e-Skills: The International Dimension and the Impact of Globalisation
The capability of European enterprises to compete and evolve at the beginning of the 21st century is becoming increasingly dependent on the innovative and effective use of new information and communication technologies (ICT). The e-skills strategy is a component of the Digital Agenda for Europe and the Employment Package to boost competitiveness, productivity and employability of the workforce. Europe needs to create better framework conditions for innovation and growth and new digital jobs and to ensure that knowledge, skills, competences, and inventiveness of the European workforce, including ICT professionals, meet the highest world standards and that they are constantly updated in a process of effective lifelong learning.

Despite high levels of unemployment, shortages of e-skills continue to increase in all sectors. The mismatch between the skills available and the needs of the labour market concern all Member States, even if it affects them to varying degrees. Remarkably, the demand for ICT practitioners is growing by around 4% a year, outstripping the supply. Forecast vacancies by 2015 are at about 500,000, and many will remain unfilled unless more is done to attract young people into computing degrees and to retrain unemployed people.

Governments in Europe are significantly increasing their efforts to address the skill shortage through dedicated policies, initiatives and partnerships. There are further positive signals since Member States are becoming much more active with for example Greece, Italy and Bulgaria having established in 2014 national coalitions as part of the “Grand Coalition for Digital Jobs” launched by the European Commission in March 2013.

The international dimension entered the European e-skills policy agenda more recently and a major event took place in March 2014 in Brussels with the participation of experts from all over the world. Feedback was very positive in so far as there is a broad consensus on the need and benefits to strengthen dialogue and exchange information at an international level to better address e-skills shortages, learn about good practices and foster greater ICT professionalism.

This brochure highlights the main findings and conclusions on the international dimension of e-skills and the impact of globalisation on digital jobs in Europe. It is providing a timely analysis and concrete and ambitious recommendations. The human capital issue and especially the e-skills agenda remain of crucial strategic importance for all countries in the world. The European Commission and national governments need to continue to be active in this area.

**Michel Catinat**
Head of Unit
Key Enabling Technologies and Digital Economy
DG Enterprise and Industry
European Commission
The key objectives of this European Commission service contract are to:

- Explore the international dimension of e-skills (particularly efforts to promote ICT professionalism), including the analysis of major policy initiatives and best practices in the world
- Assess the impact of globalisation on high-level e-skills

Ultimately, the goal of the service contract is to understand the international dimension of e-skills in order to better anticipate change and envisage possible opportunities for collaboration and cooperation. In doing so, it is envisaged that the project will, in the longer term, help to bring about a series of benefits for different stakeholder groups. It is worth emphasising that many of the objectives stated are longer term goals related to the maturing of the ICT profession as a whole. Such goals require further work and collaboration by many stakeholders and the report resulting from this service contract aims to act as one of the key stepping stones to achieving this.

Since the late 1990s, initiatives surrounding the development of e-skills and addressing skill shortages have been high on the agenda of the European Commission and EU member states. Such initiatives have had a strong focus on policies to improve e-skills throughout Europe. Examples include:

- The emphasis on skills development and lifelong learning within the European Employment Policy.
- The European Commission’s Action Plan for Skills and Mobility’s (2002) focus on developing an adaptable, skilled and mobile workforce for a dynamic knowledge-based economy.
- The CareerSpace development of core generic skills profiles, for which the ICT industry was experiencing skill shortages.
- The “Investing in People and Skills” objective of eEurope (2002), with specific emphasis placed on ICT digital literacy skills, education and training on ICT, and European certification of basic ICT skills.
- The eEurope (2005) initiative’s policy actions including for example implementing e-learning programmes and re-skilling for the knowledge society.
- The European Commission’s DG Enterprise and Industry’s “GoDigital” initiative call for collaborative initiatives between industry and academia to define ICT skills requirements, and the development and implementation of an SME training programme.
- The European Commission’s Europe (2020) Digital Agenda for Europe 2010 – 2020, with an emphasis on enhancing and implementing long-term e-skills and digital literacy policies within Member states.
- The European Commission’s “Grand Coalition for Digital Jobs”.

Employers need to work globally and cooperatively to grow the ICT profession and help solve the e-Skills gap.

Christian Pagel,
Head of Information Technology Management / CIO,
ThyssenKrupp Industrial Solutions AG.
The ICT skills gap
Skilled workers are the bedrock of successful companies. A recent survey of 1700 CEOs worldwide identified that human capital rated above all other factors as the source of sustained economic value.

In today’s highly competitive business environment, technology is a key enabling factor for communication, innovation and efficiency. However, across many global economies, the demand for workers with relevant e-skills is intensifying, and supply is failing to meet this demand. An empirica survey of CIOs and HR managers in eight European countries in 2012 estimated the demand for e-skills across the EU at 274,000. Of three scenarios prepared in this survey, the one representing the most likely future of modest economic growth suggests the likelihood of modest job growth of 100,000 jobs until 2015, with a structural shortage of 509,000 jobs caused by lack of available talent. The bottlenecks are largest in the UK, Germany, and Italy, which together account for 60% of all vacancies in Europe. This growing trend of ICT vacancies coincides with a period of high unemployment, thus implying decreasing efficiency in the labour market. Similar ICT skills gaps are evident in the US, Canada, Brazil, Australia, Russia, South Africa, Latin America, Malaysia and Japan.

The e-skills gap is particularly alarming when examining new emerging technologies. An IBM survey of 1200 IT and business decision-makers across 13 countries indicated that two-thirds believe that mobile, analytics, cloud and social technologies are strategically important; however 25% reported major skills gaps in each area, and 60% reported moderate to major shortfalls. The e-skills gap is further impacted by the numbers of women participating in the labour market. In OECD countries, women now account for less than 20% of ICT specialists. Within Europe, women make up less than 30% of the ICT workforce, and in the US only 23% of workers in STEM (Science, Technology, Engineering and Mathematics)-related jobs are women. The situation is even more pronounced with movement up the organisational hierarchy. A recent report suggests that women hold just 9% of IT management positions, and account for only 14% of senior management (when including non-technical departments) at Silicon Valley start-ups.

Our research at Forfás shows that the skills necessary to analyse and make sense of big data will become increasingly important.

Gerard Walker, Senior Policy Advisor, Forfás, Ireland.
Increasing the supply of e-skilled practitioners

Increasing the supply of ICT graduates within the tertiary education system is one solution to the e-skills problem; however, the time taken for a student to pass through the process is typically 3-4 years. Moreover, the scalability of the current educational system is limited. To address this challenge, governments and industry are contemplating alternative mechanisms to address the immediate shortage of e-skilled practitioners:

- Primary and secondary education: Improving ICT education is key to improving the pipeline of e-skilled workers in the longer term.
- Tertiary education: expectations of academia versus industry: Some industry voices are critical of the quality of tertiary education graduates. The European Commission recognises improved industry/academia alignment as key.
- Vocational education/apprenticeships: A McKinsey (2013) report examining the global transition from education to employment for young people identified that 60% of youths believe on-the-job training and hands-on learning are the most effective instructional techniques, but less than half of these are enrolled in curricula that prioritise such techniques. Hence, a growing role for apprenticeships/vocational training is envisaged in addressing the e-skills gap.
- Continual re-skilling and lifelong learning: ICT continually reinvents itself and it is this rapid pace of change that helps drive innovation and increased productivity in organisations. Consequently, these changes demand new skills from ICT practitioners; hence the ongoing requirement for lifelong learning.
- Industry based training and certification (IBTC): A recent empirica report (2013) stated that: “certificates based on IBTC are indispensable for some ICT vacancies or promotions, according to 30% of HR/CIO respondents”.
- Massive Open Online Courses (MOOCs): blended learning: A MOOC is an online course aimed at large-scale interactive participation and open access via the web. MOOCs provide an opportunity for students to access education that previously would not have been accessible to them due to financial constraints, geographic location, institutional entrance requirements, and/or personal schedules.

The importance of a global skill set – offshoring ebb and flow

Recognising the global nature of ICT and the growing importance of global value chains, there is increasing awareness of the need for ICT practitioners to possess intercultural skills. Many organisations are offshoring work, splitting activities across geographic, linguistic and cultural borders.

Mobility and immigration

Part of the skills mismatch arises from the fact that skilled workers are located in geographic regions where there is little demand for work, and are reticent to move to locations of high demand. In a 2012 survey of 500 European decision makers, “better mutual recognition of degrees and professional qualifications across borders” was identified as the number one measure to improve the mobility of skills transferability.

Immigrants also play a key role in many societies. A recent report “Then and Now – America’s new immigrant entrepreneurs” found that 24% of engineering and technology companies had at least one key founder who was foreign-born. In Silicon Valley, this number was 44%. Given the skills gap that exists globally and the strong contribution to innovation that immigrants are responsible for, immigration policy is being scrutinised as a possible solution for growth. Many within the technological industry are demanding changes in immigration to ease the current e-skills gap.

ICT professionalism can put Europe at the forefront of competitiveness and innovation and provide clear career roadmaps to prospective professionals.

Declan Brady, Professionalism Task Force Chair, CEPIS.
The need for ICT professionalism
Why is it important to mature the ICT profession? In addition to the e-skills gap aforementioned, there are further reasons:

• Poor image of the ICT profession: A poor public perception of the ICT profession is impacting on the numbers entering the profession.
• ICT knowledge deficiencies: Low levels of ICT knowledge amongst ICT practitioners and/or knowledge silos prevent a view of the 'big picture' of ICT, its interconnectedness, and its role in enabling organisational capability planning.
• Traditional focus and reliance on Computing Science degrees: Tertiary education providers need to adapt in order to meet the growing industry demand for ICT professionals who have both business and technical expertise.
• ICT project failures: Many ICT projects fail to deliver their promised efficiencies and value.
• Societal impact: The extent to which ICT, if it goes wrong, has the potential to harm society.

Building blocks of the ICT profession
The IVI and CEPIS report “e-Skills and ICT Professionalism – Fostering the ICT Profession in Europe” (2012) identified four building blocks for an ICT profession:

Bodies of Knowledge
Professional Ethics
Education and Training
Competences

At IEEE we have developed a professionalism framework in collaboration with industry, including an ITBOK that serves as an umbrella referencing other BoKs for IT specialisms.

Chuck Walrad,
Chair, Professional Activities Board,
IT Committee, IEEE Computer Society.
• Bodies of knowledge (BOKs): One method of establishing a profession is to first define an appropriate body of knowledge for that profession, which may then be used to set standards and certification processes.
• Competences: An understanding of the capability and competency needs of people working in various roles is essential for organisations to effectively recruit and develop suitable employees.
• Education and Training: Formal qualifications, certifications, non-formal learning and informal learning are mutually supportive components of a professional’s career development.
• Professional Ethics: A defining aspect of any profession involves adhering to professional ethical conduct.

ICT professionals – a working definition
There is no single agreed definition of an ICT professional. Different countries and organisations have differing views on the topic. The definition used within the context of this research is derived from an earlier initiative by the European Commission, and was accepted by the CEPIS council in 2012.

Definition: ICT Professionals
• Possess a comprehensive and up-to-date understanding of a relevant body of knowledge.
• Demonstrate on-going commitment to professional development via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education.
• Adhere to an agreed code of ethics/conduct and/or applicable regulatory practices, and;
• Through competent practice deliver value for stakeholders.

To keep moving at the speed of global business, Intel actively supports employees to continuously evolve their ICT skills to help create a better future.

Jim Kenneally,
Principal Investigator,
Intel Labs Europe, Senior Research Fellow,
Innovation Value Institute.
TECHNOLOGICAL TRENDS

Rate of change
The rate of change of ICT is fast moving and is increasingly difficult to keep pace with. As such, the ICT profession must be agile and flexible enough to adapt to, as well as, to shape these changes. Rapid change can also raise new and unpredicted ethical issues as well as problems with education and training in keeping up-to-date with technological developments. Some of the key technological trends include:

The Internet of things
The ‘Internet of Things’ (IoT) is so-called because it initially referred to the fact that the Internet increasingly includes ‘things’ or devices such as smartphones and smart appliances. Increasingly our environment will include a plethora of sensors embedded in objects (or ‘things’) that will drive contextually aware services that can be exploited by people and business.

Big data
‘Big data’ has been defined as ‘the massive amounts of data that collect over time that are difficult to analyse and handle using common database management tools’. There is a continuous stream of new content driving growth in data including website postings and usage data, sensory data, user-generated content, GPS, and RFID. Big data is important because it provides insight for marketing departments, finance, operations, strategy, and for economies and societies as a whole. This drives demand for employees who have the business and mathematical skills to interrogate and analyse this data in ways that can provide both business and societal value.

Demand for deep analytical talents in the United States could be 50 to 60% greater than its projected supply by 2018
Supply and demand of deep analytical talent by 2018

Figure 4: Projected demand for analytical talent towards 2018

1 Other supply drivers include attrition (-), immigration (+) and reemploying previously unemployed deep analytical talent(±). SOURCE: US bureau of Labour Statistics; US Census; Dun & Bradstreet; company interviews; McKinsey Global Institute analysis
Cloud computing
Cloud computing or ‘cloud’ is perceived as highly important by most businesses. A 2011 Accenture/LSE survey of over 1000 senior executives revealed that more than 50% of business respondents believed that cloud would “enable us to focus on transforming our business and not just our IT”. The benefits of cloud resonate particularly strongly with SMEs as they are able to exploit ICT possibilities, previously only available to large multinationals.

Social tools and technologies
Social technologies refer to technology-enabled approaches that facilitate interactions among people and organisations. Examples of social tools and technologies in the business context include social networking and video.

Mobile
Mobile technologies are having a huge impact on business operations globally. IDC estimates that smart mobile devices will generate 57% of the IT industry’s overall growth worldwide. While there is an organisational demand for mobile talent, a 2012 survey undertaken by InformationWeek suggests that this might not translate into additional hiring requirements for companies, as most companies are instead retraining existing employees.

At INSEAD our MBAs learn how to use data analytics to address business issues through project based learning on real company data, while also using state of the art cloud based and open source tools.

Theodoros Evgeniou, Professor of Decision Science and Technology Management, INSEAD elab.
MACRO-ECONOMIC AND SOCIETAL TRENDS

Trends
The macro-economic and societal trends that are likely to impact on the future need for skilled workers include among others: the global labour market and economic growth rates, youth unemployment, age demographics and women in the workforce. Understanding these trends is valuable as it helps to provide some insight into how globalisation may evolve over time. These were divided into three basic segments:

• Landscape: the current global macro-economic and societal landscape.
• Terrain: some of the key factors shaping the landscape.
• Horizon: the trends likely to form part of the landscape in the future.

Landscape
• Global labour market: The International Labour Office estimated an accumulated total of 197 million people without a job in 2012.
• Global growth rates: The slow rates of growth of developed economies are only a fraction of the rates being experienced in developing countries. East Asia which has experienced high growth in recent years appears to be slowing down significantly. Conversely, some European economies that were in recession now show some signs of recovery, albeit fragile.
• Youth unemployment: The global situation regarding youth unemployment is a cause for concern. Using figures from ILO, OECD and the World Bank, the Economist estimates that there may be “as many as 290m 15-to-24 year olds not participating in the labour market – almost a quarter of the world’s youth, and a group as large as the population of America”. At the same time there is also a lack of skilled entry level workers.
• The two divergent patterns of youth unemployment and inadequate availability of skilled entry level workers illustrates the nature of the current skills gap and underlines the importance and need to improve skills development for this age group, in parallel with efforts to create jobs.

In Japan we produce an annual IT HR white paper which provides us data on significant changes in the role of IT HR in the business environment so we can base our e-Skills policies and initiatives on strong evidence.

Masayoshi Tsuru, IPA, Japan.

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<td>Australia 3.1%</td>
<td>Brazil 4.0%</td>
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<td>Canada 2.3%</td>
<td>South Africa 3.6%</td>
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<td>Germany 1.3%</td>
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<td>Portugal 0.5%</td>
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<td>Market Rates 3.5%</td>
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Figure 5: Global growth leaderboard. (Source: PWC -16th Global CEO Survey, 2013)
Lack of skills is a common reason for entry level vacancies – % of employer respondents

56
53
48
45
40
38
32
30
12

36% of employers also reported a lack of skills caused “significant problems in terms of cost, quality and time” or worse

Turkey
India
Brazil
United States
Mexico
Saudi Arabia
Germany
United Kingdom
Morocco

Figure 6: Employers citing lack of skills as a cause of entry-level vacancies.

Terrain

- Global demand for skilled workers: The World Economic Forum report (2011) on global talent was clear in its diagnosis of the problem: “The Northern hemisphere faces talent shortages in a wide range of occupational clusters largely because populations are ageing rapidly and educational standards are insufficient...many countries in the Southern hemisphere report workforce surpluses due to high economic growth and stable birth rates. However, there are questions about the employability of these workers - whether they have the necessary skills to get jobs and work effectively”.

- The growth of women in the workplace: The number of women in the workforce in advanced economies rose by 77 million between 1980 and 2010, accounting for 61% of the 122 million net additions to the labour force in advanced economies. Notably, women make up a substantial portion of the percentage of college graduates in emerging economies, but this does not necessarily translate well into corresponding levels of workforce participation.

- Age demographics: In many countries, the ageing population will be encouraged to work beyond the current retirement age. For example, the UK Pensions Minister, Steve Webb, views older workers as “an untapped resource” and claimed that “over time there will be a whole set of jobs where employers need experienced older workers ... a firm that doesn’t change its attitude to older workers will be left behind”.

Horizon

- The emergence of Africa: Thus far, most emphasis on developing markets has focused on Brazil, Russia, India and China. However, Africa is also likely to change employment dynamics in the near future. The World Bank reported in 2014 that growth in Sub-Saharan Africa is forecast to rise to 6% (excluding South Africa, the continent’s largest economy).

- The digitalisation of SMEs: Small and Medium Sized Enterprises (SMEs) are central to the European and world economy. How SMEs adapt as a result of developments in ICT will have a significant impact on the need for e-Skills.

- Opportunities from globalisation: Globalisation, coupled with the fundamental technological shifts that are occurring, also presents many opportunities for enterprises. The infrastructure boom taking place in developing countries over the next twenty years, estimated to be in excess of $20 trillion, is likely to require the provision of substantial engineering, design, technical and business services which could come from Europe. The potential benefits would be shared by developing and developed countries.

BCG research shows that technology-enabled SMEs increase revenues 15 percentage points faster and create jobs almost twice as fast as their peers.

Ralf Dreischmeier, Global Leader (IT Practice), The Boston Consulting Group.
Trends
A key element of this service contract was to undertake primary research with leading stakeholders in order to capture
their visions and strategies in the area of e-skills and ICT professionalism. Stakeholders were made up of CIOs, senior
ICT managers and ICT HR Managers from a broad range of industries across Europe.

What is your opinion on the following statements?

“In our country as a whole, there is a serious ICT skills gap/mismatch that is hampering the growth of companies?”

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“In our organisation a lack of availability of high-level ICT skills is negatively impacting on our ability to grow the business.”

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</tr>
<tr>
<td>Agree(4)</td>
<td>23</td>
<td>31.9%</td>
</tr>
<tr>
<td>Strongly Agree(5)</td>
<td>11</td>
<td>15.3%</td>
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Figure 7: Perceived ICT skills gap/mismatch by survey respondents

Findings indicated that the majority (70%) of respondents believe there is a serious ICT skills gap/mismatch that is hampering the growth of companies. Further, almost half (47%) of all respondents feel that the lack of availability of high-level ICT skills is impacting on their ability to grow their businesses.

Impact of offshoring and automation
The majority (61%) of respondents feel that offshoring is likely to have a moderate or high impact on the future demand for ICT skills in their organisation. More than three quarters of all respondents (76%) feel that ‘automation’ is likely to impact on the future demand for ICT skilled workers within their organisation.

Impact of key professional trends
A minority of respondents (44%) feel that in the future there will be fewer ICT professionals in traditional ICT departments, coinciding with more ICT professionals working across the enterprise. More than half of respondents (53%) feel that Massive Open Online Courses (MOOCs) would substantially change the way in which continuing professional development for ICT practitioners is delivered within the next three years. This is surprisingly high given the relative newness of MOOCs but possibly underlines the high expectations being placed on this innovation. More than three quarters (77%) of respondents believe that ICT is a global profession and that national efforts must align on a global basis to mature the profession successfully. Further, a significant majority (80%) of respondents believe that ICT professionals should share a common understanding of a foundational ICT Body of Knowledge (a core body of knowledge that ICT practitioners must all be familiar with).
Other findings include:

- A reported increase (from an earlier 2011 study on ICT professionalism) in the use of ICT competence frameworks by respondents.
- More than half of respondents (51%) indicate that recent ICT graduates lack the necessary combination of technical, business and interpersonal skills needed to contribute to the business without additional training.
- The majority (71%) of CIOs indicate that in terms of continuing professional development, experienced ICT practitioners are successful in keeping their ICT skills up to date through continued training.
- The key technological trends most likely to drive future growth in the demand for expertise in order of importance are: cyber security, mobile technologies, cloud technology, big data, social business and consumerisation (Bring Your Own Device – BYOD).

Primary research findings summation

A number of key themes emerged through this research. Most notably, the majority of stakeholders perceive there to be a serious ICT skills gap/mismatch and view this to be hampering company growth. This is compounded by the fact that the majority of stakeholders perceive ICT graduates do not possess the necessary ICT skills to contribute to business operations. Further, earlier reported research on the impact of offshoring and automation on demand for ICT skills was supported, with over 60% and 75% of respondents respectively believing offshoring and automation would impact their organisations in the future. Varying demand rates for a variety of ICT skills were reported, each with varying scope for offshoring. An understanding of the perceived future growth/decline for specific skills and degree of offshoring likelihood is critical for individual employees in planning career paths, for organisations in planning business operations, and for government in establishing supporting policies.

The skills most likely to remain ‘onshore’:

- Information security skills.
- ICT supplier management skills.
- Enterprise architecture skills.
- Business Process Management skills.
- Digital Marketing skills.
- E-leadership skills; data visualization/data analysis, High performance computing skills and User Experience (UX) Design skills.
- Legacy maintenance skills.

The skills most likely to be offshored:

- Coding/ software engineering/ app building skills and software testing skills.

Both employers and education providers will benefit from collaboration to ensure that graduates have the right IT skills at the right time.

Frits Bussemaker,
Partner CIONET,
Nederland Liaison International.
THE IMPACT OF GLOBALISATION ON ICT DELIVERY: OFFSHORING AND GLOBAL SOURCING

Offshore services
The provision of offshore services gained in popularity through the 1990s. While initially the key driver for offshoring was to reduce cost, as service providers have become more experienced in running offshore operations and increased their ambitions, increasingly they have taken on driving operational improvements of complex processes and transforming and standardizing processes for their customers.

A perfect analysis of these changes is difficult to undertake, since much offshoring over the years has been “under the radar”, for reasons such as customers worrying about potential image repercussions of “moving” jobs offshore - or simply because the offshore element has been an integral part of the full delivery in a global supply chain. Official statistics are lacking on the extent and type of offshoring that has been undertaken and the development over the past decade. So how do we assess the extent of offshoring, the types of activities that are most affected and, hence, the types of skills that are impacted?

Through analysis of the scope of IT and business services contracts signed in North America and Europe and analysis of the revenue composition of the leading Indian offshore providers, it is clear that application-related work is the most common for offshore work. However, there is an increased tendency towards infrastructure-related work and business process outsourcing. Innovation (i.e. R&D) and “other” consistently account for the smallest proportion of contracts over the period.

Skills in the offshore value chain
Against this background, which skills are being offshored? The skill sets that are needed offshore are as varied as those that are needed onshore, but naturally for activities that can be delivered remotely and where face-to-face interaction with the end customer of the service or the product is less important. The offshore value chain is complex, and in all types of work, there are low and high-level skilled people involved in delivering on the activity or engagement. This has become more so as offshore delivery has matured and as organisations are no longer only using offshore for low-cost delivery but rather as part of a more complex global sourcing strategy.

The CIO survey undertaken for this study provides some indicators of the expected development in the future demand for skills offshore out to 2020 (see previous section). In essence, these results indicate a continuation of the trends that were observed in the past decade with no major “quantum leaps” expected.

It is of utmost strategic importance for Avaloq to recruit and develop highly e-skilled employees in our European locations.

Martin Frick,
General Manager BPO,
Avaloq Evolution AG.
From labour arbitrage to standardisation, automation and cloud
With increased maturity of offshore service delivery, there is a move away from “throwing people at the problem” to delivering more advanced services and higher productivity by standardising processes and increasing automation where possible. Standardisation of processes leads to the creation of repeatable and scalable non-human assets such as software packages, process models, and so on, to supplement and/or replace human labour, and thus automate the process as far as possible.

How automation can lead to replacement of knowledge workers has been widely described. However, the key question is whether this would result in the replacement of these FTEs or their redeployment? The probable answer is that it will be a mixture of both, quite like what has been observed with offshoring. Productivity gains do not always result in job losses.

Another interesting aspect of automation of knowledge work is that it has the potential to level the playing field between higher-cost Western countries and the typical offshore locations. If a process or a task can be undertaken solely by computers, the financial benefit of moving this task or process to the other side of the world dissipates.

Then there is cloud. Cloud represents a fundamental change in the way computing power is generated and distributed. Cloud services can be seen as an alternative to offshore, labour-intensive services, which can be provided from anywhere.

Standardisation, automation and cloud are improvements and developments in technologies that combined with increased maturity and experience of user organisations fundamentally change the way ICT and business process tasks and services are consumed. Offshoring cannot be considered in isolation. Figure 8 illustrates this seamless global use of resources - local, nearshore, offshore, and cloud-based – to deliver an integrated IT or business process.

The complexity of the global value chain highlights the need for new skills onshore to manage and/or complement the many elements. Managing teams of people, sometimes across many time zones, onshore or via services delivered through the cloud, means that the IT department of the future increasingly will need to take on the role of service broker or integrator, rather than necessarily taking on all activities itself. This is a completely new set of challenges facing the CIO.

Figure 8: Complex skills and sourcing mix in the global value chain. (Source: IDC, 2013)
The IT world is changing profoundly. The trends driving IT offshoring are changing, as the increasing use of automation tools, standardisation of processes, and re-use of assets combined with cloud computing shapes a global sourcing value chain. Consequently, the demand for highly specialised ICT skills grows both onshore and offshore. In the future, even ICT skills that are now considered “typical” offshore skills, such as programming, may be in higher demand onshore. It is important to ensure that ICT skills are developed at all levels of the value chain onshore and that effort is made to make these careers attractive. If not, a new skills gap crisis could emerge.

The speed of digital transformation by businesses and organisations, thanks to a new breed of products and services based on the convergence of 3D platform technologies (mobility, social technologies, big data, cloud computing), will directly affect the patterns of socio-economic growth in the next years. However, digital transformation requires a new mix of e-leadership skills, exploiting IT for innovation and business development. Therefore, the lack of e-leadership skills can be a competitive disadvantage for the EU industry and a constraint of potential growth.

According to our model estimates, in the most likely “Cautious Growth” scenario EU demand for total ICT skills will grow from 7.7 million in 2012 to 8.6 million in 2020, representing a 1.4% Compound Average Growth Rate (CAGR). Within this scenario, the impact of globalisation will result in approximately 753,000 jobs moved offshore in 2020, of which about 17-18% will actually be lost. The applications segment, which is the prominent focus area for many offshoring projects, shows the highest number of ICT jobs lost. More worryingly, this impact would hit ICT graduates more than proportionally, since according to our estimate, up to 4,000 jobs or 9% of ICT graduate employment could be lost to offshoring in 2020.

Figure 9: Forecast Model Assumptions: interaction of main trends. (Source: IDC, 2014)
Projections/Scenario 2/3: Innovation wins versus stagnation

Two further scenarios were tested through this research: “Innovation wins” where a jump ahead of digital transformation triggers a positive cycle of economic growth and “Stagnation” where economic recession reduces consumption and investments dragging down innovation dynamics. In both scenarios, globalisation remains a strong trend, so offshoring continues to grow. The scale of jobs potentially moved varies from only 6% of all ICT skills demanded in 2020 in the Innovation wins scenario, to 10% in the Stagnation Scenario (compared to 9% in the Cautious Growth scenario). The incidence of jobs lost over the total of jobs demanded is marginal, but qualitatively important: it varies from 1.5% in the Cautious growth scenario to 0.7% in the Innovation wins scenario and a peak of 3.4% in the Stagnation scenario.

In other words, the overall impact of globalisation and offshoring on the ICT skills market is marginal in quantitative terms, but qualitatively very important, and more relevant yet for market segments such as applications development on the one hand, and young ICT graduates on the other hand.

What can policy do to promote the Innovation wins scenario and prevent the risks of the Stagnation scenario? We have examined three main clusters of policies with a direct influence on e-skills: education and training, labour market policies, and policies for growth and the development of the digital economy. We conclude that education policies have the most relevant impact in the long term to shape the evolution of skills responding to new demand trends, but in the short term training policies and labour market policies (such as promoting internships, mobility, and public-private partnerships to bridge the gap between university and the workplace) have the highest chance of influencing the market positively. Research, innovation and macroeconomic policies supporting the digital economy have a very important role to create the framework conditions enabling growth based on IT innovation and stimulating e-skills demand.

Figure 10: Total ICT jobs moved and lost across three scenarios.
Requirements for new curricula for future skills and jobs

Emerging ICT trends have always demanded new skills and jobs. However, as a result of efficiency gains and restructuring, they have also resulted in the loss of jobs no longer meeting the requirements of industry and the markets.

The lack of training/education, the focus on the wrong skills, and the issue of outdated education systems and educators are seen as the primary training/education related barriers to the growth or impact of newly emerging technological ‘mega trends’ (e.g. cloud computing, social media technologies, big data, Internet of things) that drive economic transformation and economic growth. Each of the current mega-trends is presumed to represent a new technology platform for growth and innovation. These are the areas where Europe and European companies need to be strong in order to be innovative and competitive in the future. For each of the mega-trends, skill requirements can be identified in both the IT industry and user industries.

Adaptation of higher, executive education and training institutions

Higher, executive education and training institutions must urgently adapt to and further develop their offerings in line with industry needs. Recent research has identified the need for an adaptation and/or development of higher and executive education offerings for the provision of skills and competences for meeting these emerging industry demands.

An approach developed to support this effort starts with defining the e-skills domains and tasks for each new ICT mega trend, specifying relevant e-competences and skills and mapping these onto the competences as specified in the European e-Competence Framework (e-CF), as well as describing the roles involved as per the existing ICT professional job profiles which build on the e-CF and were developed for CEN. This approach is in line with expert opinions strongly arguing for a competence-based approach to higher education programme development when moving towards the next generation of Graduate degree programmes in Information Systems.

Higher and executive education institutions may want to use the approach and formats developed to map their own courses onto these, to identify whether there is alignment with the descriptions and required skills and thereby fit with the newly emerging skill requirements resulting from the above mega trends.

This will enable higher and executive education institutions to identify how well their current offerings already meet industry requirements and/or further develop and adapt existing or develop new curricula for programmes delivering these skills. This will help further develop the higher education and training systems in Europe to better respond to employer needs and emerging mega-trends as outlined above.

Teaching to accommodate newly emerging skills requirements

The new skills need to be taught at different levels to ensure maximum reach. This is the responsibility of higher education institutions and also those active in executive and further training. Different approaches to teaching skills for newly emerging ICT areas have been identified. These approaches are following different teaching traditions in different countries and include the following:

- Teaching new skills requirements as an integral part of already existing ‘Informatics’ or ‘computer science’ study programmes, in different master’s programmes during the Masters studies (or in the last year of the Bachelor study) like in universities in Germany, Finland and the United Kingdom.
- Non official degree programmes (titulo propio) offered in cooperation with industry next to the strongly regulated Bachelors and Masters degree courses resulting in a university certificate in countries like Spain.
- Executive training/further education courses at universities and business schools with either a more technical focus or a stronger business focus with the latter being focussed on and taught for instance at INSEAD with the INSEAD Executive Education Course ‘Data Analytics for Business’.
- Specific and dedicated ‘big data’, ‘data science’ or ‘cloud computing’ higher education programmes branded as such for commercial reasons and to make these attractive and appealing to prospective students and employers, like in the USA but also to some extent in the United Kingdom.
It is likely that these teaching traditions and ways of teaching will continue to be followed also in the future when adapting existing or developing new education programmes to best fit industry skills demands. In addition, MOOCs could be seen as an add-on which may also help to fill existing skills gaps and shortages and to increase the reach of and access to appropriate educational offerings and thereby more quickly spread the required skills.

**Best practices in teaching future skill requirements: the example case of Big Data Analytics**

The following figure provides an example of a higher education programme offered by a university (Technical University Berlin).

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**Technical University Berlin: Master’s Programme Track on ‘Data Analytics’**
(with university certificate)

**Track on ‘Data Analytics’**
The track includes a recommended schedule of courses that reflect a certain emphasis on ‘Data Analytics’

**Master’s programmes for which the Data Analytics Track is available:**
1. Business Informatics
2. Computer Engineering
3. Computer Science

**The Data Analytics Track objectives:**
1. Provide students with the necessary skills to perform data-driven decision-making.
2. Derive insight from huge, heterogeneous data sets.
3. Apply learned methodologies to address real problems in business and science.

**Intended job profiles:**
The intended job profiles include Data Scientist / Data Analyst / Data Engineer.

**Duration and modules:**
The track is running for a four semester (two years) master study with lectures, seminars and internships (cooperation with partners from industry) with a master thesis in the fourth semester.

It is structured into three pillars:
1. **Data Analysis:** machine-based learning, statistics, text mining, etc.
2. **Scalable Data Management:** Dealing with large, heterogeneous structures and data, map/reduce concept, new hardware architectures.
3. **Applications:** specific to studies: health, material science, energy, logistics etc.

**Certificate**
Successful students will receive a certificate issued by the EECS School at TU Berlin attesting to their specialisation, which is issued in addition to their master’s degree.

**Contact:**
Volker Markl, Professor and Chair of the Database Systems and Information Management (DIMA) group, Technical University Berlin
http://www.dima.tu-berlin.de/menue/database_systems_and_information_management_group/

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**Figure 11: Higher education programme offered by Technical University Berlin**
The figure below provides another example of a higher education programme offered by a business school (INSEAD).

INSEAD Executive Education Course ‘Data Analytics for Business’

Objectives:

**Business Objectives:**
- Become more aware of what business problems can be addressed with data analytics;
- Be able to better identify new business applications of data analytics;
- Better understand the promises and limitations of big data.

**Project Management:**
- Understand the processes for analyzing data and managing analytics projects.

**Technologies:**
- Become familiar with some of the latest data analytics tools;
- Use some of the latest technologies: cloud computing, open source data analytics software, online collaboration platform, tools for reproducible and re-usable analytics and research, data visualization tools, etc.

**Course programme:**
- State-of-the-art Open Source Tools: Flexible tools for efficient and effective analytics research.
- Replicable and Reusable analytics: Easy to share and hassle-free tools: platforms such as github.
- Balance IT, statistical methods, and business insights.

**The course is business case driven and requires the students to:**
- Perform a market segmentation based on data from market research.
- Understand the key purchase drivers for each segment.
- Interpret the solutions.
- Link to business strategy.
- Consider advantages and disadvantages of different solutions.
- Combine quantitative with qualitative and business objectives.

**Duration**
1 month

**Contact**
T. Evgeniou, Professor of Decision Sciences and Technology Management, INSEAD
J. Niessing, Affiliate Professor of Marketing, INSEAD

Figure 12: Higher education programme offered by INSEAD
E-SKILLS POLICIES IN THE EU

Overview
Across the EU-28 today there are some 100+ policies dealing broadly with e-skills. The success of these policies and the extent to which they benefit the ICT Profession will have far-reaching implications for the supply and demand of professionals as well as the economy at large. The urgency to generate a larger pool of European ICT professionals, equipped with the competences to match evolving labour market demands, is well established. In spite of this, Europe is largely missing an opportunity and risking future growth potential when it comes to policies that truly benefit European ICT professionals.

In examining the extent to which e-skills policies in the EU benefit ICT Professions, policies were classified into three categories: transversal, education and workplace-related. Taking recent examples of these policies where they exist in Member States, their success and impact on the profession was determined using key performance indicators and quantitative data. Complementing this with an assessment, incorporating stakeholders across Europe, shows that some conclusions apply to all Member States:

EU Member States need to make the ICT profession a policy priority. A clear message needs to be delivered: ICT professionals and the development of the ICT profession should become a higher policy priority at the national level. This is not a zero-sum game and the development of the profession as policy focus should not be to the detriment of policies ensuring the prevalence of ICT skills within the general population.

Policy metrics are needed. The establishment of key success factors as part of the policy formulation would facilitate better understanding of the impact of policies on their target audience and would enable Member States to learn from each other.

Governments should establish labour market skills monitoring systems. These should be based on concrete, granular data, to enable more agile reactions to skills gaps and shortages in the ICT sector.

It is no surprise that national e-skills policies steer clear of including concrete success metrics for political reasons, yet this makes measuring the success of any policy subjective, even within its national context. This lack of quantitative data is a barrier to effectively evaluating policies within Europe. It makes the comparison of the impact of similar policies from different countries burdensome and inhibits the transfer of successes between Member States.

For education policies key recommendations include:
• Education reform to include ICT is considered to be the single most important factor that will benefit the profession. As career preferences are being made at younger ages, an early focus on computer science, computational thinking and the foundations of computing in tandem with digital competence can provide a solid basis for the next generation of professionals.
• Teacher training curricula need to focus increasingly on informatics. While Member States’ education systems vary significantly, successes with some forerunners point to the use of ICT in pedagogy as an essential requirement for all teacher-training programmes. Since curricula reform is generally a long-term activity, rapid up skilling for ‘out of field’ teachers provides a short term solution in the interim.

All stakeholders now need to work together to develop and maintain a relevant e-Skills base for future ICT professionals.

Christoph Moeller,
Director, German Federal Employment Agency.
For workplace policies:

- Every Member State should create an e-Skills Sector Council to work closely with the professional body. Skills Sector Councils, when working within well-defined parameters and in complement to professional bodies, can bring a high benefit for the sector and provide a useful platform for pertinent issues.

- Granular labour market monitoring is needed at national level to tackle the EU skills gap effectively. A coherent approach to skills and competence monitoring in Europe would support a more effective approach to the identification, targeting and assessment of e-skills policies, as well as facilitate the development of new policies.

- The uptake of ICT competence frameworks can provide the foundation for pan-European job matching programmes. The European e-Competence Framework (e-CF) as a de facto European standard can facilitate mobility and help match people to jobs. Government adoption of such frameworks in the short-term can fast-track their positive impact.

- Up-skilling and re-skilling measures can help save ICT professionals in roles that are becoming marginalised, due to for instance automation and offshoring.

For transversal policies

- Immigration policy reform, to attract skilled ICT professionals, could be used to greater effect. In an increasingly globalised world, solving the skills gaps through sourcing skilled professionals from third countries has the potential to provide part of the solution in the next decade.

- Promotion of career opportunities in ICT and related career paths can be highly effective and should be encouraged at the national level. The image of a broad, dynamic and varied profession should be further highlighted to expand beyond a focus on coding and represent the plethora of possibilities within the profession.

- Digital strategies should include a gender dimension. With less than 30% of Europe’s women in the labour force, improving the gender balance is an obvious means to plug skills gaps. All digital strategies should integrate a gender dimension with long term targets.
POLICY RECOMMENDATIONS

The following policy recommendations are being proposed to help ensure Europe has sufficient e-skills and e-leadership skills to meet the current and future challenges. They are the result of the findings of this service contract and have been reviewed and validated by an international panel of experts representing academia, government, industry, professional associations, and employee representative groups.

**POLICY RECOMMENDATION 1: World-class e-skills excellence.**

Information and communication technology innovation is fundamentally changing the demand for current and future ICT practitioner skills. The need for education providers to engage with industry and government to understand the changing demand of skills is vitally important. The low number of women studying technology dominant subjects is another serious problem which must be addressed. This is feeding the gap in the supply of ICT skills particularly for new emerging technologies.

**POLICY RECOMMENDATION 2: Foster entrepreneurship, innovation, and jobs creation in Europe through the promotion and development of e-leadership skills.**

There is a need to promote digital entrepreneurship in Europe. For effective e-leadership, the skills required are those which enable people with very strong ICT skills to lead qualified staff from ICT and other disciplines towards identifying and designing business models and exploiting key innovation opportunities.

**The European Commission & Member States**

The Commission should promote and support public-private partnerships between education and training organizations/industry-policy makers. Member States should participate actively in European coordination and collaboration efforts, as well as develop national plans and initiatives for ICT skills development, coherent with the international framework.

**Industry, Education, and Social Partners**

Employers should collaborate with universities/business schools in an effort to increase internships, pre-job training, and mentoring schemes. Education and training Institutions need to further develop new patterns of collaboration with industry without losing sight of their primary role as educators. Social partners should collaborate in an effort to improving working patterns of ICT practitioners by combatting discrimination and facilitating re-skilling and updating after a career break.

**Professional Informatics Associations/Computer Societies**

Professional informatics associations/computer societies should promote awareness actions to increase STEM enrolment and collaborate on the EU framework specifically for the adaptation and innovation of curricula and requirements.

**THE EUROPEAN COMMISSION & MEMBER STATES**

The Commission should adopt a coordinating role to help identify the type of skills driving demand across the economic region, and how, and from where those skills are being supplied. Member states should engage with professional management consultancies to coordinate the development of a national or regional plan for the development of core e-leadership skills for critical industry sectors including SMEs.

**Industry, Education, and Social Partners**

Industry/Employers should identify ways of engaging more directly with academia to develop relevant content for the purpose of developing practical e-leadership, innovation and entrepreneurial skills. Education providers should work with industry partners to better define the demand for e-leadership, innovation and entrepreneurial skills. They should look to industry to actively participate in the design and delivery of professional skills development courses. Social Partners should encourage workers to re-train and seek re-skilling opportunities within their work environment.

**Professional Informatics Associations/Computer Societies**

Professional informatics associations/computer societies should work to promote awareness of e-leadership, innovation and entrepreneurial skills amongst their members and expand their certification/CPD programmes to acknowledge skills development in these areas.
A key issue is developing ways of making computing, informatics and the underpinning subjects exciting and accessible to school students.

Professor Andrew McGettrick, Chair of the ACM Education Board.
POLICY RECOMMENDATION 5: Support a global ICT profession.
Due to the nature of global business, ICT practitioners are being required to work increasingly in virtual teams as part of global digital value chains. They are delivering global solutions that transcend international borders, cultures, and work practices resulting in the development of multiple competence frameworks, educational standards, codes of ethics, and bodies of knowledge. This is a global issue and not just one specific to the EU. Consequently, in order to implement the policy recommendations proposed, a global initiative to address this challenge should be launched.

THE EUROPEAN COMMISSION & MEMBER STATES
The Commission should facilitate and support the formation of an international knowledge-sharing cooperative forum helping inform policy in terms of the best practices most suitable for adoption within the EU. They should provide guidance on the formation, structure and need for establishment of the ICT profession and support the dissemination of material promoting professionalism across EU member states. Member States themselves should promote the role of the ICT professional as a rewarding career option for current and potential practitioners and examine ways of formally recognising the status of the ICT Professional.

INDUSTRY, EDUCATION, AND SOCIAL PARTNERS
Industry/Employers should work with professional informatics associations to define what is required of a professional in modern society. Professional informatics associations/computer societies should work with other associations at both national and global levels to define the nature and structure of the ICT profession.

Based on ICTC’s Focus on IT (FIT) experience, gender-sensitive ICT curriculum for grades 9-12 has helped attract and retain girls in STEM-centric courses with 20% increase in girls’ enrolment since 2012.
Dr. Meenakshi Gupta, Senior Director, Policy and Research, Information and Communications Technology Council, Canada.

POLICY RECOMMENDATION 6: Dealing with the risks of a social disruption as a result of the implementation of digital business models.
Recent advances in technology are changing business models in a way that is reshaping how employees and customers interact with business. Recent research by Oxford University and MIT’s Center for Digital Business has highlighted the increasing impact of digital technologies and how the automation of some knowledge intensive work is affecting skills and employment.
Central to these studies is the recognition of the faster than expected change in the profiles of skills needed with many expected to become obsolete. There is also a need for investment and innovation in education and training, not only for the ICT sector but across the economy.

THE EUROPEAN COMMISSION & MEMBER STATES
The Commission should promote and facilitate discussion at a regional level around the potential impact technology driven innovation will have on the skills profile, capability, and economic and societal performance. There is a need to provide guidance and direction to member states in building effective multi-stakeholder plans to manage the transition to a new employee balance. Member States should work with professional societies, education providers, industry representatives and employee representatives to build a national plan to outline a response to managing the transition.

INDUSTRY, EDUCATION, AND SOCIAL PARTNERS
Industry/employers should work with social partners to understand how to transition to new work and employment practices in a way that supports digital growth. This needs to be a collaborative endeavour as without buy-in these transitions may lead to industrial actions that may negatively impact economic productivity. Social Partners need to work with worker representatives and employers to identify best and future work practices. Managing the expectations and concerns around these transitions will be vital in ensuring employees are prepared for up-skilling/re-training opportunities in the future.

PROFESSIONAL INFORMATICS ASSOCIATIONS/COMPUTER SOCIETIES
Professional informatics associations/computer societies should promote a culture of learning within the ICT practitioner workforce. This will help develop a knowledge ‘pull’ attitude to developing new skills within the workforce. This in turn will help prepare the workforce for technology driven transition.
This service contract was commissioned by the European Commission DG Enterprise and Industry. André Richier, Principal Administrator, Unit Key Enabling Technologies and ICT, was our contact point throughout the study.

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