the coming years. While the Higher Education Law from 2011 reduced state funding for study programmes especially in law and economics, it appears that the number of state-subsidised places in ICT programmes has increased over the last two years. As a means to create disincentives for graduates to leave the country in search of higher wages after graduation, government scholarships have to be paid back if graduates leave the country before finishing a minimum number of years in which they have to be available to the Hungarian labour market.

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Annex: data sources

	Source
eSkills21 study: 'e-skills' index 2010	eSkills21 study carried out by empirica. Report available at http://goo.gl/WKV7r
eSkills21 study: 'Digital literacy' index 2010	
EuRA e-skills index	EU-RA 2009: Financial and fiscal incentives for e-Skills: State of play in Europe. Synthesis report. http://www.e-skills-funding.com/images/stories/PDF/synthesisreport.pdf
ICT practitioners in % of total employment 2012	LFS data made available by Eurostat
Digital literacy skills of the population 2009/11:	Eurostat, database "isoc_ski"
• Individuals with high level of computer skills	
• Individuals with high level of Internet skills	
• Individuals using the Internet (last three months)	
Global Competitiveness Index (GCI) 2010/12	The Global Competitiveness Report 2011-2012: http://www.weforum.org/reports/global-competitiveness-report-2011-2012
Networked Readiness Index (NRI) 2010/12	The Global Information Technology Report 2011-2012: www.weforum.org/issues/global-information-technology
• Individual readiness	
• Business readiness	
• Government readiness	
• Individual usage	
• Business usage	
• Government usage	
PISA scores (2009) in:	OECD, http://www.oecd.org/pisa/
• Mathematics	
• Science	
• Reading	

Indicator	Source	Further remarks
ICT practitioner workforce 2012	Eurostat Labour Force Survey. Some imputations and assumptions not in the original data but done by empirica apply	The definition can be looked up in the final report, Gareis et al. 2014: E-SKILLS: MONITORING AND BENCHMARKING POLICIES AND PARTNERSHIPS IN EUROPE.
ICT practitioner workforce 2012 as percent of total workforce		LFS based, number of ICT practitioners / number of workers in all occupations
Assumed excess demand 2012	Empirica, IDC	This is calculated using the percentage of vacancies per existing job and is based on a survey carried out in 2012. As some countries were not covered, several assumptions apply
Forecast excess demand 2015		Forecasts are scenario based and the methodology can be found in the final report (see above). Forecast of demand in the six largest countries (DE, UK, FR, IT, ES, PL) is based on country specific economic scenarios, for the 21 smaller countries only an aggregate scenario was developed and figures allocated according to ICT employment shares.
Forecast excess demand 2020		
Forecast ICT practitioner jobs 2015		
Forecast ICT practitioner jobs 2020		
Workers 2012 - Management,	Based on Eurostat Labour Force	LFS based, definitions can be looked up in the final

business architecture and analysis level	Survey, some definitions and calculation by empirica. Some imputations and assumptions not in the original data but done by empirica apply.	report.
... as percent of total workforce		
Workers 2012 - ICT practitioners, professional level		
... as percent of total workforce		
Workers 2012 - ICT practitioners, technician and associate level		
... as percent of total workforce	Based on Eurostat Labour Force Survey, some definitions and calculation by empirica. Some imputations and assumptions not in the original data but done by empirica apply.	ISCO-88 groups 213 and 312. Due to the break in series in 2010/11 only partly comparable to later data.
Growth core ICT workforce 2001-2010		
Growth core ICT workforce 2008-2010		
Growth core ICT workforce 2011-2012		ISCO-08 groups 25 "ICT professionals", 35 "Information and communications technicians".
Growth broad ICT workforce 2011-2012		Equals the "ICT practitioner workforce"
ISCED 5A/B first degree graduates in Computer Science, 2011	Eurostat, database "educgrad_5"	This figure represents a count of first degrees in ISCED 5A and first qualifications in 5B. See discussion of this indicator in the final report.
... graduates per 1000 population aged 20-24	Eurostat, databases "educ_grad5" and „demo_pjangroup"	Graduates as above. The denominator is used to make data comparable but there is no age restriction in the number of graduates. Some imputations and assumptions may apply.
... graduates 2011 as percent of 2006 (= peak EU)		
Vocational training graduates in Computer Science, 2011	Eurostat, database "educ_grad5"	Number of Computing graduates in Upper secondary education (level 3) - pre-vocational and vocational programme orientation and Post-secondary non-tertiary education (level 4) - pre-vocational and vocational programme orientation. Some imputations and assumptions may apply.