Information Technologies and Labour Market Disruptions

A Cross-Atlantic Dialogue

BACKGROUND DOCUMENT

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An interdisciplinary, cross-sector roundtable organised by the European Commission (DG Enterprise and Industry and DG Communication Networks, Content and Technology) in cooperation with The Conference Board and Cornell University ILR School.

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20-21 March, 2014

The Conference Board | 845 Third Ave, New York City

Eurasia Room

This interdisciplinary, cross-sector roundtable is organised by the European Commission (DG Enterprise and Industry and DG Communication Networks, Content and Technology) in cooperation with The Conference Board and Cornell University ILR School. The goal is to identify micro and macro employment issues and considerations resulting from technological progress and digital technology adoption that are important to improving economic growth, innovation, job creation and employee performance, considering policy and practice, and drawing lessons from EU-US comparisons.

Background

The competitiveness and innovation capability of industry as well as social cohesion are increasingly dependent on the strategic and efficient use of information technologies as well as the knowledge, skills and competences of the workforce and citizens. There is broad consensus about the importance of IT skills for Europe: shortages, gaps and mismatches and a digital divide will affect negatively growth, competitiveness, innovation, employment and social cohesion. As new technologies are developing rapidly, skills are increasingly sophisticated and need to be constantly updated. There is a need for more individuals with creativity, innovation and higher-level conceptual skills.

Improving the availability of IT skills and increasing the talent pool involves actions at EU and national level primarily in education, training, research, industrial and labour policies but also in domains such as immigration and taxation. Following the Commission's Communication on **"e-Skills for the 21st Century"**, several initiatives have been launched. Foresight scenarios on the supply and demand (2015-2020), an analysis of the impact of global sourcing and a European e-Competence framework are now available as well as many multi-stakeholder partnerships etc.

In March 2013 President Barroso launched the **"Grand Coalition for Digital Jobs"**. A campaign "e-Skills for Jobs" will be launched on 6th May 2014 in Athens in cooperation with the Greek Presidency of the European Union. Work in the future will also include the promotion of ICT professionalism and the generation of a larger talent pool of entrepreneurs, business leaders, managers and advanced users with a focus on the strategic use of new information and communication technologies.

The international dimension and the impact of globalisation

In January 2013 the European Commission launched a project to better understand the international dimension of e-skills in order to better anticipate change, envisage possible future cooperation and improve efforts to develop e-skills for Europe. **The roundtable is part of this activity**[1].

It will benefit from excellent previous work on this topic in the U.S. especially the conclusions of the Roundtable on employment and technology[2] held at Cornell ILR in 2013.

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[1] The outcome of the discussions of the roundtable will be complemented by a separate technical workshop on ICT professionalism with international experts on 24-25 March and a conference (www.eskills2014.eu) on 26 March 2014 in Brussels. The final report[1] will be released at the end of April 2014.

The Roundtable (20-21 March 2014)

A panel of leading experts and academics has been invited to provide insights onseveral key questions:

What is the macro-economic impact of new technology on US aggregate labour demand, productivity, output and competitiveness? What does the data show and what, if anything, needs to be measured in new ways?

- Is the aggregate slowdown in productivity just a result of changes in industry composition, or is there a productivity slowdown within industries? How does the economic crisis affect macroeconomic productivity measures?
- What can be said about reconciling the various technology/job multipliers?
- How is technology impacting the globalization of supply chains and labour distribution?
- Do national productivity measurements need to be revised?
- How does technology impact on the relationship between productivity and compensation? On income inequality?
- Are there other labour market trends that intersect with technology in impacting productivity and employment? How can the effect of these be isolated?
- In terms of the impact on employment, are we experiencing an unprecedented technological shock, or will it have a similar impact as previous shocks?

What is the "frontline" (microeconomic) impact of new technology on workplace productivity, employment and employee compensation? How are we measuring what changes businesses are making to how work gets done?

- What are the types of tasks that are being displaced or replaced by technology right now, or in the next several years?
- What new tasks are enabled and/or created by technology?
- Within existing businesses, is productivity increasing? Are productivity increases advancing at a slower rate?
- What is the net impact of technology on jobs in existing businesses?
- To what degree is technology spurring employment in new start-ups and are these jobs "different"?

The Impact of Technology on the Future Workforce

- How are technology-enabled outsourcing, offshoring, and teleworking changing how/ where work gets done, and who's doing it (employees, contractors or freelancers)?
- What are the pro and cons of expanding capital investment vs. employing people?
- How are new technology and data changing recruiting, strategic HR decision-making, and management of workplace operations?

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[2] See: https://www.ilr.cornell.edu/ICS/InsightsAndConvenings/EmploymentSustainabilityInitiative/

- Which work tasks (done by human employees) are being/will be displaced or replaced by technology? Which are being enabled and/or newly created?
- Is technology "disruptive" to workplaces in different ways in Europe versus the U.S.? (And what about Asia and Pacific, Latin America, and the Middle East and Africa?)

Technology's impact skill demand, potential skill shortages, and filling the skills gap

- What are the main technological trends expected for the next decade and what are future jobs likely to look like?
- What are types of skills and jobs will be needed in which occupations?
- Will skill shortages arise due to demographical developments, lagging educational curricula, lack of company-specific training and apprenticeships?
- Can skill shortages be abated by simply "paying more", the arrival of the 'digital natives' generation, governmental educational reform, and/or increased internalizing of training costs by employers?
- What governmental policies could be helpful in this context?

Revisiting The Employer Perspective -- the dynamics of technology on organizational structure, HR management and the meaning of "having a job"

- How is technology changing how/where work gets done, and who's doing it?
- Do organizations have the change management skills to accompany technology-driven disruptions?
- How do employers balance expanding capital investment vs. employing people? Are new technologies and/or other forces changing the calculus?
- Has business culture changed from layoffs being "the last resort in bad times" to downsizing as an annual (or quarterly) constant improvement process?
- How will 'big data' impact recruitment and HR strategies and operations?
- Is technology "disruptive" in different ways in Europe than the U.S.? (And, what about APAC, LATAM, and MEA?)

Conclusions and next possible steps

What have we learned? Is a consensus emerging? What are the key research topics and policy priorities? What are the main differences between the US and Europe, and what is the implication for individuals, employers and the government?

- Polarization, income inequality? Are current trends sustainable?
- Jobs created vs. jobs destroyed, skills in demand vs. skills in decline
- What might future jobs look like?
- Impact of emerging and developing countries
- Role of government

e-Skills in Europe: An overview

The analysis (Source: Empirica) of national policy and stakeholder initiatives in the e-skills domain across EU Member States shows high or even very high levels of activity in many countries not only in the Digital Literacy domain but also in the e-Skills area where the focus is on ICT practitioners and professionals rather than the population at large. Of the 27 Member States, 12 have a value of 3 or higher on the 5-point index scale for e-Skills activity. The group of leading countries includes the U.K. and Ireland. Belgium, Germany, Denmark, France, Malta the Netherlands and Sweden also perform strongly in terms of the level of activity for ensuring adequate supply of ICT practitioners on the labour market today and in the future. The range of interventions used is very broad. There are clear indications that the 2007 e-Skills Agenda and the subsequent initiatives by the European Commission have triggered Member States to engage in public debates about the e-skills issue and helped them to develop appropriate responses.

However, the degree of integration and consistency of policy-making is still limited in a significant number of Member States. Most countries lack a master strategy or the topic still does not attract continuous attention in policy-making across the different policy areas concerned. Typically, measures are taken for adapting the education system to the demands of a knowledge-based economy, but in some countries little reference is being made to ICT practitioner skills and the need to boost supply of suitably qualified ICT professionals (e.g. Czech Republic, Luxembourg). Initiatives targeting young people, especially girls, with the intention to develop a positive attitude towards STEM subjects in general and a career in ICT in particular, are widespread, which is not surprising given their modest cost and strong (if short-lived) attraction for the media. They do, however, sometimes seem to lack sustainability and make use of questionable pedagogical / methodological approaches.

Since the onset of the current economic crisis in Europe and the resulting jump in unemployment rates across most of Europe, policy-makers have tended to direct their attention away from the issue of (current or upcoming) skilled worker shortages. The widespread problem of budget deficits appears to have a negative impact on some Member States' ability to follow through with plans to address the e-skills topic more full-heartedly and in a systematic way, especially in countries with below average GDP/head. This appears to apply, for example, to Portugal, Greece, Slovenia and Cyprus. In their place, available sources of financial support (such as ESF funds) are being used to re-train unemployed persons for jobs in the ICT domain, but national experts tend to be very sceptical about the effectiveness of such measures in terms of the success in providing e-skills needed on the labour market, especially in the countries with the highest rates of unemployment.

Other countries, however, have taken the route of strategic, long-term policy making in the e-skills domain, with strong engagements from a wide range of stakeholders in the public sector as well as the business and civic sectors. The United Kingdom has extensive experience in e-skills related policy development and remains a benchmark for multi-stakeholder partnership in this domain. The Netherlands and Ireland also benefit from strong policy leadership in the e-skills domain; these countries have a master strategy in place as well as a comprehensive infrastructure for adapting measures closely to changes in supply and demand for different types of ICT practitioners. Sweden has an e-Skills Council and shows evidence of a high level of maturity in terms of mainstreaming the e-skills issue throughout all parts of the country's education system.

Some countries, such as Denmark and Austria, use their ambitious e-government strategies as a horizontal lever to promote e-skills policy goals across a wide spectrum of policy domains, with a focus on the education sector, which is dominated by public education providers in both countries. In Denmark, a range of initiatives driven by universities in cooperation with other national stakeholders have been taken. There is already strong evidence for substantial success in attracting young people to ICT study courses over the last 10 years in the country.

Significant policy leadership and vision in the s-skills area is also found in countries with below-average economic strength (as indicated by GDP/head). This applies to Estonia which, as it places ICT at the heart of its strategy for economic development, is fully aware of the need to ensure a steady supply of sufficiently qualified ICT practitioners for medium and long-term prosperity. Neighbouring Latvia also has become active with a master strategy to develop e-skills.

The general picture suggests that most Member States have responded to the European e-skills agenda with a delay of a few years. For example, France has developed a comprehensive policy strategy with its Roadmap on Digital Policy in 2013, after a lengthy period during which national experts have complained that the country lacked policy leadership in the e-skills domain. Given the newly established policy framework, the situation in the country is expected to improve much now, also because of the strong engagement of the non-governmental sector. Spain may be on the same path as it has stepped up activities in the context of the new Digital Agenda, but it appears too early to tell yet how strong policy commitment will be.

The long-term continuity and sustainability of state programmes on e-skills has been negatively affected by the electoral cycle in some Member States. In Malta, a country that has shown policy leadership in the e-skills area as exemplified by set-up of the e-Skills Malta Alliance in 2010, a change of government in 2013 resulted in the future of the Alliance being in doubt. At the time of writing, however, the Alliance is about to be re-established in a new format. In Hungary, the Orbán government after coming to power set out to overhaul the tertiary education system, which in the face of strong opposition by stakeholders in the university system has diverted attention away from the challenge of how to improve the country's ability to produce sufficient numbers of ICT practitioners.

Some countries are seeking to secure public investments in grants offered to ICT students against the risk that graduates leave the country in search for higher wages elsewhere. To this end, Hungary has introduced legislation according to which state subsidies to university education (scholarships) must be paid back if a graduate seeks employment abroad within a certain number of years after graduation. In Malta, education grants under the "Get Qualified" scheme are paid out as tax incentives, i.e. only in the case that the graduate is employed in Malta.

In other Member States again, governments have shown limited commitment to the e-skills issue, but other stakeholders – industry, trade unions, and the civic sector – show high levels of activity. Bulgaria lacks a strategic policy approach on e-skills development, but the country's strong software industry has stepped in to fill the gap with a range of ambitious initiatives. In Germany, major industry players have taken the lead for instance in e-skills training and certification. Here, the focus is increasingly moving from the national to the regional, as key stakeholders on a region's market for ICT practitioner supply & demand join forces to address current shortcomings and projected shortages and mismatches.

In Belgium, most of the policies related to e-skills (e.g. education and training) are in the remit of the federated bodies, and the country's regions have long-established programmes which are generally regarded to be successful in spite of serious administrative hurdles, such as in the Brussels region. Some of these initiatives have even started to cross borders, i.e. to address supply & demand issues concerning e-skills in a border region.

Other countries still concentrate mainly on digital literacy activities with no e-skills related policies apart from promotion and awareness raising measures (e.g. Greece but also Italy, Hungary) and show little e-skills policy activity (e.g. Lithuania, Romania, Slovak Republic). Poland used to belong to this group as well, but has very recently shown strong efforts to e-skills development, reflected by the Broad Agreement for Digital Skills in Poland signed in July 2013. In Lithuania, as well, developments are pointing in the right direction: In early November 2013 a Lithuanian National Digital Coalition was

officially launched with the commitment of the Lithuania's government educational, library and digital and ICT sectors to boost digital skills and jobs in Lithuania.

Finland presents a very interesting example as it has to deal with a decreasing ICT sector as a result of the poor performance in recent years of the sector's national giant, Nokia. The short-term issue here is not shortage of ICT practitioners, but quite the opposite: a surplus of ICT professionals who have been shed by Nokia (or one of Nokia's suppliers) and who now must be enabled to find re-employment, including the option of self-employment, i.e. setting up their own business. Nokia in cooperation with the country's tertiary education providers as well as local/regional governments have set up a major programme for this purpose. Evidence so far suggests that this programme promises to become the most successful campaign for entrepreneurial activity based on ICT practitioner skills in the whole of Europe.

Developments since 2009

Research that preceded the present one already found evidence for a huge variation concerning the level of activity by national governments and stakeholders in the e-skills area. There is a need, of course, to interpret such differences in the context of the overall economic development of the respective countries and the maturity of its ICT practitioner labour market. It is for this reason that our previous research suggested that the analysis should be carried out by taking into account each Member States' performance on the Networked Readiness Index (NRI) published by the World Economic Forum. Using a grouping of Member States according to the NRI in 2009 (the reference year for our last study on the subject), the 2013 research allows exploring to what extent different strategies have been used by countries according to their position in terms of Networked Readiness.

- Group A included countries with very high levels of digital literacy and e-skills availability in the workforce but only modest level of activity in terms of policy and stakeholder initiatives in the e-skills domain in 2009: Denmark, Sweden, Finland, Austria, and Estonia. All of these have seen sharply increasing levels of policy and stakeholder activity between 2009 and 2013. Our research suggests that the Nordic countries have reached a higher level of maturity by now, as initiatives are focusing not on boosting supply of ICT practitioners in general, but rather on channelling ICT students to those segments of the ICT labour market where the risk of shortages is expected to be highest. At the same time, the large number of ICT practitioners in these countries' workforces means that retraining of ICT practitioners has become an issue – especially in Finland, where there are now too many people with skills in mobile telephony and too few in parts of the market which are more dynamic. In this situation, efforts are focusing on boosting entrepreneurial activity, which explains why there is increasing debate about the need for the provision of e-leadership skills.
- Group B included countries with high levels of digital literacy and e-skills availability in the workforce as well as significant levels of policy and stakeholder activity in the e-skills domain (the U.K. and – to a lesser extent – the Germany, France and the Netherlands). In all of these, levels of policy and stakeholder activity have further increased, especially so in France and the Netherlands, both of which are seeing strong policy leadership. Germany does not have a national e-skills strategy, but benefits from a strong role of stakeholders from industry. The UK's approach in the last decade has relied on strong financial engagement by the state and industry, which the recent economic crisis has made difficult to sustain. Nevertheless, the country's initiatives in the e-skills domain remain a worldwide benchmark for policy intervention in the area, with e-skills UK, the Sector Skills Council for the area, at the core of most activities.

The second category had been composed of countries with medium range NRI figures. It had been split in two subgroups:

Group C comprised countries with high levels of activity and at the same time large e-skills gaps as reported by industry, which meant that these countries could be expected to close existing gaps over the medium to long term. This included Ireland, Belgium and Malta, which were recommended to continue with high levels of effective activity. These Member States have indeed continued to show strong commitment to the e-skills topic, in spite of considerable challenges in the form of administrative hurdles (Belgium), strong budgetary constraints (Ireland); and termination of established multi-stakeholder partnerships following a change in government (Malta).

- Group D included Cyprus, the Czech Republic, Luxembourg, Portugal, Slovenia and Spain with modest levels of policy and stakeholder activity but also smaller e-skills gaps, with the exception of Slovenia. In the period 2009 to 2013, this group has again displayed medium to low levels of policy and stakeholder activity. In all of these countries with the exception of Luxembourg, the economy has been hit hard by the Eurozone debt crisis, leading to high rates of unemployment. This might have resulted in labour shortages being given little priority by policy makers. These countries will require, however, a strong ICT workforce in order to manage the structural shift of their economies towards sectors that offer room for strong growth.

The third category of countries was represented by:

- Group E, with comparatively low NRI figures in the range of 4.40 to 3.80. This included some countries with medium levels of activity in the e-skills area (Hungary, Latvia and to a lesser extent Romania and Poland), raising the expectation that policy and stakeholder initiatives would help improve the situation in the years to come. In the period 2009 to 2013, however, three of these four have displayed decreased levels of policy and stakeholder activity, which suggests that governments found it hard to sustain a focus on shortages of ICT practitioners in the face of growing budget deficits. Much of the activity in these countries appears to be related to the use of Structural Funds money for providing unemployed workers with ICT user skills and – sometimes – to retrain them to become ICT professionals. While this approach may bring short-term benefits in terms of availability of sufficiently e-skilled workers on the national labour market, it is unlikely to be of use for ensuring that employers will have an adequate supply of ICT practitioners in the medium to long term. Positive exceptions in this group are Poland, which has shown increasing efforts to secure future supply of suitably qualified ICT practitioners; and Bulgaria, in which non-government stakeholders mainly from the ICT industry have taken the lead in the absence of policy leadership by the government.

In 2013, e-leadership skills have started to become an issue in policy and stakeholder initiatives of 21 of 27 EU Member States. Developments are still in their infancy, though, with the exception of Denmark, Germany, Finland, Malta, the Netherlands and the U.K.:

- Denmark has a well-developed system for entrepreneurship training, with e-leadership skills on the way to become a key component of the education programmes.
- In Finland initiatives in response to the contraction of the Nokia ecosystem have included large-scale promotion of entrepreneurship predominantly in the digital domain. These have included comprehensive training measures to equip prospective entrepreneurs with e-leadership and traditional business skills. Education providers have responded by developing training in e-leadership skills.
- In Germany the Software Campus set up in 2012 is among the first major initiatives in Europe that focuses explicitly on e-leadership skills. It has led to an increased awareness about the need for e-leadership skills and related training and education offers.
- In Malta skills for e-Leadership and digital entrepreneurship attract considerable attention amongst policy-makers and other national stakeholders. The Centre for Entrepreneurship

and Business Incubation at Malta University and the Microsoft Innovation Centre have started to provide training in this area.

- In the Netherlands some first stakeholder initiatives which explicitly deal with e-leadership skills and digital entrepreneurship have been launched in recent years. Examples include integrated business development initiatives such as the Brainport Talent Region; and national campaigns and training schemes targeting SMEs such as 'Slimmer & veilig ondernemen in 1 minuut'. Several Dutch universities (Nyenrode, Tias Nimbas Tilburg, TU Delft) are also actively involved in the EuroCIO Executive Education Programme addressed to EuroCIO members which addresses the e-skills shortage in industry and are since recently also addressing e-leadership skills.
- In the United Kingdom increasing emphasis is put on e-leadership skills with the advent of the Information Economy Strategy and Council and the proposed joint action by government, business and academia on digital skills. Education providers have started to develop innovative offers at the interface between ICT and business management.

It becomes apparent that e-leadership skills have only become an issue in countries which rank at the top in Europe in terms the propensity for a country to exploit the opportunities offered by ICTs (as reflected in the NRI Index).

e-Skills supply and demand in Europe 2000-2020

The ICT workforce in Europe in 2012 includes 7.4 million workers, which is 3.4% of the European workforce. The workforce of ICT professionals as used in this report includes:

- Management and architecture and analysis level skills (1.5 million);
- ICT practitioners at professional level (3.4 million);
- ICT practitioners at associate/technicians level (2.5 Million).

A mapping the available statistical classification data (ISCO-08) to the CEN ICT job profiles is done in the following picture and gives an overview of the occupational structure of the ICT workforce.

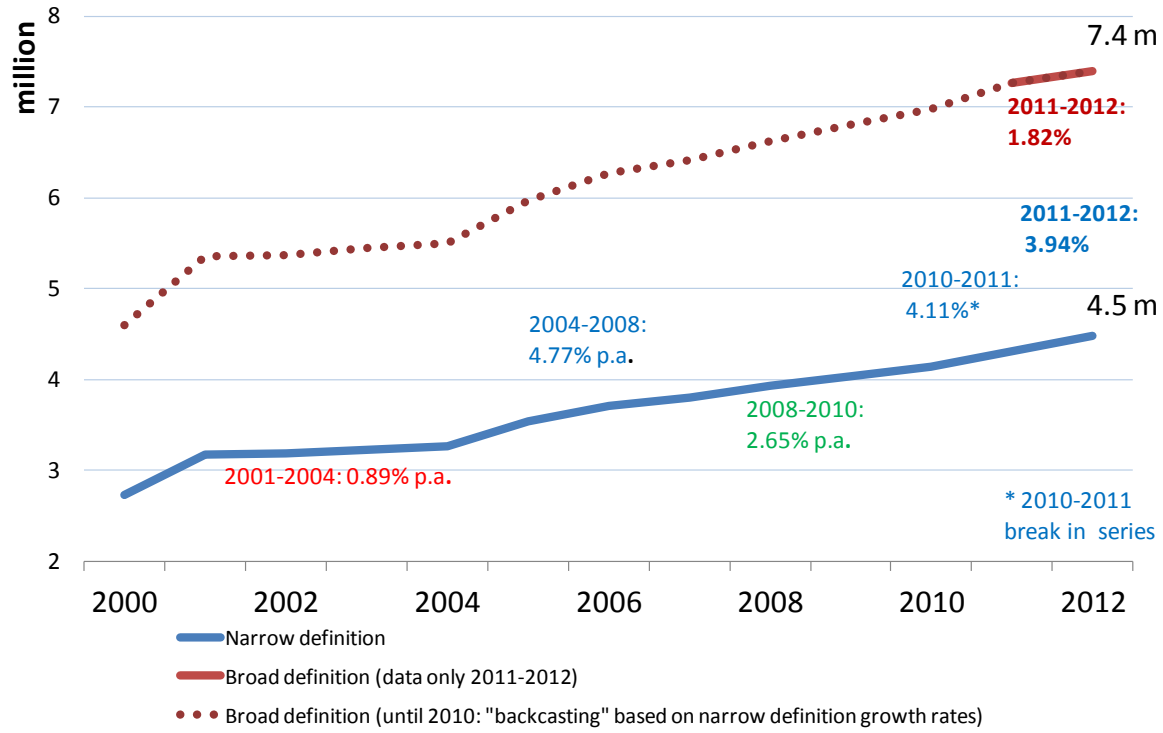
ICT practitioners are working in almost all industries of the economy and not just in the ICT industry sector, and it appears reasonable to assume that almost full employment of this occupational group exists in Europe.

Three countries already account for half of today's jobs, namely the United Kingdom, Germany and France. Adding Italy, Spain, Poland and the Netherlands, already this group of seven would reflect three quarters of the European ICT professional workforce.

The share of the ICT professional workforce within the total workforce is 3.4% in Europe and varies significantly across the European countries. United Kingdom, Luxembourg, Sweden, Finland and Denmark with a share of above 5% can be found at the highest ranks in this regards.

The Netherlands feature the largest share of management, architecture and analysis jobs within the IT workforce, their share is 40%, followed by Sweden (35%) and Finland (30%).

Development of ICT employment and average annual growth rates in Europe 2000 – 2012



Source: Eurostat LFS. Narrow definition: 2000-2010 ISCO-88 groups 213, 312: "Computing professionals" and "Computer associate professionals". Break in series 2011: ISCO-08 groups 25 "ICT professionals", 35 "Information and communications technicians". Broad definition: see elsewhere in this document.

The development of the ICT workforce in Europe between 2000 and 2012 has been very dynamic. The size of "ICT workforce" naturally depends on the definition used. Using a minimum definition, that only includes a core set of practitioners but is comparable across the time span of interest here, from 2000-2010 we have seen an average growth rate of 4.3% per year and of 3.9% between 2011 and 2012 (with a break in series 2010/11).

In a broader definition, where today's ICT workforce in Europe amounts to 7.4 million workers, the growth of workforce according to this broader definition has however been "only" 1.8% between 2011 and 2012.

The major inflows into the ICT workforce would obviously come from the ICT graduates from Higher, and in some countries Vocational, Education. The e-skills supply in Europe in 2011 from ICT graduates from Higher Education can be estimated to sum up to 113,000 ICT graduates. A closer look at the developments over the past 10 years shows a trend indicating decreasing numbers throughout Europe for the past years, but especially in the United Kingdom and Sweden. After a continuous increase and a peak of 127,000 ICT graduates leaving universities in 2006 the figures went down.

Development of the number of tertiary level computer science graduates (2000 – 2011)

Total number	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
EU-27	71,000	83,459	92,685	104,362	115,692	123,202	125,326	120,185	121,118	113,965	114,565	112,918
France	11,447	14,841	15,461	16,081	18,088	20,094	19,673	18,409	17,551	19,136	20,431	20,431
United Kingdom	21,918	24,992	27,009	30,767	27,670	29,557	28,239	25,156	23,802	19,154	19,180	19,535
Germany	5,630	5,860	6,617	8,368	11,090	12,767	14,238	16,092	16,515	17,194	16,800	16,526
Spain	10,963	13,727	16,152	19,323	19,718	18,559	17,298	15,760	14,551	15,071	15,068	14,790
Poland	1,912	3,542	4,112	5,879	10,681	13,116	14,788	14,209	13,023	12,406	12,535	12,315
Netherlands	1,308	1,454	1,645	1,754	3,611	3,969	4,650	4,385	4,083	3,928	3,858	3,651
Czech Republic	2,328	2,676	2,734	1,215	1,498	1,643	2,133	2,406	2,909	3,047	2,939	2,846
Italy	1,626	1,519	2,423	2,843	3,211	3,459	3,541	3,385	2,933	2,870	2,778	2,420
19 other Member States	16,544	17,994	20,026	22,066	24,486	24,682	25,489	24,913	25,751	21,159	20,976	20,404
Relative to peak	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
EU-27	57	67	74	83	92	98	100	96	97	91	91	90
France	56	73	76	79	89	98	96	90	86	94	100	100
United Kingdom	71	81	88	100	90	96	92	82	77	62	62	63
Germany	33	34	38	49	64	74	83	94	96	100	98	96
Spain	56	70	82	98	100	94	88	80	74	76	76	75
Poland	13	24	28	40	72	89	100	96	88	84	85	83
Netherlands	28	31	35	38	78	85	100	94	88	84	83	79
Czech Republic	76	88	90	40	49	54	70	79	95	100	96	93
Italy	46	43	68	80	91	98	100	96	83	81	78	68
19 other Member States	64	70	78	86	95	96	99	97	100	82	81	79

Source: Based on Eurostat, some estimates.

Today, like in almost all recent years except for the aftermath of the dotcom-bubble bursting, the demand for ICT workers is outstripping supply. The results of a representative empirica survey of CIO's and HR managers in eight European countries in 2012 show that the demand for e-skills, i.e. ICT professionals and practitioners, extrapolated to the whole of Europe (EU-27) can be estimated at around 274,000 in 2012. This is based on the numbers given by CIOs and HR managers in European organisations for the number of vacancies in ICT-related occupations.

Among these, we find a demand of about 73,000 vacancies for the EU-27 for "ICT management and business architecture" skills and about 201,000 for "Core ICT practitioners" and "Other ICT technicians" jobs. As percentage of existing workforce, there are 3.4% open positions for practitioners and 5.0% for management, architecture and analysis jobs.

Three scenarios have been prepared in the study. The main forecast scenario represents the most likely future as we foresee it, while a stagnation scenario assumes a slightly less favourable future and a disruptive boost scenario is meant to describe a future of increased demand due to ICT based disruptions of one or several industries of yet unknown kind. Scenarios are meant to span the space of likely possible futures.

The first scenario features an economic growth scenario based on ECFIN forecasts until 2014 and a slow recovery afterwards. GDP growth across Europe is assumed at an average of 1.0 % compound

annual growth rate between 2012 and 2015 and increases to 1.7 % on average annually between 2015-2020.

Moderate IT investments will be reflected in 2.2 % p.a. growth until 2015, with an increasing trend from 2014 on, so that the second half of the decade will see a growth rate of 3.0 % on average. IT investments will not least build upon a rapid diffusion of mobile devices and apps and of cloud services and other new IT delivery models. Big data applications and services are expected to grow considerably over the complete period of the forecasting. In the 'Main Forecast Scenario', the ICT workforce in Europe will grow from 7.4 million in 2012 to 7.9 million in 2020, of which 5.9 million will be ICT practitioners and 2 million ICT management level employees.

The excess demand or shortage (calculated as the number of open posts) amounts to 509,000 in 2015 and 913,000 in 2020. This figure can best be described as 'demand potential' or 'job potential' for ICT jobs. It should be seen as a (theoretical) figure describing the demand potential for new ICT jobs which could theoretically be additionally created in Europe due to an e-skills demand likely to occur especially in the years closer to 2020.

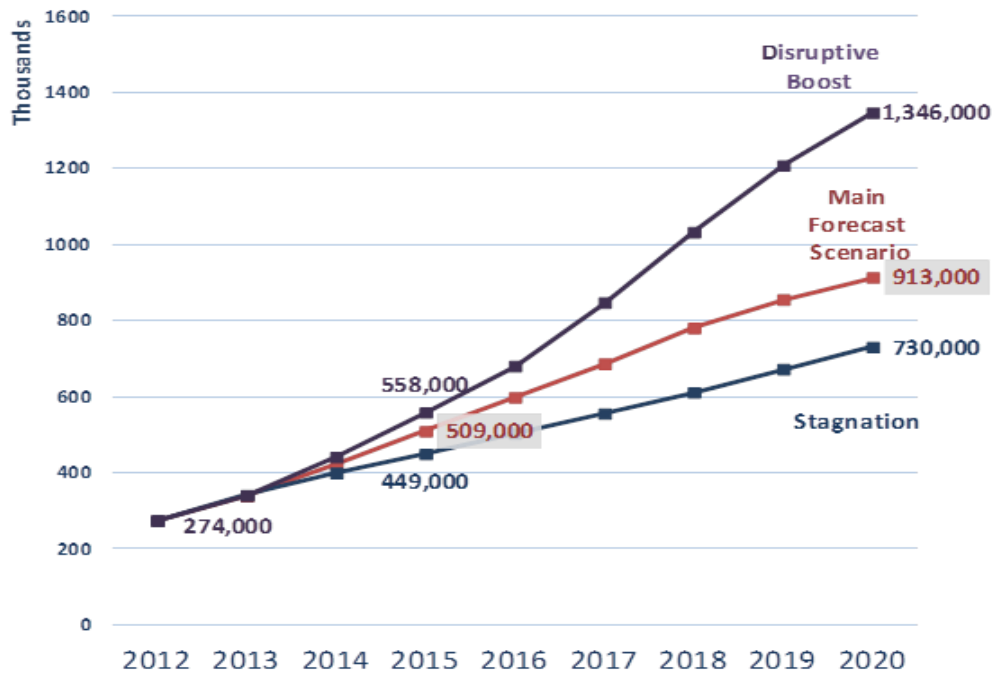
The second synthesis scenario called "Stagnation Scenario" features a stalling economic recovery: Southern European economies remain in recession – with high taxes and austerity prevailing. The US budget fight repeats itself and the impact is felt in the rest of the world.

Growth in China and other emerging markets slows down, with effects felt in Germany and many European countries which relied on increasing business from emerging economies as a strategy of recovery. As a consequence of the continued economic mire, IT budgets and investments are once again under pressure – new projects once again put on hold. Again, the focus of IT expenditure is on "keeping the lights on". A vicious cycle entails as lack of investments stops innovation, increases technical glitches and security breaches which in turn makes it difficult for companies to focus on top line growth. This will mean that ICT investments will continue to hover around the 2% mark.

As a result, the number of jobs will not increase as much, growing from 7.4 million to 7.48 in 2015 and 7.8 million in 2020. Excess demand will come in at 450,000 in 2015 and 750,000 in 2020.

The third synthesis scenario called "Disruptive boost" features some disruptive innovations taking effect in some industries, exactly which is – naturally - yet unknown. The drive towards adopting 3rd platform technologies (mobility, social, big data, cloud) increases dramatically as a new "killer app" emerges. This could for example be from the Internet of Things applications, where Line of Business budgets get released to fund ICT investments to a much higher degree; it could be the use of 3D printers where again investments may be channelled from production budgets to ICT investments; it could be a major security breach that pushes mass adoption of virtualised (or cloud) based workplace environments to control data access; or it could be faster adoption of big data/social in dealing with customers, which again lets ICT spending tap into other parts of the organisation's budget. This will produce ICT investment growth back to the rates seen at the end of the 1990s - a phenomenon that would not have been expected.

Excess demand in Europe 2012 – 2020, comparison of the three scenarios



Source: empirica, 2014

The increased innovation leads to higher economic growth from 2017 onwards. We have assumed that there is a general improvement in economic conditions from 2014 onwards to open up for the new "investment spree". Thus GDP growth will come back after 2014 and exceed the 2 percent mark again. After the disruptive boost setting in in 2017, growth will even surpass 2.5%. IT spending is assumed to increase slightly in anticipation of the disruptive boost and then still be felt in the following years. As a result, the number of jobs will increase from 7.4 million to 7.5 in 2015 and 8.1 million in 2020. Excess demand will be at 560,000 in 2015 and 1.3 million in 2020.

The international dimension

In today's knowledge-based economies, computers act as modern-day turbines, fuelled by the innovative ideas of skilled workers. However, obtaining adequate quantities of workers with the right e-skills is proving to be a challenge. Across the world, many countries are reporting difficulties in creating sufficient numbers of workers with the right skills in the right place at the right time:

- Europe: "It is estimated that there will be an ICT skills gap within Europe of up to 1.3M practitioners by 2020" (Empirica & IDC, 2013)
- United States: "Unlike the fiscal cliff where we are still peering over the edge, we careened over the "IT Skills Cliff" some years ago as our economy digitalized, mobilized and further "technologized" and our IT skilled labour supply failed to keep up" (Miano, 2013).
- Canada: "It is widely acknowledged that it is becoming increasingly difficult to recruit for a variety of critical ICT occupations – from entry level to seasoned" (Ticoll & Nordicity, 2012).
- Brazil: "Brazil's ICT sector requires about 78,000 [new] people by 2014. But, according to Brasscom, there are only 33,000 youths studying ICT related courses in the country" (Ammachchi, 2012).

- Australia: “Even though there are 10,000 jobs a year created in IT, there are only 4500 students studying IT at university, and not all of them graduate.” (Talevski & Osman, 2013).

At present, the ICT profession is immature compared to other such as the legal, medical and engineering professions – with respect to agreed bodies of knowledge, standards of education and training, and ethical conduct. This manifests itself in many ways, including, for example, poor public perception of the ICT profession (impacting on the numbers entering the profession), and a very high rate of ICT project failures (Saïd Business School[3] identified cost overruns in 8 out of 10 ICT projects, and a disproportionate number of so-called “ICT black swans”, with one in six projects experiencing a cost overrun of 200%).

This is a concern given the extent to which ICT pervades our lives. Traditionally, professions have formed when failure to apply domain-specific knowledge successfully has had the potential to adversely impact on society. As we now enter a new wave of pervasive computing with the realisation of the Internet of Everything, the extent to which ICT is embedded in society will inevitably grow. If we fail to take steps to mature the profession now, it is likely that the risks to society from ICT will grow to unacceptable levels – as such, the call for action is clear. Indeed, Vint Cerf, one of the “founding fathers of the internet” recently wrote “it is difficult to believe the software profession will escape some kind of deep accountability in the future” (Cerf, 2013).

There is also an important international dimension to the challenge of maturing the ICT profession: Historically, most professions have developed on a national basis before, in some instances, becoming established across wider geographic regions. This is understandable as most professions were formed by like-minded peers coming together to form local and national associations that would meet face-to-face to share knowledge and best practices, before developing more formal and rigorous standards of practice that would be adopted uniformly. This in itself would not present difficulties as most practitioners would practice their craft in a given country, working with other professionals possessing the same knowledge and adhering to the same codes of practice, and so on. However, the computing profession is perhaps confronting a unique challenge in its development, a challenge that most other professions did not have to confront in their relative industry: that is, ICT practitioners are increasingly working in global teams, operating as parts of a distributed global digital value chain. For a profession where standards have not even been defined and accepted at a national level, the challenges of dealing with other practitioners across borders with potentially entirely different educational systems, practices and values, introduces a level of risk and complexity that perhaps did not exist previously. For this reason, increased priority should be placed on recognising the importance of standards across borders with respect to the ICT professionalism.

Similarly, we also have to confront the reality that technological trends and new toolsets are changing the level of impact and type of work that can be undertaken by people with relatively limited computing know-how. By reducing such barriers to entry, non-ICT professionals now have at their disposal, tremendous resources that can facilitate innovation within businesses, but arguably they are perhaps also more likely to spawn systems that have been developed with scant regard for privacy, security, and ethical conduct, as they will have been developed by individuals who have not been exposed to formal computing education that typically instils an understanding of at least the rudiments of such concepts. Ensuring that such individuals, who have perhaps had limited formal

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[3] Flyvbjerg, B and Budzier, A (2011). Why Your IT Project may be riskier than you think. Harvard Business Review Magazine (September 2011). Available at: http://hbr.org/2011/09/why-your-it-project-may-be-riskier-than-you-think/

computing education, are educated appropriately in relevant concepts and practices is important to avoid increasing accusations of ICT practitioners being perceived as "cowboys"[4].

Fundamental changes are occurring at a societal, economic and technological level: the changing relative importance of first world economies, ageing populations in many regions; the emerging middle-class in developing economies; improved access to education; massively increased computational power, available to increasing numbers of individuals across the world. Such changes are causing substantial changes in the way organisations operate – including the emergence of global value chains, and their accompanying, global sourcing models. As part of these new global sourcing models, different skillsets are required in different locations, and the new technologies are demanding changes in the type of skills required.

Offshoring

As a consequence of these global sourcing models, some ICT work is being offshored to countries outside of Europe. The initial key driver for offshoring was to reduce cost, but this has evolved over time, and the types and scope of work that is offshored is becoming more complex, increasingly involving higher level skills as organisations use offshoring to gain access to capabilities that may be in short supply locally or onshore – but with cost savings typically an expected outcome. In this respect the offshore value chain is complex involving many different types of work requiring both low-level and high-level skills, and is now used not solely for low-cost delivery but rather as part of a more complex global sourcing strategy. Although there is considerable variety in the skillsets that are offshored, the balance in terms of volume of skills naturally shifts towards skills for activities that can be delivered remotely and where face-to-face interaction with the end customer of the service or product is less important. In this respect, IDC forecasts on offshore spending suggest that application-related activities will continue to dominate in terms of the use of offshore facilities in the near future.

As offshore service delivery matures, there is increasing emphasis on delivering more advanced services and higher productivity by standardising processes and increasing automation where possible. 'Process factories' are one such example of increased standardisation – breaking down the components of processes so they can be redistributed logically and physically to gain economies of scale and geographic reach; reuse of assets for multiple clients or functions; and the use of non-human assets (software, process models,…) to automate processes as much as possible. Cloud, together with standardisation and automation, has played an important role in global sourcing delivery, helping organisations to transform to a new model for consuming ICT and business process tasks and services. This multi-faceted approach to sourcing is important, as it underlines an important shift in the strategies of many offshore providers. For example, the largest Indian offshore providers have established near-shore centres in Eastern (and Western) Europe, hiring local staff, in order to support the local customer base – again, reflecting the importance of "being close to the customer" for some key skills. This also clearly has important repercussions for the types of skills that are likely to be in demand in Europe to support the local customer base.

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[4] To avoid confusion, it is worth emphasizing that we are not considering ICT end-users in this report. Clearly, ICT professionals possess some end-user skills, but our focus here is primarily the examination of the higher level e-skills required by ICT professionals (e.g. software design, enterprise architecture, infrastructure management, data modeling etc.

Offshoring of ICT skills

Reflecting the radical changes in ICT technologies, growth is witnessed in skillsets such as cloud computing, social computing, mobile computing, and big data. Table 1 below, derived from a survey of senior ICT executives, shows how demand for certain skillsets is likely to grow, and which skills are/are least likely to be offshored.

CIO views on skillset demand/location. Source: primary research, 2013

Skillset trends (2013-2020) – CIO Perspectives		
Most likely to grow	Most likely to be offshored	Least likely to be offshore
Data visualization (83%)	Coding (54%)	Information security (81%)
Information security (80%)	Software testing (45%)	Enterprise architecture (76%)
User experience design (74%)	ICT Support (40%)	ICT Supplier Management (76%)

It is also interesting to note that the skillset that is most predicted to experience decreased demand is legacy maintenance (more than double any other skills). However, the fact that only 21% of respondents viewed this as likely suggests that in overall terms, most CIOs believe that demand for ICT skills generally will remain relatively robust over the period 2013-2020.

The impact of offshoring

When offshoring does occur, it is often presumed that all related ICT jobs will be lost onshore. However, evidence suggests that the impact on jobs is limited: not only can ICT staff be redeployed, but new ICT positions may also be opened by offshoring vendors that want to expand their business in the EU by establishing a physical local presence to better serve their EU customers. IDC estimates that on average only 22-23% of total jobs impacted by offshoring are indeed lost. Moreover, empirical studies show that as offshoring matures, the number of jobs lost onshore in terms of total jobs moved decreases. IDC estimates that by the end of 2020, the number of ICT jobs lost due to offshoring will represent some 17-18% of total ICT jobs moved. In absolute terms, this means that some 60,400 EU jobs were lost up to 2012 and some 132,900 jobs are forecast to be lost by 2020. On average, some 9,000 jobs will be lost in the EU every year, starting from some 7,000 in 2013 to nearly 12,000 in 2020. As such, the impact of offshoring on jobs lost is not huge. However, there are missed opportunities, not represented by jobs lost, rather by jobs the EU is not able to attract, which are, of course, relevant and not quantified in the data shown below.

Total ICT Jobs Lost - AGGREGATE

	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	6,400	7,400	8,400	9,500	10,800	12,200	13,800	15,500	17,500
Germany	10,200	11,700	13,200	15,000	16,900	19,100	21,500	24,300	27,100
Italy	1,500	1,700	1,900	2,200	2,500	2,800	3,200	3,600	4,100
Poland	1,800	1,900	2,000	2,100	2,300	2,400	2,500	2,700	2,800
Spain	3,000	3,200	3,500	3,800	4,100	4,400	4,800	5,200	5,600
UK	26,700	29,000	31,000	33,100	35,300	37,500	39,900	42,300	44,900
EU21	10,800	12,500	14,400	16,400	18,800	21,500	24,400	27,500	30,900
Total EU	60,400	67,400	74,400	82,100	90,700	99,900	110,100	121,100	132,900

Source: IDC, 2014

Given the higher than average reliance on offshoring and the high number of jobs moved, the UK will suffer the most from ICT job losses, adding up to nearly 44,900 in 2020. Germany and France will follow, with cumulative losses of 17,500 and 27,100 ICT jobs in 2020 respectively. Further examination of the data suggests that the applications segment, which is the prominent focus area for many offshoring projects, shows the highest number of ICT jobs lost. More than 64% of losses up to 2012 happened in this segment (Table 5). It will also remain the segment that will suffer the most along the forecast period, with average yearly losses of some 5,000 jobs (from 3,900 in 2013 to 6,500 in 2020). See table below.

Total ICT Jobs Lost by Segment - Total EU - AGGREGATE Putting the statistics into perspective

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Applications	38,800	42,700	46,700	51,100	56,000	61,200	67,000	73,100	79,600
Infrastructure	8,400	10,000	11,600	13,200	15,000	17,200	19,800	22,700	25,900
Other	10,900	12,300	13,600	15,100	16,700	18,300	19,900	21,600	23,500
R&D	2,300	2,400	2,600	2,800	3,000	3,100	3,400	3,600	3,900
TOTAL ICT JOBS L	60,400	67,400	74,500	82,200	90,700	99,800	110,100	121,000	132,900

In aggregate, the overall impact of offshoring on ICT jobs is relatively limited – as can be seen in the table below. Jobs lost represent quite a small share of total ICT skills demanded (0.8% in 2012), ranging from 0.2% in Italy, where offshoring is still embryonic, to 1.6% in the UK, where offshoring is quite mature. Nonetheless, by 2020, ICT jobs lost will account for 1.5% of total ICT skills demanded, nearly doubling the share compared to 2012.

% Jobs Lost of Total ICT Skills Demanded

	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	0.7%	0.8%	0.9%	1.0%	1.1%	1.2%	1.3%	1.5%	1.6%
Germany	0.8%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.6%	1.7%
Italy	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%
Poland	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%
Spain	0.6%	0.7%	0.7%	0.8%	0.8%	0.8%	0.9%	0.9%	1.0%
UK	1.6%	1.6%	1.8%	1.8%	1.9%	1.9%	2.1%	2.3%	2.4%
EU21	0.5%	0.6%	0.7%	0.7%	0.8%	1.0%	1.1%	1.2%	1.4%
Total EU	0.8%	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%

However, although the net projected impact of globalisation is estimated to be relatively low (approx. 1.5% by 2020), the reality is that in certain sectors/skillsets, it is likely that the effect is likely to be felt to a greater extent. Indeed, the impact on graduates is expected to be higher (over 9% by 2020) – representing an important concern for the sustainability of the ICT skills pipeline in the longer term. As such, there is the risk that the statistical headline figure of 1.5% masks the potential impact on workers and diminishes the imperative for appropriate policy action to be put in place. For this reason, we also advocate the importance of policy actions that emphasise the need for worker retraining while in-situ with existing employers, and if required, further targeted retraining initiatives and incentives for workers who have lost their job, and schemes for supporting employers in the training of their graduate intake.

Automation

The natural rhythm of employment in computing and it continual focus on new technologies dictates that some practitioners invariably find their jobs roles at risk as new technologies emerge and as others fall out of favour. In most instances, practitioners are able to retrain in order to find employment in similar roles – for example, retraining in a new computing language or environment. To many people working in ICT, this is largely accepted as business-as-usual, given the high level of innovation in the profession. However, the type and scale of automation that is now emerging suggests that substantially more jobs will be at risk from automation.

For example, skills such as infrastructure management and software testing are not only vulnerable to offshoring; they are increasingly vulnerable to automation. Indeed, 76% of our CIO respondents perceived automation as having a moderate/high/very high impact on demand for e-skilled workers. Moreover, our experts felt that automation was a greater threat to demand for e-skills than offshoring (with twice as many respondents (34%) viewing automation as a high/very high impact, compared to only 17% of respondents for offshoring). The importance of this threat is underlined by the fact that some offshore providers are now forging relationships with suppliers of autonomics solutions to break the linear link between project size and manpower required.

Given the massively increasing scale of computing power that is being introduced into the market (the impact Moore's Law becomes increasingly salient over time), it is possible that large segments of ICT practitioners might find themselves increasingly vulnerable to technological redundancy (e.g. software testing). An interesting dynamic stemming from the automation of knowledge work is that it may also help to level the playing field between higher-cost Western countries and typical offshore locations. If a process or task can be done solely by computers, the financial benefits of moving this task or process offshore dissipates, and the 'work' is more likely to remain onshore (although the interpretation of work remaining 'onshore' in a cloud-based world is open to interpretation). However, if the design and higher level skills required to exploit the machines can be retained onshore, there is the potential for workers in Europe to "race with the machines". This is an important dynamic: if workers in Europe can be skilled to "race with machines", there is the potential for European workers to exploit the new technologies effectively, bringing increased growth and competiveness to Europe.