e-SKILLS: THE INTERNATIONAL DIMENSION AND THE IMPACT OF GLOBALISATION

Final Report

August 2014

Prepared for the
European Commission
DG Enterprise and Industry

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EXECUTIVE SUMMARY

The International Dimension of e-Skills

In today's increasingly knowledge-based economies, new information and communication technologies are a key engine for growth fuelled by the innovative ideas of highly-skilled workers. However, obtaining adequate quantities of employees with the necessary e-skills is a challenge. This is a growing international problem with many countries having an insufficient numbers of workers with the right e-Skills. For example:

- **Australia**: "Even though there's 10,000 jobs a year created in IT, there are only 4500 students studying IT at university, and not all of them graduate" (Talevski and Osman, 2013).
- **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).
- **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 and Nordicity, 2012).
- **Europe**: It is estimated that there will be an e-skills gap within Europe of up to 900,000 (main forecast scenario) ICT practitioners by 2020" (Empirica, 2014).
- **Japan**: It is reported that 80% of IT and user companies report an e-skills shortage (IPA, IT HR White Paper, 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).

The ICT professionalism gap

Contributing to the availability of an adequate e-skills supply is the relative immaturity of the ICT profession compared to other professions such as engineering, medicine and law. This is evident with respect to agreed bodies of knowledge, standards of education and training, competences, and ethical conduct. This manifests itself in many ways including poor public perception of the ICT profession thereby impacting on the numbers entering ICT education, and the disturbing rate of ICT project failures. This is a serious concern given the extent to which ICT pervades our lives. Traditionally, professions have formed when failure to apply domain-specific knowledge successfully had the potential to adversely impact on society. As we 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, it is very likely that the risks to society from ICT will grow to unacceptable levels – as such, the call for action is clear.

Vint Cerf, one of the founding fathers of the Internet 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 international dimension to the challenge of maturing the ICT profession. Historically, most professions have developed on a national basis before becoming established across wider geographic regions. This is understandable as most professions were formed by like-minded peers to share knowledge and best practices, before developing more formal and rigorous standards of practice that were 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.

The ICT profession is confronting a unique challenge in its development - the fact that ICT practitioners are increasingly working in global teams and operating as part of distributed global digital value chains. For a profession where standards have not yet been defined and accepted at a national level in many countries, the challenges of dealing with other practitioners across borders with potentially different educational systems, practices and values, introduces a level of risk and complexity that perhaps did not exist previously. Consequently, recognising the importance of standards across borders with respect to the ICT profession is becoming an increasing priority.

Furthermore, technological trends and new toolsets are changing the impact and type of work that can be undertaken by individuals with minimum ICT knowledge. By reducing barriers to entry, non-ICT professionals with formal qualifications in other domains, have at their disposal several resources to facilitate innovation within business. While "career changers" represent a potential talent pool to bridge the e-skills gap, the challenge remains that individuals who have not been exposed to formal ICT education are perhaps more likely to develop systems with inadequate regard for privacy, security, and ethical conduct. Ensuring that individuals with limited formal ICT education are educated appropriately in relevant concepts and practices is important to avoid ICT practitioners being perceived as "cowboys" (a full definition of the term "ICT professional" is contained in the report glossary).

Emerging new skill sets

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; and increased computational power available to growing numbers of individuals globally. Such changes are causing substantial alterations 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

and (re)distribution of labour, different skill sets are required in different regions of the world. New technologies are demanding changes in the type of skills required.

Offshoring

Global sourcing has led to some ICT work being offshored to countries outside of Europe with cost reduction as a key driver. Now the type and scope of work that is offshored is more complex, and increasingly involves higher level skills as organisations use offshoring to gain access to specific capabilities that may be in short supply locally or onshore – but with cost savings still expected. There are different types of skills with different levels of complexity offshored, with a correspondingly high level of variety in the skill sets offshored. In most cases the skills which are offshored are those relating to activities that can be delivered remotely and where face-to-face interaction with the end customer 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' for example break 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, etc.) to automate processes as much as possible.

Cloud technology, together with standardisation and automation, is playing an important role in global sourcing delivery, helping organisations 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, while US and European ICT services companies have expended in India and other Asian countries for a long time, the largest Indian offshore providers have established more recently near-shore centres in Eastern and Western Europe, hiring local staff in order to support local customers and thereby reflecting the importance of "being close to the customer" for some key skills. Clearly, this also has important repercussions for the types of skills that are likely to be in demand in Europe to support the local customer base.

Offshoring of ICT skills

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

SKILLSET TRENDS (2013-2020) – CIO Perspectives		
Most likely to grow (% respondents)	**Most likely to be offshored (% respondents)**	**Least likely to be offshored (% respondents)**
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%)

Table 1: CIO views on skill set demand/location (Source: primary research, 2013).

The strong growth for data visualization and information security skills reflects the growth in importance of big data and concerns over cyber security. Similarly, the growth in demand for User Experience Design skills relate to the need to develop interfaces that are usable on e.g. different mobile devices, such as smartphones and tablets. Coding, software testing and ICT support are most likely to be offshored as expected, since these skills are already at the heart of offshoring.

The survey results indicate that information security and enterprise architecture are unlikely to be offshored, as they are perceived as being too strategically important to be offshored or outsourced. Similarly, the desire to keep ICT supplier management in-house or at least onshore, suggests a desire to retain central control over suppliers.

The impact of offshoring

It has often been feared that offshoring means 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 businesses in the EU by establishing a physical local presence to better serve their EU customers.

IDC estimates that on average 22% of total jobs impacted by offshoring are 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 17% of total ICT jobs moved.

In absolute terms, this means that some 60,400 EU jobs were lost by 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 each 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 relevant and not quantified in the data shown below.

	2012	2014	2016	2018	2020
France	6,400	8,400	10,800	13,800	17,500
Germany	10,200	13,200	16,900	21,500	27,100
Italy	1,500	1,900	2,500	3,200	4,100
Poland	1,800	2,000	2,300	2,500	2,800
Spain	3,000	3,500	4,100	4,800	5,600
UK	26,700	31,000	35,300	39,900	44,900
EU21	10,800	14,400	18,800	24,400	30,900
Total EU	60,400	74,400	90,700	110,100	132,900

Table 2: Total ICT Jobs Lost – AGGREGATE (Source: IDC, 2014).

Given the higher than average reliance on offshoring and the high number of jobs moved, the UK will suffer the most ICT job losses, with up to 44,900 in 2020. France and Germany 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 ICT job losses up to 2012 happened in this segment (Table 3). 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).

	2012	2014	2016	2018	2020
Applications	38,800	46,700	56,000	67,000	79,600
Infrastructure	8,400	11,500	15,000	19,800	25,900
Other	10,900	13,600	16,700	19,900	23,500
R&D	2,300	2,600	3,000	3,400	3,900
TOTAL ICT JOBS LOST	60,400	74,400	90,700	110,100	132,900

Table 3: Total EU ICT Jobs Lost by Segment – AGGREGATE (Source: IDC, 2014).

In aggregate, the overall impact of offshoring on ICT jobs is relatively limited (Table 4). Jobs lost represent 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.

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

Table 4: % Jobs Lost of Total ICT Skills Demanded (Source: IDC, 2014).

Although the net projected impact of globalisation is estimated to be relatively low, in certain sectors/skill sets the effect is likely to be felt to a greater extent. For example, the impact on graduates is expected to be higher (over 9% by 2020) due to the typical job roles they hold being more easily "offshoreable" with lower skills level and expertise. This represents 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 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, incentives for workers who have lost their jobs, and schemes for supporting employers in the training of their graduate intakes.

Assessment of EU Member States policies

In terms of proposing concrete recommendations for future policy actions to address the e-skills gap and the impact of globalisation, an assessment was undertaken of EU Member States policies in this space. This research found that across the EU-28 there are some 100+ policies dealing broadly with e-skills (including in particular policies such as digital literacy/user skills and e-inclusion etc.).

The European landscape is diverse given that Member States are at different stages of maturity and have varying issues considered of national importance. Nevertheless existing policies can be grouped into three general categories:

- **Policies focusing on education** aimed at modernising national educational systems at primary, secondary and tertiary level. These policies address the inclusion of ICT as a core competence and the development of teacher training curricula that provide teachers with the skills to use ICT as a teaching and learning tool.
- **Policies focusing on the workplace** addressing a wider range of goals. They intend to tackle shortages of skilled ICT practitioners by reforming national immigration policy, encouraging the up-skilling and re-skilling of experienced professionals, or by matching curricula and labour market demand. Others

focus on establishing national sector skills councils for ICT or multi-stakeholder partnerships benefitting the ICT profession etc.

- **Transversal policies** which cut across a number of domains with an impact on areas such as education, the workplace, and the state of the digital economy at a national level. Three types of transversal policies were identified: policies that encourage a better gender balance, policies that promote ICT career opportunities and career paths, and policies aiming to establish labour market monitoring programmes/mechanisms.

A simplified list of key policies was derived in order to facilitate cross border analysis. Twelve key policies were identified through this process (a detailed analysis is outlined in Chapter 9). From the analysis across Member States derives the following findings:

- Including ICT in education reform is considered to be a key factor
- Teacher training curricula needs to include ICT
- Immigration policy reform should be implemented to attract talent
- ICT career opportunities and career paths should be strongly promoted
- Labour market monitoring is needed at national and EU level
- The uptake of the e-Competence framework should be promoted
- Member States should consider multi-stakeholder partnerships
- ICT training and educational curricula should meet labour market demand
- Up-skilling and re-skilling measures help ICT professionals to take new jobs
- Matching of jobs and ICT professional competences needs to increase
- ICT education for girls should be promoted
- Member States should create a dedicated entity to design and implement a coherent and consistent long term e-skills strategy (e.g. ICT skills sector council, national coalition etc.)

Policy recommendations - the road ahead

The analysis of Member States policies and best practices supported the definition of new policy recommendations to enable Europe to better respond to the challenges relating to ICT professionalism and globalisation in the longer term. These include:

- ***Drive commitment to ICT practitioner up-skilling with a focus on world-class excellence.***
  Globalisation and a new wave in ICT innovation are fundamentally changing the demand for future ICT practitioner skills. Hence, the need for government and education providers to engage with industry to understand the changing demand of e-skills is vitally important. Another aspect to be considered is the imbalance in the number of women seeking a career in technology dominant subjects at second and third level education. These issues cannot be overlooked when developing policies for world-class ICT practitioners, as

these issues are feeding the gap in the supply of e-skills particularly for new emerging technologies.

- ***Foster entrepreneurship, innovation, and jobs creation in Europe through the development and promotion of e-leadership skills.***
  It is an economic imperative that organizations are given the necessary skills to drive initiatives that leverage digital tools. Unfortunately, the number of organizations that are already doing this is relatively small. Therefore, there is crucial need to promote e-leadership and digital entrepreneurship in Europe. The skills required are seen as those which enable IT savvy people to lead multidisciplinary teams towards designing business models and exploiting key business innovation opportunities. Their success is defined as leveraging the best use of developments in ICT and delivering real value to their organizations.

- ***Promote SMEs competitiveness and integration into global digital value chains.***
  Many low-skilled ICT tasks are being automated or offshored. Many organizations are developing leaner, more cost effective business models. SMEs need to understand the implications of the global sourcing model and what it means in terms of their own competitiveness. A failure to realise the implications will have a significant impact. Understanding the demand SMEs will place on the development and provision of skills needs to be established. A clustering approach can then be developed to establish an understanding of the growing need amongst SMEs for key e-skills.

- ***Foster mobility and become a magnet for talent***
  The lack of skilled ICT professionals across Europe is projected to increase, with a possible gap of up to 900.000 by 2020. Becoming a talent magnet for the whole range of ICT skills will not be practical. Member States and regions need to understand what industry sectors they wish to develop, and then focus on the world-class skill sets required to achieve excellence in these areas. Universities and providers of academic and professional training will need to be part of this conversation, as they will need to develop the engine to provide the skills to support the competitive economic growth strategy for their respective areas.

- ***Support a global ICT profession***
  Due to the global nature of ICT and of increasingly of the economy, ICT practitioners are increasingly being required to work in international virtual teams as part of global digital value chains. This reflects different historical precedence from other professions such engineering - which interact at international level, but the focus and need for regulatory compliance happens at a national or regional level. ICT practitioners, on the other hand, find themselves delivering global products, services and solutions that transcend international borders, cultures, and work practices. This has resulted in the development of multiple competence frameworks, educational standards, code

of ethics, and bodies of knowledge. This is a global issue. An international initiative needs to be developed to address this challenge.

- ***Deal with the risks of social disruption as a result of the implementation of digital business models.***
  Recent advances in ICT are changing business models in a way that is re-shaping how employees and customers interact with businesses. Research by Oxford University and MIT has highlighted the increasingly strong impacts digital technologies and the automation of some knowledge intensive work are having on skills and employment. Common to these studies is the recognition of the faster than expected change in the profile of skills needed with many skills expected to become obsolete, and the need for investments and innovation in education and training, not only for the ICT sector but across the whole economy.

These policy recommendations are designed to support and develop a capability across the EU to sense and respond to the changes being driven through technological innovation. They focus on the need to build and maintain a relevant skills base that will allow organizations to perform and compete within a digital marketplace.

Conclusion

The current international landscape for e-skills and ICT professionalism is complex. Given the pervasive role played by technology in all aspects of business operations, the ability to leverage technological innovations plays a distinctive role in business competitiveness in the current dynamic and globalised business landscape. However, many challenges exist, in providing a sufficient number of appropriately skilled workers to take on these new roles.

As the world is confronted with an e-skills gap of growing magnitude, this can in turn curb economic competitiveness and recovery, given ICT role as an enabler of business value. At the same time as a shortage of skilled workers is being experienced, the world is confronted by a jobs crisis and particular concern is expressed over the high level of youth unemployment. This is further compounded by the fact that many enterprises believe that ICT graduates lack the necessary combination of skills to contribute to the business without significant additional on-the-job training.

A key challenge remains the perceived relative immaturity of the ICT profession which can make it a less attractive career choice compared to other professions. Macroeconomic and societal challenges also impact upon the e-skills talent pool. This manifests itself in constantly shifting demand for certain IT based skills to emerging and growing economies. Also being experienced, in more established economies has been a shift away from STEM based courses to social science (including business and management) and the Humanities and the Arts. In addition to the existence of a

growing e-skill gap during a period of high unemployment, a wave of new technological trends are representing important shifts. As part of the new global sourcing models, different skill sets are required in different regions, and new technologies keep demanding changes in the type of skills required. These new technological trends are likely to act as further drivers of increased demand for ICT practitioners over the coming years.

As we look towards 2020, many of the skills currently utilized in the ICT units of European organisations will no longer be required/ desired at the current cost levels. The employment outlook for a significant proportion of ICT workers, particularly those working in basic ICT support, coding and testing, will be challenging, with these skill sets expected to be ones most likely to be offshored. The emergence of new formidable economic players (BRICs) and offshoring have important repercussions for the types of skills that are likely to be in demand in Europe in the coming years. However, it is important to bear in mind that even if tasks are undertaken in a nearshore or offshore location, this does not necessarily mean that all the positions onshore are lost.

The far-reaching impact of mismatches and shortages of ICT professionals on society, employment, and the future economy, points to the urgency of developing the currently fragmented ICT profession in Europe. Yet few Member States consider ICT professionalism to be a high policy priority. Those policies that do address relevant elements fail to establish performance metrics that would allow objective evaluation of their impact. Without such data, Member States have subjective views of their own policies and in the absence of granular and comparable labour market monitoring systems, the transfer of successes from one Member State to another is inhibited. Some good policies already exist but examples of their application are ad hoc and not well documented.

In general, policies also lack scale and transferability. This makes it difficult for them to get the policy priority needed to stave off future storages and develop the profession in Europe. The policy recommendations derived from this research and put forward in this report should enable Europe to respond more effectively to the challenges relating to ICT professionalism and globalisation into the future. It is important to state however, that these recommendations are dependent upon a commitment to stakeholder engagement, dialogue, and transparency at a national, regional, and ultimately an international level to address this issue.

CHAPTER 1: INTRODUCTION

Project objectives and scope

The main 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 globalization 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 to 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, as outlined in Figure 3. 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 will require further work and collaboration from many stakeholders and this report aims to act as one of the stepping stones required in order to achieve these goals.

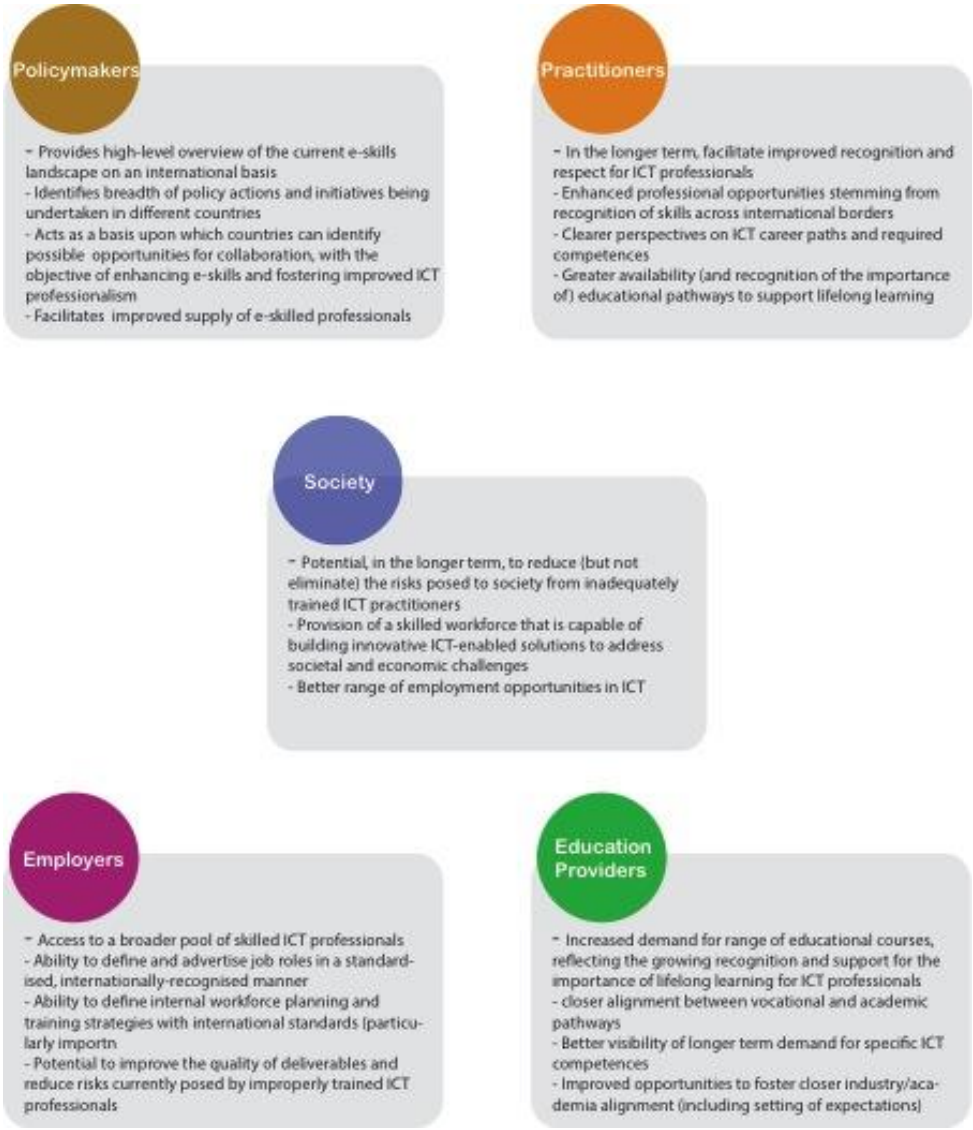


Figure 1: Project objectives (long-term)

In examining the international dimension of e-skills and ICT professionalism, initiatives, practices, and policies are examined within Europe and internationally, with particular focus on Australia, Brazil, Canada, China, India, Japan, Russia, South Africa and the USA. It is envisaged that many stakeholders from many countries will read this report. As such, efforts have been made to ensure that the content is readable and understandable by readers, regardless of their location. However, in some parts of the report, region-specific language may be used. For example, in some instances when referring to offshoring, the explicit reference is to work being offshored outside of Europe. In such cases, the context-specific nature of the text has been highlighted.

Specific details of the service contract are outlined in Table 6.

Service Contract	
European Commission	DG Enterprise and Industry Unit Key Enabling Technologies and Digital Economy
Contractors	IVI (lead partner); IDC; CEPIS; Empirica
Tender No	No 198/PP/ENT/CIP/12/C/N01C023
Duration	Jan 2013 – April 2014
Contact	Stephen.mclaughlin*(at)* nuim.ie

Table 5: Summary of the service contract details

Contextual background

ICT's importance in the global economy is unquestionable. The continuing transition to knowledge-based economies as well as increasing levels of automation within manufacturing economies, demand the successful exploitation of ICT. Successful exploitation of ICT, in turn, demands the availability of a workforce possessing the necessary ICT knowledge and skills. However, within Europe, an ICT skills gap of up to 13% is forecast, potentially acting as a brake on the region's productivity. Other world economies are confronting challenges of a similar scale.

The ICT profession as a whole is immature in comparison with professions such as law, medicine and engineering. When viewed from a macro perspective across Europe and further afield, there is limited consistency in terms of the basic building blocks of the ICT profession, such as bodies of knowledge, competences, education, and ethics. The impact of an immature profession manifests itself in many ways, including inadequate numbers of students entering the profession, negative public perception of the industry in some countries, and high incidence of failed ICT projects including patterns of ICT "black swans". As ICT becomes ever more pervasive, for example, via the 'Internet of Things' and 'Internet of Services', the extent to which ICT is applied by inadequately skilled practitioners has the potential to harm society increases. This last factor is particularly important as, historically, growing concern over the impact to society of failing to apply domain-specific knowledge successfully, has been the point of inflection for the maturing of other professions. Given such a precedent, there exists a strong argument for maturing the *ICT* profession.

As Europe transitions to a knowledge-intensive economy, its long-term success and competitiveness will be increasingly dependent upon effectively leveraging ICT and ensuring that the ICT workforce possesses the requisite knowledge, skills and competences. Such skills, according to the European Commission's (2007) communication on "e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs", include both ICT practitioner skills, ICT user skills and e-business or e-leadership skills. The pervasiveness of ICT and the speed of technological change means that ICT skills need to be continually developed and updated for issues such as cloud computing, green IT and cyber security. Further, compared to in the past where greater emphasis was placed on technical competences, today increased focus is placed on the need for dual thinkers who possess a hybrid of technical and business competences.

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 strongly focused 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 launch of 'Grand Coalition for Digital Jobs'.

Definitions

It is worth highlighting at this juncture, that there is no single agreed definition for an ICT professional. Different countries and organisations have differing views on the topic. For the purposes of this project, the following definition as outlined in the table below, derived from a previous report on ICT professionalism (2012), is used.

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.
The term relevant body of knowledge encompasses the requirement for a broad and deep knowledge base, which is up-to-date, accommodating both a common ICT body of knowledge, and pertinent specialist knowledge and skills. Professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. keeping abreast of latest technological trends) as well as non-technical aspects (e.g. developing better presentation skills). Professionals are accountable to themselves, the ICT profession and society, through an agreed code of ethics/conduct or applicable regulatory practices. Competent practice communicates the concept of quality of products and services being delivered by practitioners.

Table 6: Definition of an ICT professional

To avoid confusion, it is worth emphasizing that this report does not consider ICT end-users skills. Clearly, ICT professionals possess some end-user skills, but the focus here is primarily the examination of higher level e-skills required by ICT professionals, including for example software design, enterprise architecture, infrastructure management, and data modelling. In terms of occupational categories, this definition can be thought of as including:

- Core ICT practitioner skills
- Management and business architecture skills
- Other ICT technician skills

However, it does not include:

- ICT mechanics and manual workers skill
- Non-ICT professionals working in the ICT sector

Table 8 outlines the relevant ICT professional occupations according to ISCO-08 (International Standard Classification of Occupations, 2008).

Management, architect and analysis positions	
1330 Information and Communications technology service managers 2421 Management and organisation analysts 2511 Systems analysts	
ICT Practitioners	
2152 Electronics engineers 2153 Telecommunications engineers 2356 Information technology trainers 2434 Information and communications technology sales professionals 2512 Software developers 2513 Web and multi-media developers 2514 Applications programmers 2519 Software and applications developers and analysts not elsewhere classified 2521 Database designers and administrators	3511 Information and communications technology operations technicians 3512 Information and communications technology user support technicians 3513 Computer network and systems technicians 3514 Web technicians 3114 Electronics engineering technicians 3139 Process control technicians not elsewhere classified 3252 Medical records and health information technicians
2522 Systems administrators 2523 Computer network professionals 2529 Database and network professionals not elsewhere classified	3155 Air traffic electronics technicians 3211 Medical imaging and therapeutic equipment technicians 3521 Broadcasting and audio-visual technicians 3522 Telecommunications engineering technicians
NOT included in the definition	
ICT mechanics and manual workers skills 7421 Electronics mechanics and servicers 7422 Information and communications technology installers and servicers 8212 Electrical and electronic equipment assemblers	Any other non-ICT professionals working in the ICT sector

* Non-exclusive job code (includes both ICT and non ICT analysts).

Table 7: Definition of ICT professional occupations based on ISCO-08 categorisations (source: Empirica, 2013).

Figure 2 illustrates a hierarchy of ICT skills, promoted by the European Commission, with the shape of the pyramid reflecting the relative prevalence of ICT end-user skills in comparison to e-Leadership skills and ICT Practitioner skills.

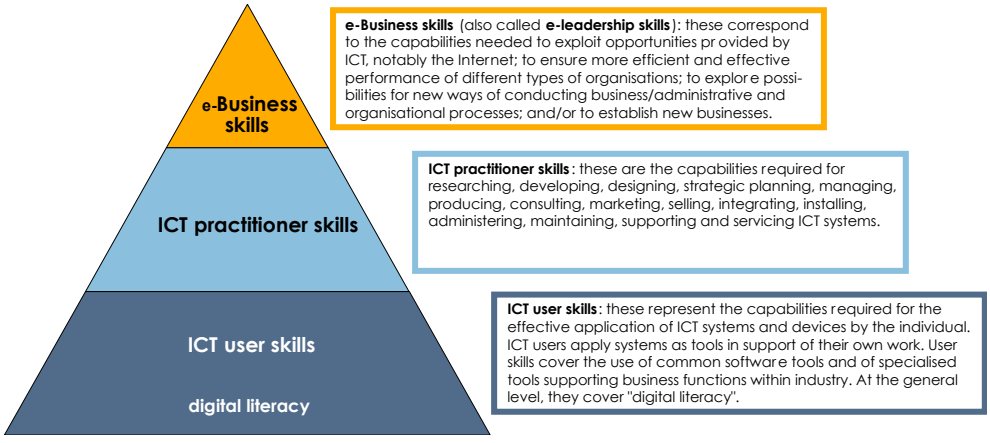


Figure 2: e-Skills pyramid (source: European Commission DG Enterprise and Industry, 2011).

Concluding remarks

In order to move towards maturing of the ICT profession, the current service contract aims to investigate and identify potential areas of collaboration and cooperation between industry participants, academia, and governmental bodies, on an international basis. To date, many countries and regions have embarked on initiatives to tackle the deficit of e-skills and mature the ICT profession. Typically, although not without exception, these initiatives have been undertaken on a national or regional basis.

Reflecting the global nature of ICT, this report aims to develop a better understanding of the international landscape for e-skills, documenting its current form, and the trends and factors that are influencing it. In doing so, there will be engagement with various stakeholders from many countries, in an effort to identify tentative options for collaboration in the longer term. In facilitating the exchange of stakeholder views on challenges, initiatives, and best practices, it is envisaged that the initiative will establish a positive, favourable environment for international cooperation in the longer term.

The report also endeavours to examine the impact of globalisation on the demand for e-skills, more specifically through assessing the impact of offshoring. In the past, ICT offshoring was associated with the outsourcing of low-level ICT activities to lower-cost economies. However, with the many changes taking place in the technological landscape such as the emergence of cloud computing, as well as fundamental shifts in the international educational landscape, suggest that the type of work being outsourced is evolving. In particular, the nature of work being offshored appears to be moving up the professional spectrum. Such changes are likely to influence the demand for e-skills within Europe. For this reason, the report shall also consider the nature of the future demand profile for e-skills in order to facilitate appropriate targeting of investment in e-skills within Europe.

CHAPTER 2: PROJECT APPROACH

Introduction

Figure 3 summarises the overall approach adopted in this service contract, indicating the key activities and outputs for each of two phases.

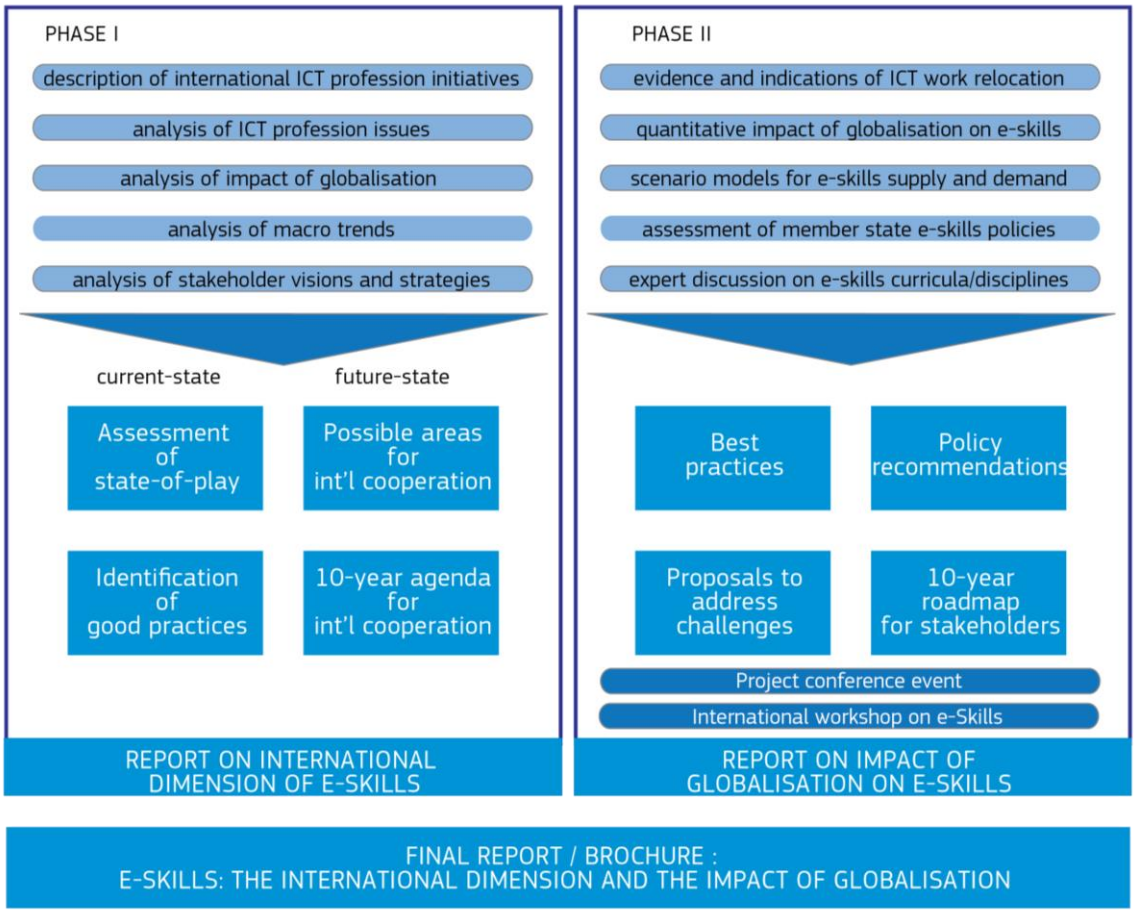


Figure 3: Overview of the project approach

This final report is a combination of key research findings from both 'phase one' and 'phase two'. Chapter 3 - Chapter 5 inclusive are 'phase one' deliverables; Chapter 6 – Chapter 10 inclusive are 'phase two' deliverables, while Chapter 11 draws an overall conclusion to the study.

Data sources: key stakeholder engagement activities

This service contract draws upon the insight and knowledge of recognised experts via a series of surveys, interviews, and workshops. A broad range of stakeholder groups have been consulted including:

- ICT industry
- ICT user organisations
- Education providers, both academic and industry-based
- Qualification and certification bodies
- ICT practitioner organisations including informatics societies
- Social partners
- Standards organisations (e.g CEN)
- Member states including policy makers/national e-skills bodies
- European Commission

The experts invited to participate are fundamental to the success of the work and their contributions have the potential to shape future policy initiatives on e-skills and foster the creation of a positive climate for international collaboration in this domain. During 'phase one', emphasis was placed on understanding the current e-skills and ICT professionalism landscape on a global basis and identifying relevant policies and a tentative agenda for collaboration. In contrast, during 'phase two', the emphasis focused on developing more concrete proposals for collaboration and developing support for the proposals.

Stakeholders were engaged through various data collection methods including:

- Surveys
- Interviews (1:1 and focus group)
- Workshops
- Websites (using partner websites)

Note: Although the current research study is funded by the European Commission, it should be emphasised that this work is an initial, informal attempt to better understand the current international landscape for e-skills. It is not, and should not be construed as, a formal international outreach programme from the Commission requiring formal representation from all relevant partners.

Related project initiatives

During Q1 2013, the European Commission launched a series of related initiatives, and an open dialogue with these initiatives was maintained in order to avoid overlap and identify potential opportunities for collaboration. The following initiatives have been highlighted as being particularly relevant:

- Monitoring and benchmarking e-skills policies and partnerships (2013)
- Development of European guidelines and quality labels for new curricula for e-leadership skills (2013-2014)

- Policy support programme for the grand coalition for digital jobs

Project events

Two main stakeholder events, linked to this project, were held:

- International e-skills and ICT Professionalism Workshop: This workshop gathered approximately 25 representatives from national e-skills bodies and related experts to discuss e-skills and ICT professionalism. Each participant provided an overview of the problem space from his/her own regional/industry perspective, highlighting examples of recent initiatives and best practices, in order to facilitate a common understanding of the challenges facing the ICT profession and identify tentative areas for collaboration that can be explored further.
- International e-Skills Conference: A dissemination event, with approximately 120 participants took place during March 2014, and promoted the main service contract findings and recommendations to interested policy makers and key stakeholders.

Project deliverables

Key project deliverables include:

- 'Phase One' Report: "The international dimension of e-skills"
- 'Phase Two' Report: "The impact of globalisation on e-skills"
- Final Report: "The international dimension of e-skills and the impact of globalisation on e-skills"
- Project Brochure in all 23 official languages of the European Union
- Conference Report

CHAPTER 3: DESKTOP RESEARCH

Introduction

This chapter provides an overview of the current ICT professionalism and e-skills landscape based on desktop research. It considers:

- The landscape for e-skills
- The landscape for ICT professionalism
- Major global technological, social and economic trends and developments

- The impact of globalisation on e-skills

The debate relating to ICT professionalism and e-skills is complex, comprising numerous issues and emerging trends, with many differing views held by multiple stakeholders across geographic borders. The review presented in this chapter highlights many of the key issues, and where practical and relevant, it makes reference to specific national and regional perspectives.

Figure 4: Wordcloud illustrating current challenges facing the ICT profession.

A key component of this current research includes a series of country profiles showing the current landscape for e-skills and ICT professionalism for each European member state, as well as a select number of non-European countries. These country profiles are broken down by Bodies of Knowledge, Professional Ethics, Education and Training, and Competences. Appendix A provides detailed content for each country. In particular, it has identified a broad range of initiatives that could act as valuable examples of best practice.

e-Skills landscape

This section describes the current landscape for e-skills, describing challenges, issues, trends and initiatives.

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 (IBM, 2012).

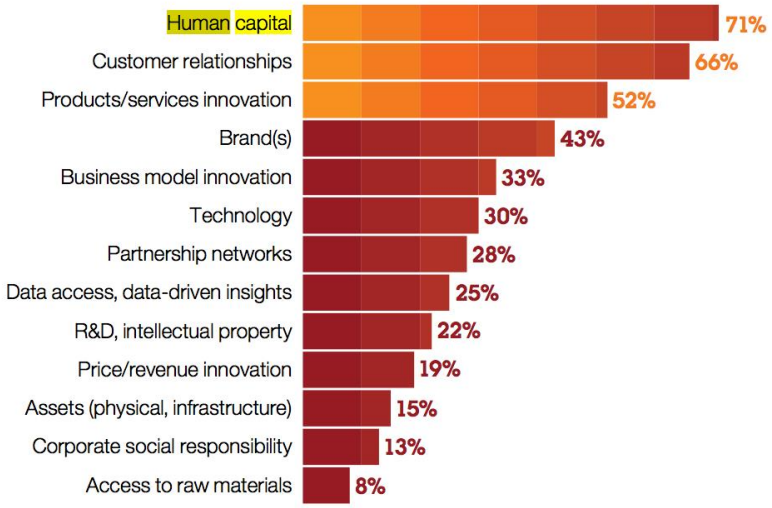


Figure 5: Sources of sustained economic value identified by CEOs (Source: IBM, 2012)

In today's knowledge-based economies, 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 (2012) estimated the demand for e-skills (ICT professionals and practitioners) across the EU at 274,000. This includes 73,000 vacancies for ICT management, architecture and analysis skills, and approximately 201,000 for ICT practitioners.

The demand structure is also visible in employment broken down by occupations, with some marked changes. While the overall ICT workforce grew by 1.8% between 2011 and 2012, the increase in management, business architecture and analysis level jobs was 8.5%, and in ICT practitioners at professional level (ISCO level 2) it was 3.7%. At the same time, ICT practitioners at technician or associate level fell by 3.9%, with core technician groups (ISCO 35) down 2.5% and industry and engineering ICT technicians down 5.1%.

Three scenarios were prepared in the course of a recent study (European Commission, 2013h). One represents the most likely - and most optimistic - future. Alongside this, a stagnation scenario assumes a less favorable future, and a 'disruptive boost' scenario envisages demand rising because of ICT-based disruptions of one or more industries. The first scenario assumes modest economic growth (European GDP increasing from 1.0 % annual growth in 2012-2015, then 1.7 % a year in 2015-2020) and moderate IT investments (2.2 % p.a. growth until 2015, 3.0 % in the rest of the decade). IT investments will be largely driven by rapid diffusion of mobile devices, apps, cloud services and other new delivery models. Significant growth is foreseen for big data applications and services through to 2020. This scenario would imply modest job growth of 100,000 until 2015, with a structural shortage of 509,000 caused by lack of available talent. It also suggests that 509,000 jobs could be created if the skills were

available. The bottlenecks are largest in the UK, Germany, and Italy - which together would account for 60% of all vacancies in Europe.

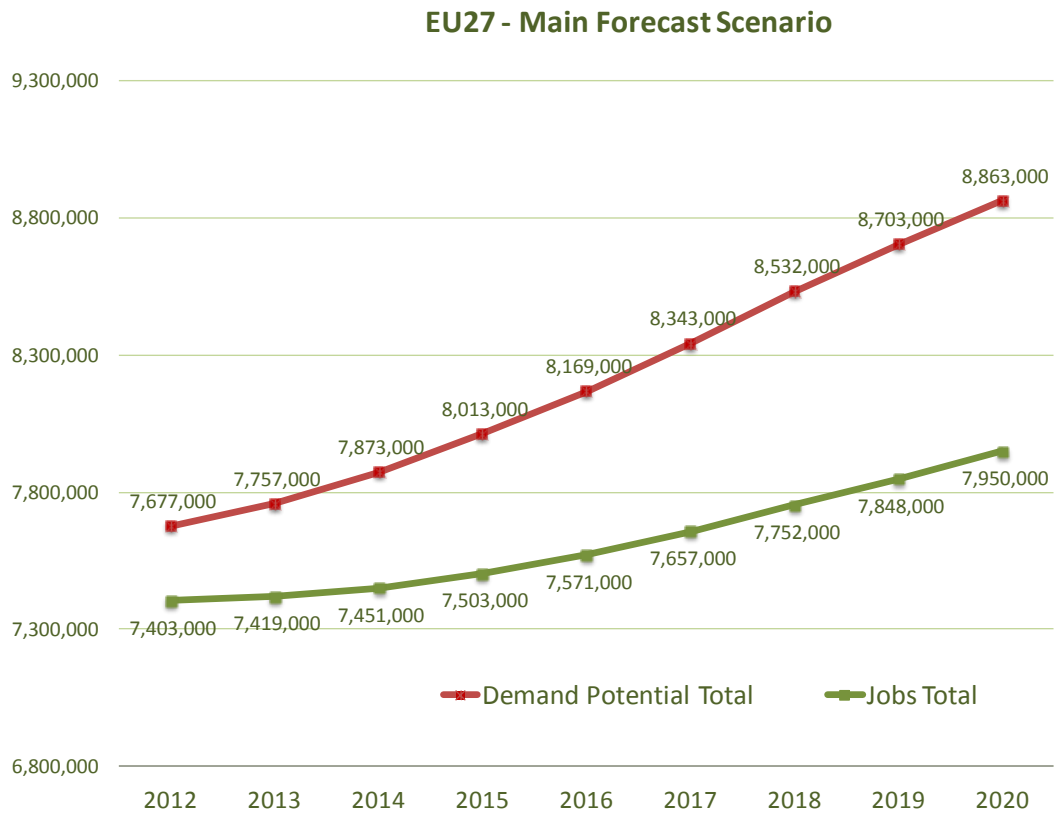


Figure 6: ICT workforce development and ICT worker demand potential in Europe (EU27) 2012 – 2020 (main forecast scenario). (Source: Empirica, 2013).

This growing trend of ICT vacancies coincides with a period of high unemployment, suggesting a break with the norms expected under the Beveridge curve, thus implying decreasing efficiency in the labour markets. Examination of the literature pertaining to many other regions paints a similar picture relating to the existence of an ICT skills gap as outlined previously at the start of this report. The picture is even more alarming when examining the situation for 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 were strategically important, but only one in ten organisations have all the skills it needs, with 25 percent reporting major skills gaps in each area, and 60 percent reporting moderate to major shortfalls (IBM Center for Applied Insights, 2012).

However, there are also some caveats worth mentioning as different perspectives on this matter exist. Estimating demand for e-skills on a national/international basis is a complicated task, as different countries use different categorisation schema for identifying job roles. As a consequence, obtaining accurate numbers, particularly for job types that did not exist when the categorisation schemes were originally introduced, is difficult. As such, estimates should be used as a general indicator of demand, and examination of trends is possibly more revealing than absolute numbers.

Where demand for ICT practitioners is outstripping supply, economics theory suggests that salaries should be increasing. However, in some countries, this accompanying pattern does not appear to be taking place. For example, the Economic Policy Institute states that over the period 2000 to 2011, the average hourly wage for US workers possessing at least a bachelor's degree in computer and math occupations rose less than half a percent per year (Economic Policy Institute, 2012). It could be argued that the recessionary climate is impacting on employee's propensity to change job, thereby reducing the inflationary salary trends.

However, a blog article in the Harvard Business Review (Wadhwa, 2013) presented an opposing view, casting doubts on the EPI report and similar views. It offered three reasons arguing against those who rejected the notion of a skills gap and the need for immigrant workers:

- Lack of worker mobility: The US has amongst the highest rates of home ownerships, making it difficult for workers to move particularly when demand for skilled workers is highest in areas with very high house prices (e.g. Silicon Valley, New York). Reinforcing this argument, such locations are among those with the lowest unemployment rate. These factors help explain why some regions are experiencing high unemployment but others are experiencing a lack of skilled workers.
- Wages: Some sources have suggested that H1-B immigrants were "cheap labour" brought in to suppress local salary conditions. However, Wadhwa (2013) points to research from the Brooking Institute, suggesting that the areas with most H1-B requests were experiencing greater wage growth than other areas, and that H1-B workers were typically paid more than US-native born workers with similar educational attainment.
- Invention: Wadhwa (2013) also points to two related research publications indicating that locations with higher concentrations of immigrant college graduates and H1-B visa holders witness higher levels of innovation/invention (as measured by patents).

It is also important to note that the skills most in demand change frequently, especially in ICT, and workers do not always up-skill accordingly. As such, some highly-skilled workers remain highly skilled, but are skilled in the wrong technologies, and therefore viewed unemployable by prospective employers. Together, these elements suggest why on the one hand, employers are demanding more skilled workers, while at the same time, there are a number of skilled workers unemployed.

While radically increasing the supply of ICT graduates might seem a logical response, policymakers must also take into consideration the costs involved, the relative rigidity of the current education infrastructure, and the fact that even with increased throughput, there would be a lag of at least three years before the first graduates of any such initiative would be ready for the marketplace. In addition, there are many concerns voiced by employers as to the quality of graduates currently being delivered to the marketplace. For these reasons, many countries are now investigating a broader range of policies to increase the supply of skilled ICT workers.

Threat to ICT jobs from automation / Hollowing out of skills

In 1930, the economist John Maynard Keynes wrote "We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come, namely, technological unemployment. This means unemployment due to our discovery of means of economizing the use of labour outrunning the pace at which we can find new uses for labour. But this is only a temporary phase of maladjustment" (Maynard Keynes, 1930). Many are familiar nowadays with the notion of 'technological unemployment', many expect its influence to increase, and some are now questioning if the period of adjustment will only be temporary. A survey published by the Economist Intelligence Unit (2010) suggested that 67% of respondents expect a growing proportion of roles to be automated.

When the Luddites protested against the new automated looms in the early 19th century, they were demonstrating their opposition to the technology that they believed threatened their jobs. In practice, however – at least in the US – the numbers in employment at the end of each decade increased through to the end of the 20th century, reinforcing the notion that new jobs would replace old jobs and ways of working. However, there are no guarantees that this pattern will prevail, and technological unemployment may represent a far greater threat to employment prospects than for example, the threat from offshoring.

In 1966, the US Presidential Commission on Technology, Automation and Economic Progress concluded that "technological progress may induce demand for very skilled and highly educated people in numbers our society cannot yet provide, while at the same time leaving stranded many of the unskilled and poorly educated with no future opportunities for employment" (Stewart, 2013). Increasing numbers of economists today seem to align with this view, suggesting that the real challenge will be polarized employment levels, potentially brought about by differing levels of education and skills.

Moore's Law is the prediction of Intel co-founder Gordon Moore that the number of transistors on a chip will double approximately every two years. Reflecting this trend, ICT continually evolves and changes form on a scale and rate that is unprecedented. In describing the law of accelerating returns (Kurzweil, 1999), the rate of change initially seems small, but due to the exponential nature of growth, it rapidly yields capabilities that become increasingly overwhelming in their potential application. The notion is further examined in "Race Against the Machine" (McAfee & Brynjolfsson, 2011) when they consider the possible implications of technological advancement encroaching on employment opportunities in the US. As evidence of this change, they point to the increasing disconnect between US productivity and employment.

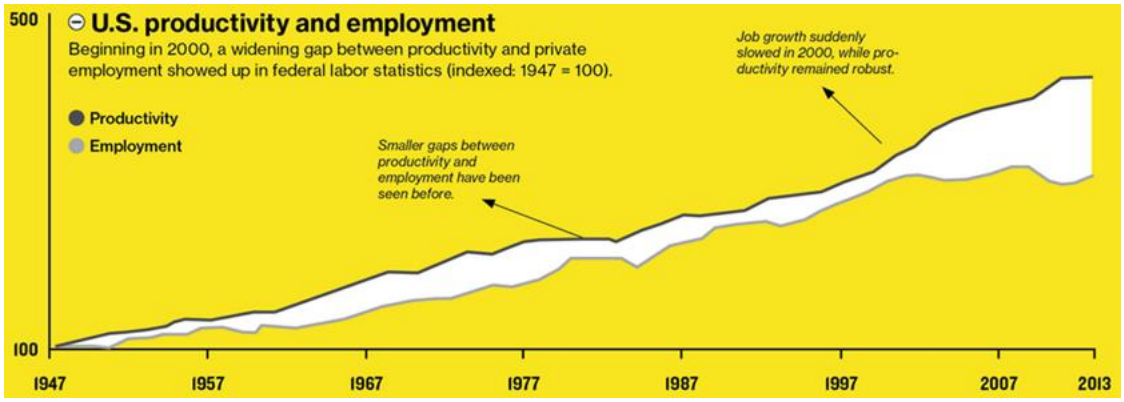


Figure 7: US productivity and employment (Rotman, 2013)

There is also evidence of this impact in other countries. According to NASSCOM, in 2003 approximately 38,000 engineers were needed to earn $1bn; in contrast, in 2012 only 20,000 are needed to earn each additional $1bn in revenue. This statistic can be taken to show how India is moving up the value chain curve; but it is also interpreted in some quarters as an indication of the increasing levels of automation (Mishra, 2013). A recent report identified the automation of knowledge work (a type of work currently undertaken by 9% of the global workforce) as one of the disruptive economic changes that is likely to influence the way future society operates (McKinsey Global Institute, 2013). David Autor posits that "recent computerization has substituted for low skill workers in performing routine tasks while complementing the abstract, creative, problem-solving, and coordination tasks performed by highly-educated workers". Figure 8 illustrates this inverted bell-shape curve.

Panel A: Panel B:

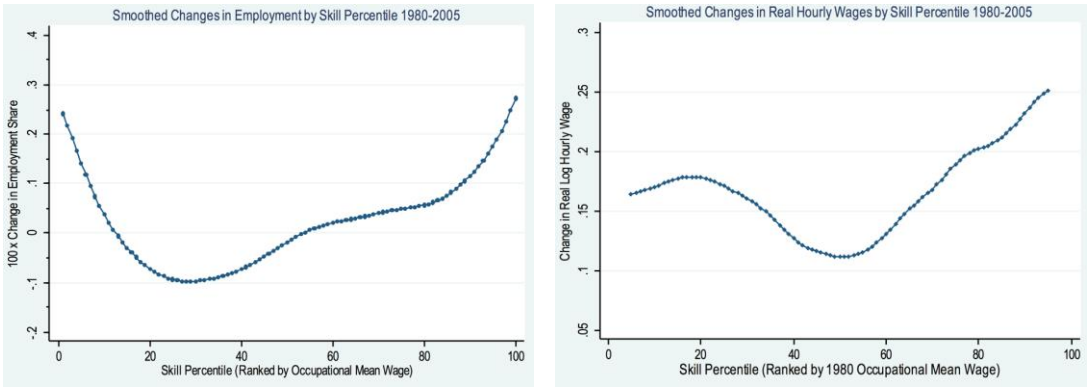


Figure 8: Smoothed changes in employment (Panel A) and hourly wages (Panel B) by skill percentile, 1980-2005 (source: Autor and Dorn, 2013).

The source of this growing income inequality and increasing employment polarization (i.e. concentration of employment in the highest and lowest paid occupations) is often attributed to the combined effects of rapid technological change and expanding international trade. According to Autor et al (2013) "there is also a growing sense that trade and technology are a unified force affecting labour markets".

ACM recently discussed the notion that advances in artificial intelligence and robotics could have significant repercussions for future employment opportunities (Ford,

2013). Ford suggested that the routine nature of most jobs, even "higher-wage white collar jobs will be increasingly susceptible to software automation and machine learning". If such a pattern is borne out, the shape of the curve could become even more pronounced. Some of the retail, service oriented jobs might also disappear if Ford's viewpoint is confirmed, for example, from a technical perspective, fast-food is simply a form of 'just-in-time' manufacturing, with the same potential for automation opportunities to be realized.

IT infrastructure management services (one of the most commonly cited types of IT offshoring) is particularly vulnerable to disruption by automated systems according to Sid Pai of ISG, who stated "if I can use a piece of software to do the work for me, then I don't need to ship that work over to India...that's the real threat to the IT and business process services industry" (Swabey, 2013a). Possibly recognising the potential impact of automation, Infosystem (a major provider of IT outsourcing services) signed a partnership agreement with IPSoft (a provider of autonomic IT services) in 2013, and this partnership will include collaborating on an Autonomics Centre of Excellence, that will focus on developing technical competences and training 5,000 Infosystem employees in the discipline of autonomics.

On a much smaller scale, O2 is already using business process automation software to reduce its dependence on offshore workers and automate a small number of its processes (Flinders, 2012). Quocirca estimate that 30% of an IT team's time is spend on low level tasks such as responding to minor user incidents, carrying out routine procedures or checking for errors (Tarzey & Longbottom, 2012). Reflecting this pattern, systems integrators could become the biggest users of automation software.

However, Ovum predict that while automation via software robots may prove disruptive in the longer term and ultimately deliver significant cost savings in service delivery, the current solutions are too immature, and they therefore state that "software robots will not ring the death knell for offshoring" (Ovum, 2013). Ovum argue that the pace of change in IT services and business processes (including regulatory and compliance guidelines, customer demands, technology advancement, integration dependencies, disperse stakeholder locations) is too rapid to support fully automation at this point in time. This relative level of immaturity of the solutions and a lack of industry standards suggest that take-up of the software will be slow, at least in the short term, and restricted to specific narrowly defined tasks.

Women in ICT

In OECD countries, women now account for less than 20 percent of ICT specialists (Tandon et al, 2012). Within Europe, women make up less than 30 percent of the ICT workforce (European Centre for Women and Technology / The Parliament, 2013). In the US, the National Maths and Science Initiative (NMSI) reports that men over the age of 25 held 87 percent of bachelor's degrees in engineering fields. In the work environment in the US, the situation is equally poor - only 23 percent of workers in STEM (Science, Technology, Engineering and Mathematics)-related jobs are women, even though women constitute 48 percent of workers in all occupations (Warrior, 2013), suggesting there is considerable effort required in order to attract women to the technical work environment. The situation is even more pronounced when advancing

the organizational hierarchy. The NCWIT report (2010) suggests that women hold just 9 percent of IT management positions, and accounted for only 14 percent of senior management positions (when including non-technical departments) at Silicon Valley start-ups. These findings provide some cause for concern. The blue line in Figure 9 outlines the percentage of computing undergraduate degrees being awarded to women in the US. Unlike other science subjects, the pattern for women indicates a negative trend, and the figures indicate a rapid decline from 35% in the mid-1980s to fewer than 20% in less than ten years. Some observers have referred to this as the "incredible shrinking pipeline" (Camp, 2012). Director of Engineering at Facebook, Jocelyn Goldfein remarked "the numbers are a challenge….there are just fewer women graduating [as Computer Science majors] and fewer women in the industry" (Cohen, 2013).

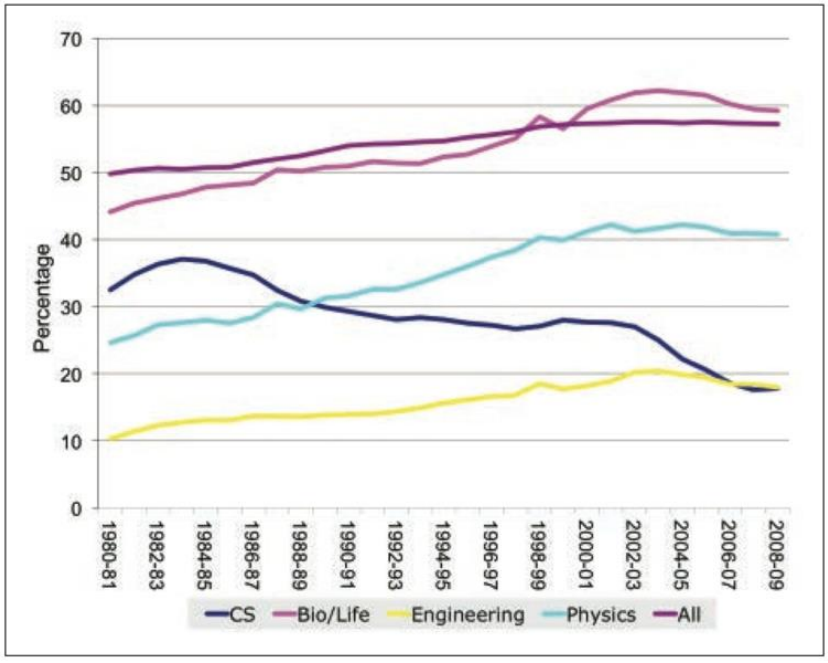


Figure 9: Percent of undergraduate degrees awarded in the United States to women in different science and engineering fields (Source: ACM Inroads 2012).

Aside from the low numbers of women entering the profession, there is also some evidence to suggest poor levels of retention. A HBR article, 'Stopping the Exodus of Women in Science' (Hewlett et al, 2008), found that the opt-out rate of women from full-time work as scientists, engineers and technologists was remarkably high. Over time, 52% of women in these roles quit their jobs, with the majority leaving the profession in their mid to late thirties and not returning in the future.

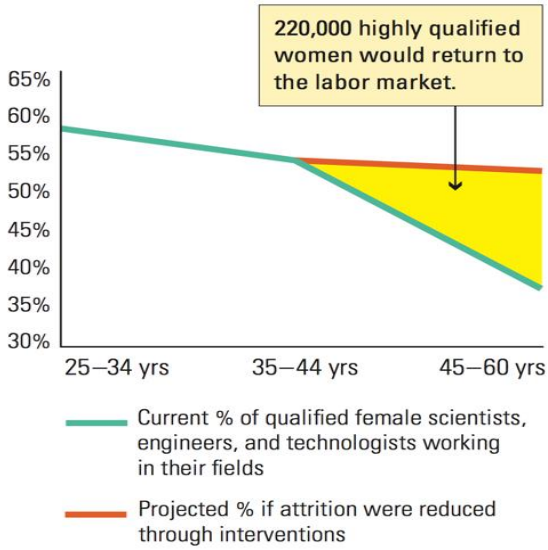


Figure 10: Female attrition from scientific professions in the US (source: Hewlett, Buck Luce, & Servon, 2008).

As is evident from the red line in Figure 10, efforts to cut the rate of attrition by just 25% would make substantial inroads into increasing the number of women in the profession in the longer term. The same report estimated that by cutting the rate of female attrition by 25%, approximately 220,000 highly skilled workers would be added to the labour market. Given the critical importance of workers with such skills in the global economy, this potentially represents an important source of economic competitiveness.

Increasing female participation in the ICT workforce is important. Given the low levels of women in ICT in Europe, a significant increase in participation could make large inroads into plugging the current skills gap. Further, women should be represented equally in the workforce and have the same opportunities as men to participate in the profession. To have such differing levels of participation suggests that there may be some implicit discrimination present that is dissuading women from working in this field. From a quality perspective, it is important that ICT project teams are diverse, as there is evidence to suggest that the diversity of the individuals contributing to a project enhances the quality of solutions delivered (Eney et al, 2013). The situation of women in ICT differs in other parts of the world. Examination of the statistics for certain developing countries suggests a more positive outlook, in that there is a greater percentage of women working in ICT. For example, an ITU study on women in ICT reports "women account for about 65 per cent of the total professional and technical workers in IT services and IT-enabled services in the Philippines. In India, women make up 30 per cent of the IT services and IT-enabled workforce - a much higher rate of female participation than in the services sector in general - and this share is expected to grow to 45 per cent by 2010" (Tandon et al., 2012). However, there are also some concerns raised relating to the type of work that is being undertaken by women (Cabrera-Balleza, 2005). More specifically, Business Process Outsourcing (BPO), the service segment of ICT work, is the single largest employer of women. The types of work undertaken in BPO include service call centres, helpdesk, and financial services transaction processors. In many instances, the type of work undertaken does not require specialised ICT skills, and therefore, it

has been argued, does not reflect women's true participation in the information society. There are many challenges related to women's participation in the ICT workforce. Nancy Hafkin, former chief of the Development Information Section, UNECA, identified four broad categories impacting on the "leaky pipeline" (Cabrera-Balleza, 2005):

- Cultural and attitudinal barriers, such as perceptions about the role and status of women;
- Situational barriers that include lack of family commitment, lack of partner support and living in rural or isolated areas;
- Qualification barriers such as lack of formal math and science education or experience in computer programming skills;
- Institutional barriers that block women's access to science and technology education. These include the lack of female teachers and assumptions of male teachers about capabilities of women students; inflexible admissions, selection and entry requirements which do not take into account women's varying educational backgrounds, approaches and abilities; and heavy attendance requirements for practical skills and laboratory work which are more difficult for women to meet in view of their family and domestic responsibilities.

However, there is also some evidence to suggest that the situation may be changing - for example, according to a senior VP within Genpact, an Indian business processing company, "the impact of globalisation is very high in the organisational hierarchy, especially at the mid-management level, as the percentage of male and female employees is roughly the same" (Lamont et al, 2013).

However, making substantive change is likely to take time. A 2012 ITU report reaffirms the gender segregation, with women strongly represented in the lower level ICT occupations but lacking in the more senior levels. The report found that women accounted for 30% of operations technicians, but only 15% of managers and 11% of strategy and planning professionals.

Although not specific to ICT, a survey cited in Harvard Business Review suggested that, for highly educated workers, women's incomes are more comparable to men's in developing countries: "42% of highly educated women earn as much or more than their spouses" (Hewlett and Rashid, 2010). For China, the figure was 39% and for Brazil 40%. In contrast, for the US, the figure was only 25%. Similarly, the percentage of women entering universities in developing countries is remarkably high: 60% in Brazil, and 47% in China. In Russia, 86% of women aged 18 to 23 are in tertiary education (Hewlett and Rashid, 2010).

Attitudes of women in developing countries also appear to be different. The same HBR survey identified that 85% of women respondents in India class themselves as very ambitious; in Russia and China, the figures were 63% and 65% respectively. In contrast in the US, only 36% considered themselves very ambitious. Unfortunately, there is also a greater perception of sexual discrimination in the workplace in developing countries.

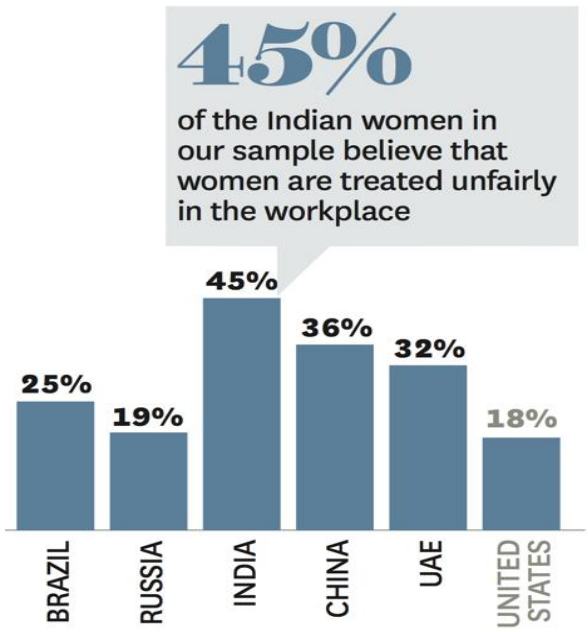


Figure 11: Treatment of women in the workplace. (source: Hewlett and Rashid, 2010).

Gender attitudes to technology also appear to exist among millennial (young people aged 18-30), according to Telefonica's Global Millennial Survey in 2013 (Telefonica, 2013), which polled over 12,000 young people across 27 countries. Male respondents believed more strongly that technology had an influence in shaping their outlook in life (39% of males compared to 22 percent of females) and that technology is the most important area of study to ensure future personal success (42 percent of males versus 29 percent of females). Given the growing importance of ICT in the workplace, the fact that young women appear to gauge technology as less important suggests that negative perceptions of technology continue to exist among young women, and this may potentially impact on their propensity to enter technology-based roles.

Improving the image of the profession

One of the difficulties in increasing supply of ICT skilled workers is the negative perception of the ICT profession held by many individuals. This is an important concern if the number of people considering entering the profession is to be increased. Highlighting the decline in the provision of ICT graduates in Australia, Adam Redman of ACS comments that "ten years ago, more than 10,000 students chose to study ICT at university" (Griffith, 2013); nowadays "there are only 4500 students studying IT at university, and not all of them graduate" (Talevski & Osman, 2013).

It has been suggested that there is a need to improve the image of ICT professionals, highlighting the diverse, multi-disciplinary, business-oriented opportunities afforded by the profession. This should be targeted at all stages of the pipeline – from schoolchildren, to students, to graduates, to experienced workers in other professions, to the unemployed. This message needs to be communicated widely as it is important that everyone, even people not working in ICT, recognise the different role now being undertaken by ICT workers.

The recent code.org video, featuring the line "great coders are today's rock stars", is one recent and very successful example of this (garnering over twelve million views on YouTube in under two weeks). Although this targeted the specific field of coding, rather than the wider ICT profession, it has helped to reinforce positive messages about working in ICT. However, effecting cultural change takes time and effort, and many more initiatives will be required to achieve any kind of meaningful and prolonged success.

Increasing the supply of e-skilled practitioners

Many economies are experiencing shortages of e-skilled practitioners. Increasing the supply of ICT graduates within the tertiary level education system is one solution to the above problem, but in practice, 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, such as the provision of intensive industry-driven courses addressing particular employer demands. Such courses are typically targeted at young, unemployed as well as experienced workers looking to re-skill to meet emerging requirements for e-skills in the workplace.

Dr Jonathan Liebenau of London School of Economics presents an alternative to focusing on increasing the supply side (Liebenau et al, 2012). Rather than increasing the number of ICT practitioners, and certified training facilities, Liebenau et al, recommend *better use* of existing skilled personnel. In order to achieve this, he recommends:

- Promoting self-learning and in-house training, and harnessing the benefits by fostering more extensive utilisation of developing skills.
- Emphasising the coordination, co-invention and multiplier effects of ICT in adapting business routines.

In essence, the proposed focus is on establishing a workforce that is capable of adapting to the changing market conditions and the expectations of employers, thereby supporting firms in harnessing ICT for productivity gains and innovation. Such changes will require significant cultural changes in the workforce and an underlying educational infrastructure (for example MOOCs) to facilitate the required level of self-skills learning.

European initiative: Grand Coalition for Digital Jobs

On 4-5 March 2013, the European Commission launched the Grand Coalition for Digital Jobs, a large-scale multi-stakeholder partnership, with the aim of increasing the overall supply of digitally skilled professionals and to better match supply and demand of digital skills. The focus of the coalition is on concrete actions that can be implemented in the short term with high local impact, building on and scaling up on-going programmes and best practices.

The objectives of the actions include:

- Improve the image and attractiveness of ICT careers
- Offer training packages co-designed with the ICT industry
- Offer more aligned degrees and curricula at vocational and university level education that will respond to the needs of students and the industry
- Improve recognition of qualifications across countries by stimulating take-up of a European certification scheme for digital skills of ICT professionals, based on the existing e-Competence Framework
- Reduce labour market mismatches by stimulating mobility
- Stimulate digital entrepreneurship by liaising with Start-up Europe, a single platform for tools and programmes supporting people wanting to set up and grow web start-ups in Europe

Reflecting the importance of the reach and ambition of the Grand Coalition initiative, it was launched at an event in Brussels hosted by President Barroso, Vice Presidents Neelie Kroes and Antonio Tajani, and Commissioners Laszló Andor and Androula Vassiliou. The success of the initiative however, is entirely dependent on the level of traction and support that it acquires from stakeholders in industry, academia, and government. At the launch event, a number of organisations made pledges to create ICT jobs and training opportunities. However, these initiatives will not be funded by the Commission – they are entirely industry-driven.

Following an open tendering process, in Q4 2013, a consortium was tasked with facilitating the realisation of the goals of the coalition, helping to identify best practices, and communicate and scale successful initiatives across the region. However, its success will depend entirely on the support of the many stakeholders involved.

National initiative: Tech Skills Partnership (UK)

In the UK, an industry-led consortium, Tech Skills Partnership, is responding to a (tendering) call from the UK government to create jobs, raise skills, drive economic growth and bid for funding through a new initiative, the Employer Ownership of Skills Pilot (potentially worth up to £340m in matched funding). The consortium includes organisations such as Accenture, BT, O2, Microsoft and other large and small organisations.

The proposals are likely to focus on the following four areas:

- Establishing an increased pipeline of talent
- Setting new standards for apprenticeships
- Enabling employers to define and recognise the educational courses and training they value
- Creating an effective skills ecosystem for the information economy

(See www.techskillspartnership.com for more details)

If successful in their bid, this could provide a useful example for other countries faced with similar challenges.

Primary and secondary education

Improving ICT education is key to improving the pipeline of e-skilled workers in the longer term. If children are discouraged from learning ICT at school, it will be more difficult to encourage them to consider a career in ICT in the future. Moreover, given ICT's importance to all companies, not just ICT companies, it seems essential that all children should be encouraged to acquire the relevant skills and knowledge in order to foster economic growth.

In examining the teaching of IT to primary and secondary education students, a recent report remarked that "informatics education, unlike digital literacy education, is sorely lacking in most European countries. The situation has paradoxically worsened since the '70s and '80s" (Informatics Europe & ACM Europe Working Group, 2013). In this respect, it is important to differentiate digital literacy (a set of basic skills providing fluency in the use of computer tools and the internet) from informatics (the science behind information technology, and a cross-disciplinary field underlying today's scientific, engineering and economic progress, encompassing concepts such as algorithms, data structures and computational thinking). By focusing on digital literacy, there is the risk that society will be skilled in consuming technologies, but incapable of building on and developing new technologies, thereby posing a threat to Europe's continued economic wellbeing given the critical importance of IT. To counter such threats, the aforementioned report argues that "informatics education must become, along with digital literacy, an obligatory part of general education". However, the report also recognises that the current shortage of informatics skills among teachers seriously impedes plans to teach informatics at schools, and therefore suggests various kick-start initiatives aimed at encouraging links between industry and schools to provide the necessary skills to teachers.

The problem of school curricula that fail to provide a solid understanding of ICT is a common issue, not unique to Europe, and many countries are now embarking on new initiatives to change the situation. In the US, less than 5% of K-12 (kindergarten to

age12) schoolchildren are exposed to computer science programmes (Roizen, 2013). However, in the absence of formal school educational initiatives, many independent initiatives have been launched by individuals passionate about bringing change to this domain, such as Coderdojo and Code Club World.

However, some moves into formal education are taking place at an ever-younger age. In Estonia, a new program called Progetiiger (Programming Tiger) has been launched to teach all children between 1st grade and 12th grade a basic understanding of computer programming, and knowledge of how to create their own web and mobile applications. The teaching occurs either in classes or in hobby clubs. In the pilot in 2012, 30 primary school teachers completed the training course and more teacher training was planned for 2013. The organization operating the courses (Tiger Leap Foundation) now also provides courses to facilitate teaching of technology at kindergarten.

The UK government has also recently announced its intention to dramatically alter the Computing curriculum in schools in 2014, with the intention of teaching children in Key Stage 1 (ages 5-7) how to "create and debug simple programs" and "understand what algorithms are". In the US, ACM and code.org have recently announced a partnership to promote the teaching of informatics to children in US schools (Roizen, 2013), and the Computer Science Teachers Association (CSTA) has a number of initiatives in place, notably the Computer Science Principles course, aimed at addressing the current gaps.

A 2011 study of international education programmes (Jones, 2011) assessed the current state of education in each country. Some key findings include:

- Israel was regarded as having "the most rigorous Computer Science high school program in the world" with the curriculum receiving regular updates.
- In India, computing education was not mandatory, and was an elective for children in 9th grade (approx. age 14), but there was no formal curriculum for 1st-8th grades. {Update: to address this gap, a new Computer Science curriculum for K-12 schools was published by the Indian Institute of Technology, Bombay in June 2013 (Iyer et al., 2013)}.
- South Korea was identified as having a long tradition of teaching computing in schools. Computing Science was being taught in approximately one third of middle and high schools.

Continual re-skilling / Lifelong learning as a requirement

Jacques Delors wrote "the concept of learning throughout life thus emerges as one of the keys to the twenty-first century. It goes beyond the traditional distinction between initial and continuing education. It meets the challenges posed by a rapidly changing world" (Delors, 1996).

ICT continually reinvents itself – new hardware, new software, new platforms and it is this rapid pace of change that helps drive innovation and increased productivity in organisations. At the same time, these changes also demand new skills from ICT practitioners. Interestingly, many graduates have high expectations of receiving

training in their first jobs, and often the type of training that is offered by employers is perceived as a point of differentiation for graduates (Smith and LaVelle, 2013).

However, over time, most ICT practitioners develop a suite of skills and knowledge that help to keep them employed. As a consequence, it is rare for employers to offer additional training opportunities to experienced professionals. Given the dynamic nature of ICT, it is possible that this mindset will have to change. Craig Barrett, a former chief executive officer of Intel Corporation, famously remarked that "the half-life of an engineer, software or hardware, is only a few years."

Many organisations currently rely on replenishing their skill sets through the recruitment of new graduates. However, if offshoring of lower-level positions becomes a more common occurrence, the availability of fresh talent will decline – potentially impacting on the need for up-skilling of existing practitioners or increasing reliance on outsourcing. Whereas traditionally engineers may have moved into a different role after a period of years (in some cases, a managerial role), this will not always be possible in an economy that is not continually expanding. For this reason, workers will need to continually update their skill sets to remain competitive.

In the past, the task of remaining skilled was complicated. It depended on employers wanting to provide funding for training. In some cases they were unwilling to do so, on the grounds that it may have increased the probability of the employee leaving the firm. With the increasing availability of online education (particularly MOOCs) and equally importantly, the increasing levels of recognition of such tuition, it is probable that ICT practitioners will have access to an unparalleled array of educational resources. However, it is also likely that keeping oneself up to date will become a necessity demanded of all practitioners in order to remain competitive.

Expectations of academia versus industry

Some industry voices are critical over the quality of tertiary education graduates due to the difficulties experienced when graduates transition from university to industry. There have been many studies in this domain. The following table, adapted from a presentation by Leeuwen (2009), highlights many of the key aspects:

UNIVERSITY focus	INDUSTRY focus
Computer science	Software and systems engineering
Concepts of the present and the future	Concepts of the present
Knowledge and academic skills	Skills in the technologies being used
Frontier research	Concrete results

Table 8: University versus industry focus

There are also many questions to be answered regarding the quality of graduates. For example, the World Economic Forum and Boston Consulting Group report (2011) suggests that due to the uneven quality of education systems, only 25% of Indian and 20% of Russian professionals are currently considered employable by multinationals.

The European Commission recognises as key the improved industry/academia alignment, and there have been numerous reports and events calling for closer collaboration between the two sides. More recently, at the meeting of the Competitiveness Council in Vilnius (July 2013), the Lithuanian research and education minister Danius Pavalkis (chair of the council), remarked "It is not for the

education system to formulate what kind of professionals they will prepare, but the other way around…Industry should say exactly what skills people should have in their armoury". This comment underlines the belief that closer collaboration between industry and academia is an important factor in tackling the shortage of young people with business knowledge as well as scientific and technical skills.

However, the situation is complex and there is unlikely to be a panacea for "improving alignment" between industry, educators and students. For example:

- School-leavers are not always best-informed about the type of university courses that are most likely to lead to future job success. As such, it is difficult for universities to market and develop courses in emerging domains such as 'big data' and the 'Internet of things'; or indeed in combination degrees (e.g. Finance/ICT). A consequence of this is that the courses employers rate highest are unsuccessful in attracting adequate numbers of students. In this respect, actions to create an international ranking of ICT-related university courses/establishments (based on graduate employability rates, salaries, etc. similar to the existing MBA course ranking schemes) might help school leavers to identify relevant courses with good employment prospects. Similarly, initiatives to increase awareness of relevant emerging careers in ICT to students and school careers advisors might help to increase uptake on such courses.
- Historically, many employers provided graduate training programmes to help transition graduates into the workplace effectively. The availability of such programmes, particularly in Europe, has declined substantially in recent years, leading to some commentators in academia remarking that current employer expectations are unrealistic in that employers expect fully work-ready graduates, capable of delivering market-quality solutions. This, in turn, raises the question of the extent to which universities should even be attempting to create "work-ready" graduates rather than focusing on providing a more conceptual, theoretical grounding to students? What in essence, should be the role of an academic education? More specifically, some people question the importance of providing students with a broad education which has an enduring quality and which will hopefully facilitate students in the lifelong acquisition of skills, rather than focusing on providing students with the most in-demand ICT skills that may be out-of-date, by the time the student graduates.

Resolving these differences of opinion is important. At present, some employers in Europe appear to be offshoring certain entry-level jobs to lower-cost economies due to their concerns over the availability of relevant ICT skills. While this provides an opportunity for firms to reduce costs in the short-term, it also has repercussions on the sustainability of the ICT skills pipeline in the longer term. If graduates are not provided with the opportunities to develop relevant experience in entry-level roles, they are unlikely to possess the knowledge and experience required for more experienced roles in the future. This in turn, has the potential to exacerbate the supply problem further, as future computing students are dissuaded from entering the profession due to concerns over possible prospects for employment on graduation.

For this reason, closing the gap between the expectations of employers and academia is essential e.g. better understanding and alignment of the roles played by academic education and workplace training; the engagement of employers in universities in defining curriculum, and providing guest lectures, placements, interview practice, careers talks and mentoring.

Vocational education / apprenticeships

A McKinsey report (2013) examining the global transition from education to employment for young people, identified that 60% of youths believe that 'on-the-job training' and 'hands-on learning' are the most effective instructional techniques, but less than half of that percentage are enrolled in curricula that prioritise such techniques (McKinsey Center for Government, 2013). In this respect, providing adequate guidance and information to students at the time of selecting relevant courses is likely to prove useful in closing this gap, and would also most likely increase the number of students choosing some form of vocational education (assuming the supply was available). Although not specific to ICT vocational education, Figure 12 highlights some of the challenges confronting vocational education, namely the fact that even though more people view vocational education as helpful for getting a job, it is perceived as being less valued by society. Educating parents and students on the nature of modern-day apprenticeships is likely to prove worthwhile in creating more positive views of such schemes.

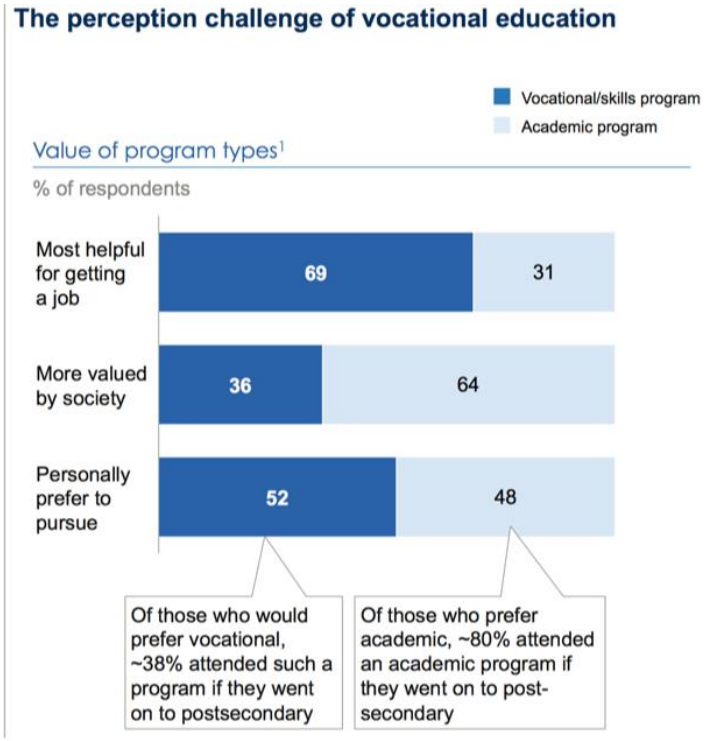


Figure 12: Attitudes to vocational education (Source: McKinsey Center for Government, 2013)

In contrast, apprenticeships are often viewed positively by employers. A recent ICM study revealed that employers in England considered apprentices as 15 percent more

employable than those with other qualifications; and those with Higher Apprenticeships as being 25 percent more employable than those who took an alternative route into work (National Apprenticeship Service, 2013).

A survey examining parental opinions of apprenticeships in the UK found significant gaps in understanding and dated attitudes towards apprenticeships (AAT, 2013):

- 81% of parents were unaware that a Higher Apprenticeship was a university-level qualification.
- Parents also underestimated the importance of apprenticeships in terms of securing employment, mistakenly believing that apprenticeships are more suitable for boys and less academic individuals. Parents were also unaware of the premium placed by employers on higher apprenticeships over degrees.

Parental opinion is important as parents exert considerable influence over their child's future. The evident lack of understanding by parents of higher apprenticeships suggests that governments wanting to use apprenticeships as a vehicle for improving employment prospects might first have to tackle cultural attitudes in some countries, if they are to achieve their goals. In the US, vocational education is relatively immature – the US Secretary of Education described career and technical education in the US as "the neglected stepchild of education reform" (US Department of Education, 2011). While many countries are embarking on new apprenticeship initiatives, there are still some doubts over their effectiveness.

Germany is renowned for its dual-education system that combines apprenticeships with formal schooling. Under the scheme, youths who are not interested or sufficiently qualified for university enter the programme that lasts approximately three years. During this time, the trainees work 3-4 days in a local firm, with the remainder of the time spent studying a related course at a relevant educational establishment. Due to the close alignment between the needs of companies and students and the opportunity for employers to vet trainees during the programme, many of the trainees stay on at their firms as full-time workers on completion of their studies. Recognising the low levels of unemployment in Germany and Austria (under 8%), both of whom operate dual-education systems, compared with the very high levels of youth unemployment in many other European countries, there is considerable interest in replicating the scheme elsewhere. With this in mind, Germany recently signed memoranda with Greece, Latvia, Portugal, Slovakia and Spain to establish vocational-education systems in each country (The Economist, 2013). However, as the Economist points out in the same article – this same education system also existed in the 1990s when Germany's economic situation was much worse compared to most of Europe. Moreover, research into the long-term impact of vocational education reveals "the advantages of vocational training in smoothing entry into the labour market have to be set against disadvantages later in life" (Hanushok et al, 2011). Such a conclusion would suggest that the continuing professional development will become even more critical for recipients of vocational training, and this may have to be reflected in future policy direction.

European Alliance for Apprenticeships

The European Alliance for Apprenticeships was launched in March 2013 as part of the World Skills Competition. By that time, 5.7 million young people were unemployed in the 27

Member States of the EU (European Commission, 2013c). Solving the issue of youth unemployment and facilitating young Europeans in finding an initial job are what the Alliance intends to address. As stated at the launch, "apprenticeships can play a crucial role in tackling youth unemployment by giving young people the skills and experience sought by employers"(European Commission, 2013d). The aim of the Alliance, therefore, is to help and support youth employment by promoting high quality apprenticeships and work-based learning across Europe. It also aims to facilitate national apprenticeship schemes by identifying the most successful apprenticeship schemes in the EU and providing appropriate solutions for each of the member countries.

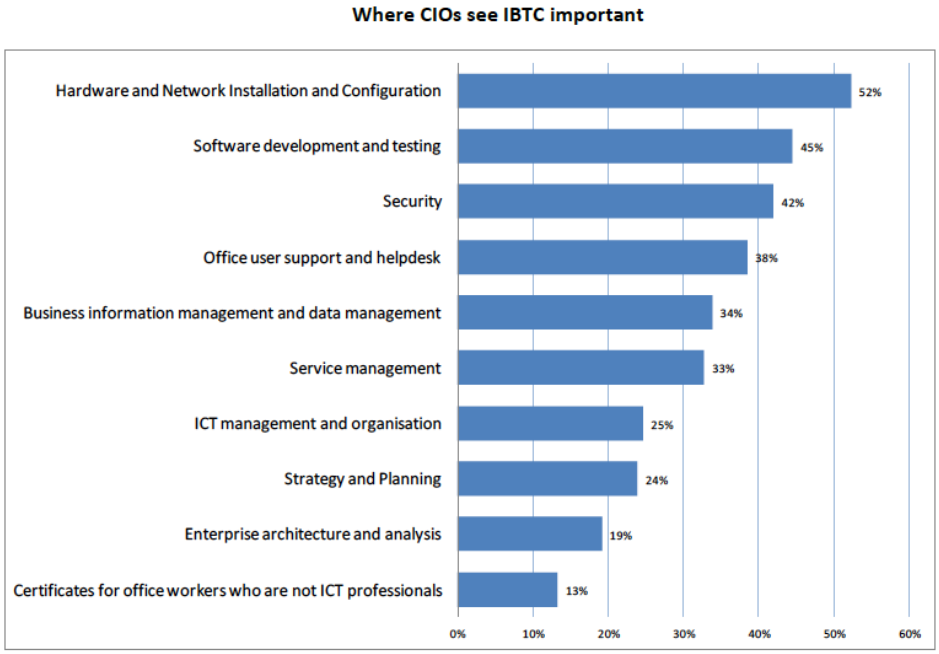
For the first time, the European Commission, the Presidency of the EU's Council of Ministers, and European-level trade union and employer organisations support the Alliance synergistically. DG Education and Culture, and DG Employment, Social Affairs and Inclusion are joint co-ordinators. The Alliance relies on and works closely with a collaborative partnership of key employers and stakeholders, such as public authorities, businesses and social partners, chambers of commerce, VET providers, youth representatives and employment services etc. The three strands of action are (European Commission, 2013e):

- Reform of apprenticeship-type systems across Europe
- Change of mindsets on the benefits of apprenticeships
- Optimal use of EU funding and resources

The Alliance gains support from the European Round Table of Industrialists (ERT) with a network of business 'ambassadors', which represents 7 million employees from 50 multinational companies. The European Association of Chambers of Commerce and Industry (Eurochambres) intends to promote partnerships based on those who have already established a relationship with their counterparts in Germany, Spain, Austria, Romania and Hungary. Apart from this, projects on setting up a dual apprenticeship system are also being implemented in Romania and Slovakia by the Austrian Federal Economic Chamber. Some other key individual business stakeholders also plan to contribute to more and better apprenticeships in the EU.

Industry based training and certification (IBTC)

ICT industry training and certification makes an important contribution towards validating practitioner ICT skills. A recent report stated that; “Certificates based on IBTC are indispensable for some ICT vacancies or promotions, according to 30% of HR/CIO respondents” and “45% see certification as an important asset” (Empirica, 2013). Certifications are particularly important in specific domains. A survey conducted by Empirica (2013) identified IBTC as being most important in the following domains: hardware and network installation and configuration, software testing and security See figure below:



Note that figures are weighted by ICT employment, meaning percentages should be read as respondents representing x% of ICT employment.

Figure 13: Relative importance of IBTC by domain (Source: Empirica 2013).

The following figure highlights the level of acceptance within the profession for certifications.

Shares of ICT staff were reported, averaged per country-size, class-sector combinations, and grossed up using official statistics on ICT employment

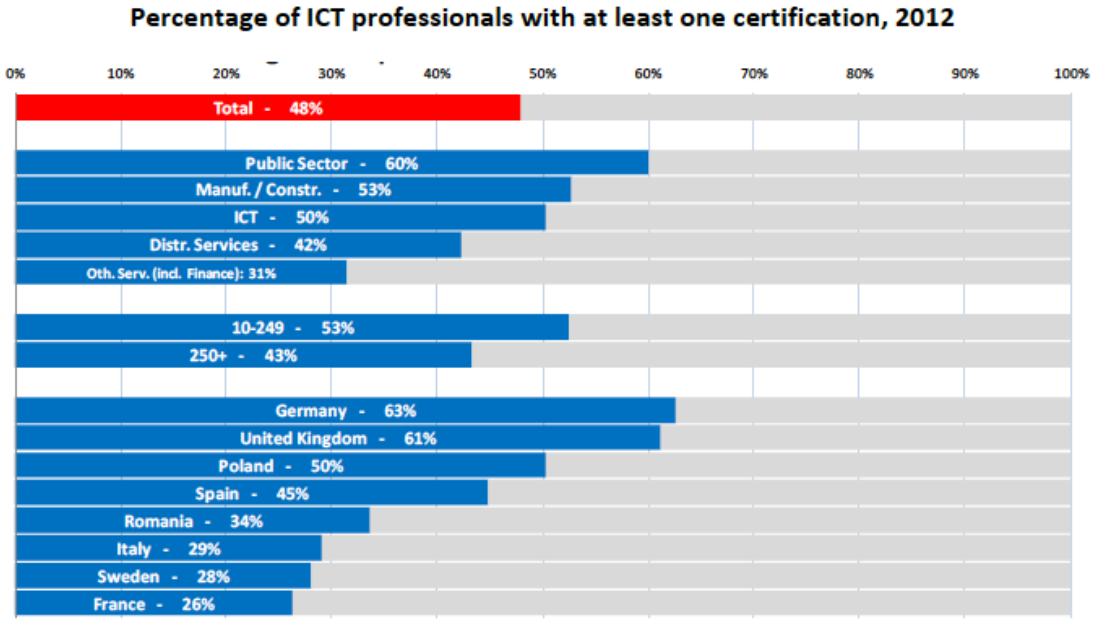


Figure 14: Percentage of ICT professionals with at least one certificate (Source: Empirica, 2013)

However, at present, there is no single quality label in place for ICT certification within Europe hampering employers' understanding of the most relevant certifications for a role, and impacting on practitioners' ability to plan careers. In order to address this challenge, it is purported that reference to a common ICT competence framework would help facilitate transparency and comparability between certifications. Within Europe, efforts are being made to adopt the European e-Competence Framework (e-CF). Moves to adopt the framework must be demand-driven. To this end, discussions between relevant stakeholders are already underway to facilitate the adoption of the e-CF in a wider context (e.g. European Platform for ICT Skills).

Massive Open Online Courses (MOOCs)

A massive open online course (MOOC) is an online course aimed at large-scale interactive participation and open access via the web. Although MOOCs, as a concept, has been around for several years, it is only since the start of 2012 that the term has mushroomed in usage. MOOCs are important as they provide an opportunity for hundreds of thousands of students to access education that previously would not have been accessible to them – due to financial cost, geographic location, institutional entrance requirements, and/or personal schedules. In addition, the calibre of lecturers offering MOOC courses can be very high in contrast to local universities. This can be an important consideration, bearing in mind that the McKinsey Global Institute reported that only 25% of Indian and 20% of Russian professionals are currently considered employable by multinationals due to the uneven quality of education systems (World Economic Forum & Boston Consulting Group, 2011). However, it should also be borne in mind that elite universities are typically renowned for their reputation in research, rather than the quality of the lectures and tutorials: as such, the institutional "brand" should not be considered a proxy for teaching quality (Daniel, 2012).

Given their low (if not entirely free) cost, and their scalable open access (potentially with thousands of students participating in a class), MOOCS are perceived by some as a disruptive innovation (where new technologies supersede established ones). Many now believe that MOOCS will result in a decrease in the costs of higher education in general, and have the potential to increase the number of students taught at a given price point. However, at this stage, it is not known how MOOCs will alter the educational landscape, but it does look likely that they will have a significant impact on tertiary education. And as explained in a later section, they may also have an equally large, if not larger, impact on continuing professional development. Given the issues relating to the inadequate supply of e-skilled workers and the lack of on-going professional development, MOOCs are potentially significantly important for the ICT profession.

For example, an MIT lecturer might offer a MOOC in Software Engineering that would normally cost thousands of pounds for MIT students to attend on-campus. In contrast, MOOC students from all over the world will pay nothing for similar course content and lectures accessed online via EdX. Typically, students of a MOOC watch lectures for a set period of time each week, with online tests, wikis and forums to foster engagement and facilitate understanding of the course content. While participant numbers for a single course can run into hundreds of thousands, the

attrition rate is also high (e.g. over 95% in some instances). Nonetheless, MIT reported that more students successfully passed a MOOC in Circuits & Electronics, than the number of students who would take the course in person, on-campus in forty years. This underlines the potential that exists for MOOCs to radically increase the supply of ICT graduates. MOOC providers include EdX (formed by MIT, Harvard and UC Berkeley), Coursera, and OpenUpEdu (a recent European initiative, part-funded by the European Commission). In addition, Google offers an open source MOOC platform – 'Course Builder'.

One major criticism of the original MOOCs was that there was no formal academic credit or recognition of the study undertaken (other than a certificate of completion), even after success in the final exam. However, that situation is now changing. Colorado State University Global Campus become the first institution to grant credit to students who passed a MOOC – offering students the opportunity to gain college credits for $89 (the cost of the required proctored exam) versus the $1050 cost of the campus course. However, not a single student availed of the offer (Kolowich, 2013). Such reports are not preventing new initiatives from emerging: Georgia Tech (one of the leading US engineering schools) is now working with Udacity to offer an accredited Computer Science Master's degree for less than $7000 (compared with over $25,000 for its full-time campus-based course) and hopes to have up to 10,000 enrolees in the next three years. It is planning to offer the tuition for free but credits will not be offered unless registered with the university (Empson, 2013).

Cultural differences could also play a significant role in the adoption of MOOCs. In surveying 3400 students across different countries on the statement that 'online education is more valuable than classroom education', 43% of Japanese respondents and 42% of Chinese respondents agreed, whereas only 10% in the US and 22% in Europe agreed (IBM Institute for Business Value, 2012).

To date, much of the attention on MOOCs has been on the availability of high-quality tuition from eminent lecturers at leading universities at low cost, if not entirely free altogether. However, another highly important aspect of MOOCs is the data that is collected remotely on student usage and performance throughout the entire MOOC experience – every pause/replay, every question answered correctly, every question answered incorrectly, every section replayed, every question raised in an online forum, indeed every action and possible cause for the action for different types of learners can be examined to provide some insight into student behaviour, with the intention of amending aspects of the course to enhance student learning. Moreover, such data can also provide insight into the performance of the individual learner, and this data may, in future, become of interest to potential employers. Indeed, in the future, such data could provide much stronger evidence of understanding and mastery of a subject than a piece of paper labelled "degree".

While MOOCs may (or may not) provide students with an excellent academic learning experience, it is possible that employers will remain unconvinced of the merits of students who have learned via the method. In many instances, employers often rate interpersonal/communication skill, industry knowledge, drive and attitude above academic results. However, clearly, this is no guarantee that a traditional university will instil such abilities to a greater extent than MOOCS at this point in time.

MOOCs - blended learning/ "Flipped classrooms"

While some universities perceive MOOCs as a threat to their existence and others as mere hype, there is also a pattern of blended learning (known as "flipped classroom") starting to emerge in some academic establishments. These combine online tuition via MOOCs, with campus-based classroom activities such as quizzes and collaborative work. In contrast to most online-only MOOCs, students who pass these courses can (under certain circumstances) now receive full credit.

Interestingly, this blended learning approach seems to be delivering impressive results. In reporting on an initiative at San Jose State University, the Wall Street Journal, reports that course rates for a class on circuits and electronics increased to 91% (whereas pass rates without the online component were only 55%). Although this is only a single example of such success, the results suggest that the model is certainly worthy of further examination. Moreover, the opportunity for flipped classrooms to facilitate increased throughput of students suggests that further initiatives in this space will emerge.

However, although MOOCs are often referred to as "open", they are not necessarily free. Most informal learning for individual learners is free or low cost. However, institutions wanting to use MOOC content as part of their courses (e.g. flipped classrooms) will have to pay for the privilege.

MOOCs - continuing professional development for ICT professionals

Thus far, the focus of Massive Open Online Courses (MOOCs) has largely been on developing academic university content in an online format. Vendors such as SAP and Cisco have provided online education for some time, but such training typically focuses on specific vendor solutions. In some instances, the courses can be expensive and/or suffer from poor levels of recognition/transferability in the employment marketplace.

However, it is surprising that there do not appear to have been many initiatives to combine academic and industry education in the MOOC platform. In this respect, MOOCs could play a vital role in delivering continuing professional development. For example, it is ossible to imagine a future MOOC in the form of an e-Leadership course offered via OpenUpEdu, combining both academic content from, for example, the University of Bologna, with industry expertise from experts in Twitter and Yammer, and users in BP and Tesco. Similarly, the opportunity to include SMEs as part of the industry-based content could help facilitate awareness of the importance of SMEs and the entrepreneurial opportunities that exist within them. As mentioned above, the detailed dataset that is captured on student performance throughout the course could provide a valuable form of evidence of mastery of the subject. Indeed, this type of data may, in the future, form the basis for a new form of 'certifications'.

The profile of some MOOCs courses suggest that many learners are over 25 and already possess a degree. As such, combinations and collaborations, as described above, could prove compelling for professionals and course providers, and help to foster entrepreneurial attitudes within students. The MOOCs landscape is changing rapidly and given the current focus on e-skills across the political landscape, it is envisaged that this situation will change in the near future (e.g. http://academy-

cube.eu), as it is important that continued efforts are made to foster greater involvement of industry within MOOCs.

MOOCs - fraud / authentication of participants

Regardless of whether the audience is students or ICT professionals, one key concern with regard to MOOCs is authentication of the learner. In other words, how can we be certain that the person participating in the MOOC and undertaking all of the MOOC tests is actually the same person that claims he/she is certified to employers. There is a serious risk that some will be tempted to invite a more competent friend to undertake the exam on their behalf, thereby artificially enhancing their own person level of ICT competence. Different mechanisms to minimise this risk are being examined, but it is likely that the solutions will lag market demand for some time yet.

Alternative educational paths

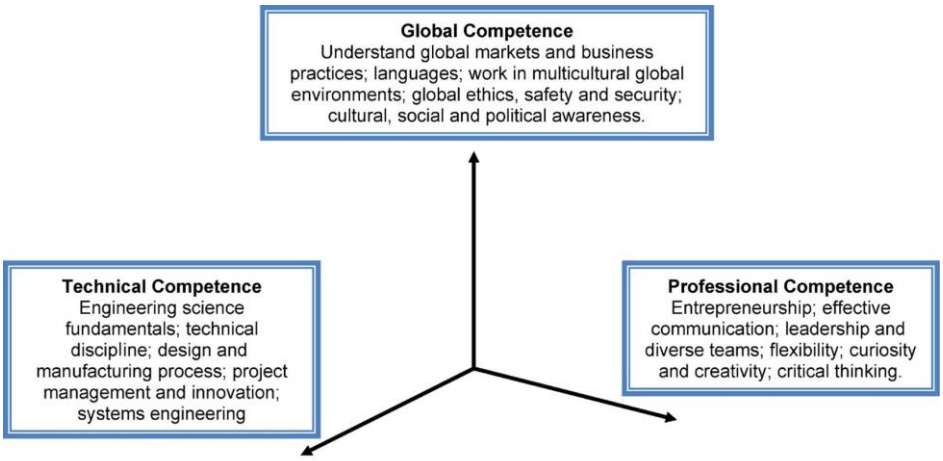
MOOCs represent one alternative means of educating students and professionals. In most use-cases, the intention is for MOOCs to be used either in conjunction with existing university courses, or as a direct substitute for university education (but still employing the same concepts). However, there are more radical education alternatives. For example Peter Thiel has founded the 20 under 20 programme which offers $100,000 to young people wanting to bring ideas and projects to life, under the mentorship of a network of industry contacts, investors, scientists, and entrepreneurs who provide guidance and business connections to young people.

Similarly, at a high school level, there are some interesting initiatives underway. For example, the Academy for Software Engineering is a high school in Manhattan devoted to computer science that opened in 2012. For its inaugural year, it received 1400 applications for a class of 123 students. Notably, the school does not solely attract computer 'whiz kids', but employs an open policy such that students without any coding experience can also join the school. The school relies heavily on establishing industry partnerships for mentoring and after-school programs in its attempt to offer "small academic classes integrated with industry internships, team projects and other real-world, problem-based experiences" (from www.afsenyc.org). In this respect, it has been successful in attracting organisations such as Twitter and Foursquare to participate in these programs. A second computer science high school; the Bronx Academy for Software Engineering is scheduled to launch next year.

The importance of a global skill set

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 different geographic, linguistic and cultural borders. In order to facilitate effective working practices, a better understanding of intercultural differences is believed to be an important factor. Recognising the high levels of migration associated with ICT and the fact that increasing numbers of ICT workers will work outside of their country of origin (either permanently, temporarily or virtually), these competences are important even when offshoring is not involved. Understanding different cultures and gaining

awareness of the impact of different cultural norms should be integrated into the curriculum for future ICT professionalism education. Different countries have different ways of working; they also have different attitudes to privacy, trust and sharing. Considerable research has already been undertaken regarding the notion of a "global engineer" (Parkinson & Parkinson, 2009) and the related competences required. Figure 15, while targeted at the engineering profession, highlights the importance of establishing a multi-dimensional focus to the skills that are developed in the next generation of engineers: combining strong technical skills (as a foundation) with the necessary professional competences, and acting in a global context (Rajala, 2012).



Adapted from Y. Chang, D. Atkinson, and E.D. Hirleman, "International Research and Engineering Education: Impacts and Best Practices," *Online Journal for Engineering Global Education*, Vol. 4, Issue 2, 2009.

Figure 15: Global engineering professional: the 3-D engineering (Source: Rajala, 2012)

More recently, investigations are underway into internationalizing the Information Systems curriculum (Pawlowski, 2012). The importance of intercultural competences is likely to grow as digital enterprise ecosystems emerge across a geographically disparate landscape, and as the mobility of practitioners increase.

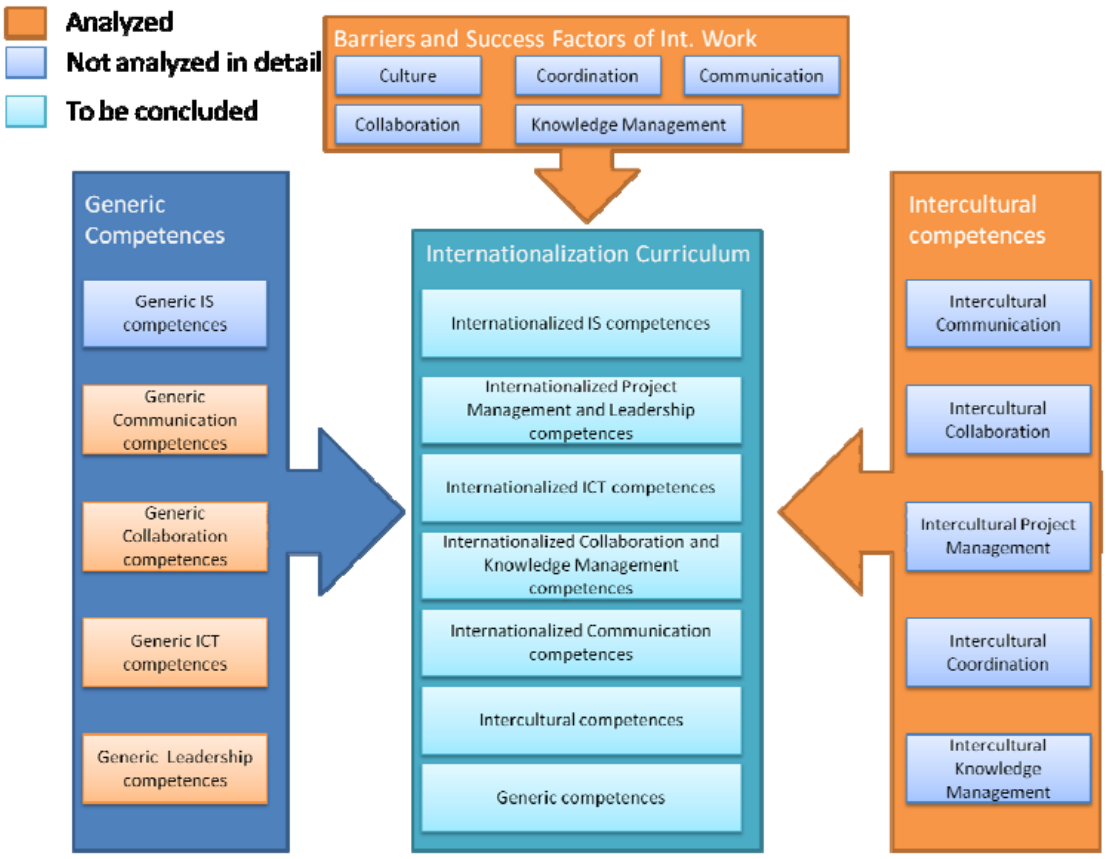


Figure 16: Framework of the international IS curriculum (Source: Pawlowski and Holtkamp, 2012)

Although not specific to IT, but reflecting the importance of the international dimension of education, the European Commission published a new communication in July 2013 entitled "European Higher Education in the world". This was aimed at improving student and staff mobility, developing more world-class innovative curricula, strengthening ties with non-European partners, developing international higher education networks, promoting language skills, and expanding digital opportunities. In this context, an international IS curriculum could play a significant role.

The changing face of the ICT department

Given the on-going digitization trend and the extent to which ICT is becoming embedded in every organizational process, the role of the ICT department itself is under scrutiny. Some industry observers (Finnegan, 2013) believe that the ICT department could disappear altogether by 2020 as it becomes embedded in departments throughout the entire organization. Such views are typically based on the premise that many organisations will move towards increasing levels of automation and the use of cloud-based IT services. However, rather than eliminate the need for ICT skills, it is believed that the type of skills required will change, with, for example, more emphasis placed on the staff's ability to orchestrate and integrate external services and service providers, rather than internally building and owning services.

Christopher Mines, Forrester Research Director commented; "IT will be embedded in the marketing sales, customer service and manufacturing organisations…The skill sets are still there and used to orchestrate those external service providers, but there will be no identifiable or central IT organisation - our call is that that will be a thing of the past by 2020" (Flood, 2013). Such changes are important to understand as they are relevant to possible ICT career structures in the future.

Offshoring – ebb and flow

While many companies are considering new offshoring arrangements, some companies with existing offshoring practices are now re-shoring, or more typically, re-shoring certain parts of their ICT processes (Baldwin, 2013). There appears to be a number of reasons for this change in flow including diminishing cost savings (due to increasing wage costs in many offshoring locations), dissatisfaction with service quality, cultural differences and poor contextual understanding, low levels of innovation, and lack of control over risk and strategy. Whereas in the past, the benefits of labour arbitraging alone were sufficiently large to influence decision-makers, there has been a growing recognition of the importance of considering a wider range of factors in any decision-making process. However, while some companies are considering re-shoring some aspects of their offshore processes, it is rarely a wholesale change. As suggested in the recent HfS report on sourcing services in the USA "there will not be a severe course correction. Jobs will not simply flock back offshore overnight; rather, the US will become a viable component of organisation global delivery models" (HfS, 2013).

One further important factor is the growing recognition by the CEO and other business leaders that technology is no longer a commodity, at least not all of technology can be considered a commodity, and certain skills are required in-house in order to compete more effectively and be embedded within the business in order to develop products and services that match requirements in an agile fashion. This is a significant change of mindset and is likely to be one of the reasons for the growing tendency of some organisations to assign a new Chief Digital Officer, requiring strategic, business-savvy ICT skills (e-Leadership). This in turn, is another sign of the recognition of the business value and strategic importance of ICT to compete effectively in a global marketplace.

However, it is also important to recognize that in the longer term, the growth in local business volumes in developing countries will far outweigh growth in developed countries. As such, if the above trend is repeated, there is likely to be demands for large parts of ICT (e.g. big data analysis) to be co-located to where that business is taking place (i.e. in the developing countries).

To date, the US and UK have been the largest target markets for offshore providers. One of the factors thought to be influencing this is the availability of skilled workers in the host country that can speak English. In contrast, very few Indian, Chinese and Brazilian workers can speak German, French or Italian. (However, Africa is now being favoured as an offshore destination for French companies). For UK and American companies, this can represent a significant business opportunity as it enables these companies to take greater advantage of the labour cost opportunities that exist in the host countries. In contrast, other European states are unable to exploit

the opportunities to the same extent, diminishing their overall cost effectiveness. However, this also means that from an employment perspective, workers in many European states are to some extent, protected from external competition due to the limited number of overseas workers with fluency in their native tongue.

Mobility of ICT professionals

Part of the skills mismatch may arise 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 for e-skills. In a 2012 survey of 500 senior European decision makers, "better mutual recognition of degrees and professional qualifications across borders" was identified as the top measure for improving the mobility of skills transferability across Europe. Although not specific to ICT, it underlines the problems that employers face when recruiting people from overseas.

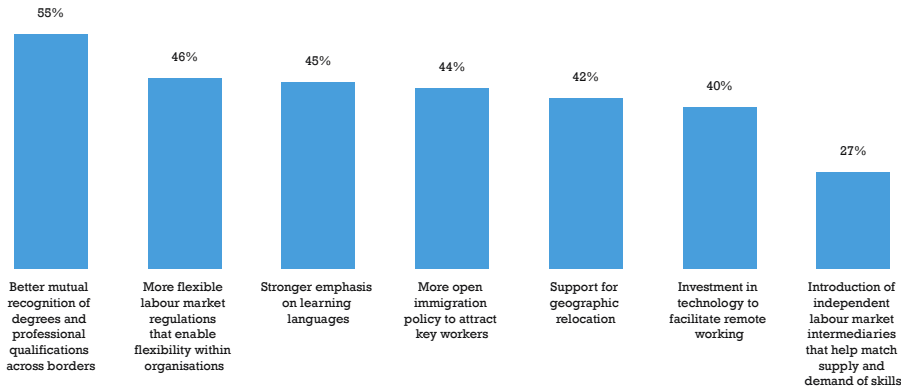


Figure 17: Measures ranked most effective in terms of improving the mobility or transferability of skills within Europe. (Source: Accenture, 2012).

Levels of worker mobility are low. Labour mobility in the US (inter-state) is significantly higher than in the European Union (intra-EU) - employed: 3.2% in the US versus 2.8% in Europe; and Unemployed: 5.2% in the US versus 3.6% in Europe (Accenture, 2012). However, the importance of these low levels may be overstated. As we transition to a knowledge-based economy, and in particular, the notion of an Internet of Services, the importance of geographic co-location to the delivery of services is likely to become less important. The fact that so many services are already being delivered via offshoring providers is testimony to the decreasing importance of physical co-location. However, certain activities are believed to rely upon physical co-location, in particular, those relating to innovation. Hence, practitioner mobility is still likely to be required and desired, at least in the short term.

Immigration

Immigrants play a key role in many societies, but the importance of their contribution within America has perhaps been more deeply researched and documented. A recent report "Then and Now – America's new immigrant entrepreneurs" (Wadhwa et al, 2012) found:

- 24.3 percent of engineering and technology companies had at least one key founder who was foreign-born. In Silicon Valley, this number was 43.9 percent
- Of the total number of immigrant-founded companies, 33.2 percent had Indian founders (greater than the next top seven countries of immigrant-founder companies combined)

Significantly, the report also identified that the number of immigrant founders in Silicon Valley had declined since 2005. This raised concerns over the US' future ability to remain economically competitive in the international market given such a trend, underlining the possible importance to the US economy of such immigrants. Foreign nationals are also authors of the majority of patent applications filed by many US companies: 65% at Merck, 64% at GE and 60% at Cisco.

Given the skills gap that exists in many countries across the world and the strong contribution to innovation that immigrants are responsible for, immigration policy is being scrutinised as a possible solution for growth. In the US, at present, many foreign-born ICT professionals are hired using a temporary visa (H-1B visa), prior to petitioning for permanent residency status ('a green card') in the long term. However, there are significant restrictions imposed on H-1B visas. Firstly, they are limited in numbers and demand far outweighs supply. Furthermore, the legal status awarded to holders of such visas prevents them from moving location or job role (including promotion). As demand for highly-skilled workers increases globally, there is the risk that such workers will be less inclined to want to work in the US given the restrictions imposed on their careers. Many within the technological industry are demanding changes in immigration to ease the current skills gap being experienced. One such example is the recently launched fwd.us, a lobbying organisation tasked with pushing political parties to adopt immigration policies that, in the words of Mark Zuckerberg, "ensure more jobs, innovation and investment"(Zuckerberg, 2013).

New legislation in the form of the Immigration Innovation Act, known as the "I-Squared Act", aims to substantially increase the size of the H-1B program (by threefold). However, the proposed new legislation is not without its opponents. For example, the Washington Alliance of Technology Works, a technology worker advocacy group affiliated to the Communication Workers of America union, suggests that the new plans are more focused on facilitating the provision of cheap, temporary labour, and "accelerates the offshoring of American high-tech jobs" (Washtech, 2013).

In a 2011 statement to the US House of Representatives Committee on the Judiciary Subcommittee on Immigration Policy and Enforcement, B Lindsay Lowell (Director of Policy Studies, Institute for the Study of International Migration) posited that "globalization by lowering the bar to mobility, and by creating new opportunities abroad, should lead to lower selectivity over time, i.e. a smaller and smaller proportion of migrants with that certain X-factor that generates innovation or entrepreneurial activity. In a competitive, globalizing world, getting the immigrants with that X-factor should be what innovative admission policy is all about; not fighting yesterday's battles over more or less immigration".

Lastly, in considering future demand for ICT skills, it is important to realise that many industry observers predict strong increases in demand as a consequence of the increasing digitisation that businesses are facing due to pervasive computing and

other technology trends. If wage increases do follow as a consequence of such trends, it is possible that entire tranches of ICT work will be offshored to address the increased cost. Consequently, efforts to address potential salary increases may prove beneficial in the longer term for domestic employment opportunities.

In Australia, the situation on immigration is set to change, following the introduction of the new Migration Amendment (Temporary Sponsored Visas) and the principle of labour market testing. Employers are now required to prove that they have searched locally before attempting to employ an overseas worker on a 457 immigrant visa. However, IT jobs that require a bachelor's degree and five years of experience, or an associate degree or diploma can be exempted from labour market testing by a ministerial decree in the future – they won't need to be advertised (Griffith, 2013).

Some politicians have claimed that 457 visas were being abused by IT employers to the detriment of employment prospects for Australians (e.g. Julia Gillard), but the ACS and AIIA argue that the 457 visas solve immediate skills shortages than can only be addressed adequately by longer term investment in ICT education and skills development (Thimmaya & Ghosh, 2013).

Wage conditions

ICT wages continue to rise in most countries, with increases typically exceeding that of other professions, reflecting the excess demand for ICT workers at this juncture. The fact that these salary increases have coincided with a recessionary climate in many countries is testimony to the enduring importance of ICT to industry. However, in certain fields and in certain countries, the increases suggest that a bubble environment may be coming into play.

Michael Page, the professional recruitment consultancy, estimates that demand for technology talent remains high in China across both the commercial and manufacturing sectors, driven by continued growth in the local domestic market, as well as across Asia as a whole. The company estimates that for the coming year, the average percentage salary increase for technology professionals will be in the region of 10-15%, depending on the industry. However, it also notes that substantially higher increases of 30-40% might be achieved by professionals with specialist skill sets in high growth industries such as pharmaceuticals, healthcare, utilities, R&D, IT providers, technical manufacturing and automotive (Michael Page, 2013).

In the US, ICT workers continue to demand a premium. Figure 18 shows average starting salaries for graduates, with Computer Science and Engineering students commanding a premium over other disciplines.

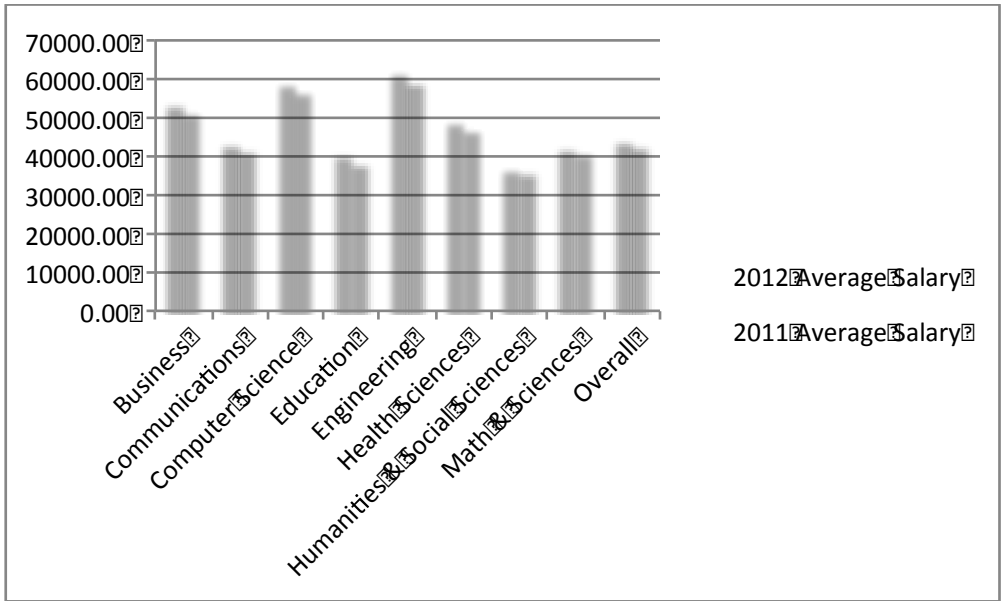


Figure 18: Average salaries by discipline (starting salaries, United States only) (Source: NACE, 2013).

In Canada, a drop in the number of ICT workers has corresponded with an increase in remuneration. According to 2011 figures, average income across all Canadian industries stood at $45,488, whereas ICT salaries ranged from $48,889 to $72,653 depending on the role (and with salaries 3% higher over the year) (Ovsey, 2011).

Categorisation of ICT jobs

As previously outlined, there appears to be a shortage of e-skilled workers in Europe, as well as in many other countries. However, different countries have different job categorisation schema, and there is no single agreed list of job classification codes relating to ICT workers. As a consequence, it is difficult to develop granular estimates of worker shortfall, and to compare estimates across borders, complicating the task of formulating appropriate policy responses based on inadequate data.

To address this issue, some countries and regions are now developing new mechanisms for estimating the numbers of workers with e-skills. For example, the European Commission (in conjunction with CEDEFOP) is currently embarking on an ambitious initiative to support comparability and consistency of job codes across all industries, including ICT. The project, entitled ESCO (European Skills/Competences, Qualifications and Occupations) is expected to support ICT job codes by the year 2014 **(**European Commission, 2013f). The approach adopted in this project differs from previous classification methods (that typically focused solely on occupational titles) as the scheme now covers occupations, skills/competences and qualifications. This approach recognises that the specific skills needed for a given job can vary significantly, depending on the employment context, and for this reason the ability to hone in on the skills of an individual provides additional flexibility.

Similarly, at a country level, the situation is dynamic. For example, the United Kingdom recently embarked on a consultation exercise (Department of Culture, Media and Sport, 2013) to investigate the extent to which certain IT occupations and

industries have creative elements and should therefore be considered for inclusion in a proposed new IT Creative Industries statistical grouping. While such an approach to classification might help to underline the creative aspects of working in ICT (and thereby help to attract new entrants to the profession), opponents have voiced concerns (Virgo, 2013) that the proposals might split the current ICT profession (thereby diminishing its relative importance) and are unclear as to how "creative" ICT work can be meaningfully segregated from "non-creative" ICT work.

ICT professionalism landscape

This section describes the current landscape for ICT professionalism, including:

- The need for ICT professionalism
- The building blocks of the profession
- Current challenges, issues and collaboration initiatives related to the ICT profession
- Possible future directions for the evolution of the profession

The need for ICT professionalism

Prior to examining the many issues surrounding the ICT profession, it is worth considering why it is important to mature the ICT profession. There are numerous reasons:

- ICT skills gaps - Skills gaps of up to 864,000 practitioners in Europe are forecast by the year 2015 (IDC / Empirica, 2009), potentially acting as a brake on European competitiveness and recovery, given ICT's role as an enabler of business value
- 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 prevents a view of the 'big picture' of ICT, its interconnectedness, and its role in enabling organisational capability planning. In this respect, a 2011 CEPIS survey suggested that "79% of respondents may not have the breadth of e-competences required by their role" (Cepis, 2011).
- 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; moreover, industry demands people from alternative professions/disciplines
- ICT project failures – Recent research from Saïd Business School (Flyvbjerg and Budzier, 2011) identified cost overruns in 8 out of 10 ICT projects, and a disproportionate number of "ICT black swans", with one in six projects experiencing a cost overrun of 200%.
- Societal impact - The most important reason for change stems from the extent to which ICT has the potential to harm society.

Professions have traditionally emerged when failure to apply domain-specific knowledge successfully would have had an adverse impact on society. As we now enter a new wave of pervasive computing, with the realization of the 'Internet of Everything', the extent to which ICT is embedded in society will inevitably grow. If steps to mature the profession are not taken now, it is likely that the risks to society from ICT will grow to unacceptable levels. As such, the call for action is clear. 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). It is worth mentioning that a mature ICT profession is not a panacea that will eliminate every conceivable risk to society from ICT, but it will make a significant contribution towards eliminating risks that stem from ignorance of key ICT concepts, methodologies and professional behaviours, which is a common occurrence in many organisations today.

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.

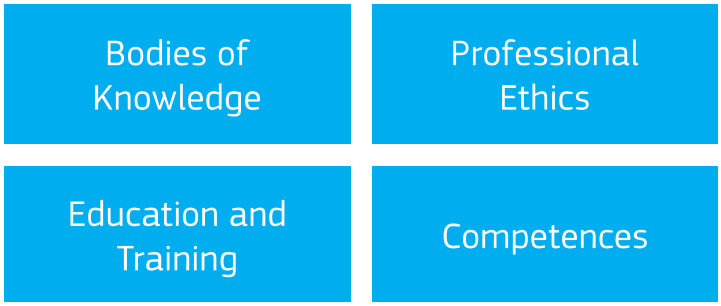


Figure 19: Building blocks for an ICT profession

- Bodies of knowledge (BOKs): One method of establishing a profession is to first define an appropriate body of knowledge, which may then be used to set standards and certification processes. A BoK is more than simply a collection of terms, a professional reading list, a collection of websites, or even a collection of information. It is the accepted ontology for a specific domain. In essence, a BoK forms a considerable repository for the professional knowledge as used by various professionals.
- Competences: An understanding of the capability and competency needs of individuals working in various roles is essential for organizations to effectively recruit and develop suitable employees. Understanding the core areas of expertise required by various roles and maintaining appropriate levels of competences through commitment to continuous professional development is necessary to building any profession.
- Education and Training: Formal qualifications, certifications, non-formal learning and informal learning are mutually supportive components of a professional's career development and they attest to an individual's competences and skills.
- Professional Ethics: A defining aspect of any profession involves adhering to professional ethical conduct. The need for professional ethics and adherence to

established Codes of Ethics/Conduct, which specify principles of individuals' behaviour within various professions, societies and organizations, is paramount to maturing any profession and to garnering positive public perception.

These same four building blocks were proposed as forming the foundations for maturing the ICT profession. Comparing the ICT profession to other professions, such as law and medicine, against the above four factors underlines the relative immaturity of the ICT profession (it is worth noting that the four building blocks identified above represent a simple model for emphasising the key aspects of the profession. In the original report cited above, each building block further broken down and examined in greater detail in order to construct tentative proposals for a European framework for ICT professionalism. Reflecting the importance of this initiative, a more recent initiative includes a series of activities aimed at updating the framework further, with a view to stimulating stakeholder engagement at a more granular level).

ICT professionals – a working definition

There is no single agreed definition for an ICT professional. Different countries and organisations have differing views on the topic. In some countries (e.g. Germany), the language has no equivalent word for the term "professional", complicating the task further. The definition used within the context of this work is derived from an earlier initiative of the European Commission, and was accepted by the CEPIS council in 2012 (see Table below).

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.
The term 'relevant body of knowledge' encompasses the requirement for a broad and deep knowledge base, which is up-to-date, accommodating both a common ICT body of knowledge, and pertinent specialist knowledge and skills. Professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. keeping abreast of latest technological trends) as well as non-technical aspects (e.g. developing better presentation skills). Professionals are accountable to themselves, the ICT profession and society through an agreed code of ethics/conduct or applicable regulatory practices. Competent practice communicates the concept of quality of products and services being delivered by practitioners.

Table 9: Definition of ICT professional

It is worth noting that some professional associations make explicit reference to software engineers. However, as can be seen from the above definition, ICT professionals are intentionally considered to be a wider community than software engineers.

ICT competence models

ICT competence models typically act as a common basis for describing the skills and proficiencies of ICT professionals. In essence, they normally comprise a series of competences with defined proficiency levels for each competence. In this way, employers, employees, and education providers are able to possess a common understanding of ability for a given competence and proficiency level. Thus, they can be used, for example, by employers to define job roles, by practitioners to assess their own ICT competences, and by training providers to explain which competences will be addressed in a course.

Organisations are increasingly using ICT competence models. This is most likely due to the need to communicate practitioner competences both within and across organisational boundaries, and also across national borders. Some organisations have developed and implemented their own proprietary ICT competence models (for example, SAP and Microsoft have their own in-house solutions), but there are also a number of important frameworks that have been developed or are under development for widespread adoption in industry, including:

- European e-Competence Framework (e-CF) – CEN (European Standardisation Committee) ICT Skills Workshop
- Skills Framework for the Information Age (SFIA) – SFIA Foundation (UK)
- Common Career Skills Framework – IPA (Japan)
- IT Competency Model – ETA/ODEP (US)
- Occupational Skills Framework (OSPM) – ICTC (Canada);
- National Curriculum and Competency Framework (under development) – e-Skills Institute (South Africa).

Initially, competence frameworks were developed for use in a single country, but the situation has evolved considerably in recent years with the e-CF, SFIA and CCSF now gaining traction internationally. This pattern emphasises increasing awareness of the importance of competence framework to employers, employees, educators and governments. Further, it emphasises the growing recognition that ICT is a global profession, and the tasks of developing, promoting and maintaining a plethora of national solutions is unlikely to be sustainable, and detracts from the benefits of having a common solution that works across borders.

As can be seen from the list above, there are numerous organisations that concurrently develop, maintain and promote such frameworks. This is understandable given the history of the development and adoption of the frameworks at a national and international basis. However, the value of a framework typically increases as more people start to use the same framework. Moreover, given the significant costs of maintaining and developing national (or quasi-national) models, it is possible that closer alignment in the development of the frameworks may help to reduce costs and increase potential benefits, in the longer term. This is an area that is proposed as a possible point for discussion in the Collaboration Roadmap (see Key Findings chapter). Nonetheless, it is important to emphasise that agreeing on a single global framework is an unlikely next step; however, there may be some information-sharing activities that could be undertaken in the short term. These may include, for example, developing common definitions for new emerging ICT competences, thereby helping to improve alignment between the different solutions and potentially reduce maintenance costs.

Individual practitioner ICT competences versus organisational ICT capabilities

Although CMMI (Carnegie Mellon's Capability Maturity Model Integration) is confined to process maturity, the success it has achieved underlines the demand for forms of assurance of quality at an organisational level. Similarly, the success of models such as ITIL and COBIT and newer frameworks such as the IT-CMF, suggest strong demand for organisational level improvement of the IT function. There is also evidence to suggest that there is considerable demand for solutions that would facilitate the "certification" of organisations for their ICT capabilities in a similar way to the manner in which practitioners are certified for their ICT competences, thereby providing assurance that certain quality criteria have been fulfilled within the organisation. This is likely to be particularly beneficial for SMEs, as it would provide

assurance to potential buyers of their services that a certain level of ICT capability had been achieved, thereby facilitating the firm's inclusion into global value chains. Given the increasing speed of transition towards global value chains as a consequence of globalisation, it is likely to become increasingly important for SMEs to be able to demonstrate their capabilities (particularly their ICT capabilities) on a global stage in a way that is internationally recognised. As such, internationally recognised "certifications" of an organisation's ICT capabilities are likely to prove an attractive proposition, assuming that some form of convergence on standards can be achieved.

The establishment of such "organisational certifications" has important, and potentially beneficial, ramifications for ICT competence frameworks. For example, although ICT competence models can be used in isolation within organisations to define job roles and plan training requirements, some industry commentators such as Martin Curley (VP, Intel) have observed that organisations are likely to struggle to maximise IT business value if their strategy solely revolves around people (i.e. ICT competences). The reason for this is that IT strategy now typically requires optimal utilisation of a wider range of "levers", and CIOs must therefore optimise usage of people, processes, technology and information. Given this requirement, research is now being undertaken to investigate interaction between ICT (practitioner) competence models, such as the e-CF, and ICT (organisational) capability models, such as the IT-CMF. This is significant as adoption of organisational ICT capability frameworks is likely to stem further adoption of individual practitioner competence frameworks (and vice versa).

Ethical codes of conduct

Codes of ethics/conduct play a key role in the definition of any profession, facilitating the adoption of common forms of behaviour among professionals. Codes of ethics/conduct serve a number of valuable purposes, including:

- Self-regulation
- Definition of professional value and standard setting
- Increased public awareness of professional behaviour
- Indication of responsibility and accountability for work performed
- Support for the legal process
- Evaluation mechanism for the public and a basis of comparison with other professions
- Enhanced reputation of the ICT profession (Berleur et al, 2004; Udas et al, 1996).

In an ICT context, codes of ethics/conduct are significant. For example, as new products and services are developed, there is an underlying need for the range of privacy issues arising from the collection and management of customer data to be fully addressed. As the production of ICT solutions and the delivery of IT enabled services becomes increasingly international and integrated into global value chains, the importance of consistent standards of practitioner behaviour is likely to increase.

Codes of ethics/conduct versus codes of practice

Although often used interchangeably, the two terms have separate meanings:

- Codes of ethics provide high level statements or guidelines on issues such as honesty and integrity, which govern an individual's ethical conduct. These documents tend to be relatively static in nature.
- Codes of practice provide specific and detailed statements pertaining to "good practice" or how an individual executes his/her technical work in the operational environment. Such codes relate to specific domains such as security, software engineering etc. and due to rapidly evolving technological environments are subject to more frequent change than codes of ethics/conduct (adapted from Berleur, 2004).

Codes of ethics in the ICT domain are relatively commonplace in professional societies. In the United States, ACM has had its official code of professional conduct since 1972; IEEE has adopted a code of ethics; and the Data Processing Management Association also has a code of ethics. The British Computer society agreed upon codes of practice and conduct in 1983, while the Australian Computer Society adopted a code of ethics in 1987 (Dahlbom & Mathiassen, 2001).

However, although most of the professional societies have developed relevant codes of ethics/conduct, concern has been expressed that there is currently little enforcement of them, or sanctions against members who breach them. Infringement, complaint and redress procedures vary across national contexts. However, there are notable challenges to establishing sanctions and enforcing codes of ethics/conduct:

- Most practitioners working in ICT do not belong to a national computer society. Therefore, any breach of the code that results in exclusion from the national society is unlikely to have a significant impact on a practitioner's employment prospects
- Some practitioners belong to more than one organisation/society (an issue that may become more pertinent as the volume of international projects increases), creating difficulties or conflicts where the codes do not align
- There is no legislative basis for enforcement in most countries; as such implementing enforcement is an issue

It is important to recognize that approaches to ethics vary across countries, reflecting the different traditions, different cultures, and divergent perspectives on professionalism that exist globally. For example:

- Whitcomb et al (1998) identified differences between American and Chinese values and their rationales behind ethical decisions
- In Japan, codes of conduct are not well known among ICT professionals; many Japanese individuals maintain that ICT does not impact on ethical issues, and is just a technological concern (Nagao and Murata, 2007)
- More recently however a study (Davison et al, 2009) reported a willingness among Japanese and Chinese ICT professionals to follow established rules and laws, suggesting that approaches in East Asia may be changing.

Attempts to overcome this divergence by formulating a single, consistent and universal code for the ICT profession were unsuccessful and such an approach is regarded as infeasible. Instead, more recent initiatives have recognized that cultural distinctions across national boundaries should be reflected in national computer society codes, thereby facilitating acceptance and buy-in at a local level.

As ICT increasingly pervades society, the right to privacy and desire to have confidence in the ethical behaviour of ICT professionals is likely to grow. As such, the importance of codes of ethics is also likely to increase over time. IFIP has undertaken considerable work in examining codes of ethics and developed recommendations on their content and the process for developing them. CEPIS has also undertaken significant work in this area, promoting the adoption of codes of ethics and maintains an ethics repository on its main website, containing the codes of ethics and conduct of its member societies.

As more practitioners formally agree to adopt a relevant code of ethics, the importance of the code may also increase in stature, as it is only once a certain critical mass has been established that the sanction of being excluded from the profession has meaning. However, without any form of professional body in existence that has the opportunity to meaningfully exclude practitioners from the profession for serious breaches of the code of ethics (and where this will impact on an individual's employment prospects), its impact is likely to be limited in the short term.

Bodies of knowledge (BoKs)

BOKs are vital to professions. Agresti (2008) suggests that the first requirement for any area of practice to qualify as a profession is that it corresponds to an organized body of knowledge. The ability to demonstrate mastery in the application of a body of knowledge is a key attribute of anyone wanting to join a profession.

Peter Denning describes a body of knowledge (BOK) as "an organized description of the knowledge of a field". It is important to recognize that BOKs can take many forms including, for example, a textbook, a syllabus with or without bibliographic detail, or even a maturity model. In doing so, BOKs play a key role in supporting education, certification, professional stature, professional development and organizational improvement (Agresti, 2008).

BoKs are intended for specific purposes. Therefore, although many are described as IT Bodies of Knowledge, they are typically used in a specific domain, by certain stakeholders, with a given purpose. A number of BOKs, that are particularly relevant in the definition of the ICT profession, are described below.

ACM CS2013

Every decade, ACM jointly sponsors a curricular volume on computer science aimed at providing modern curricular guidance for undergraduate computer science programs internationally. The latest CS volume (CS2013) was released in 2013; the last full release was in 2001, with an interim revision issued in 2008. The development process for each release is significant and involves many academics and

industry experts – work for the latest release began in 2010. This long lead time has led to accusations of its content not keeping pace with industry, particularly given comments such as Craig Barrett's (former Intel CEO), "the half-life of an engineer, software or hardware, is only a few years"). However, universities counter-argue that teaching the most up-to-date practices will only result in ephemeral qualifications, in contrast to the career-sustaining value derived from teaching enduring concepts.

In its examination of the various undergraduate computing degree programs, ACM and IEEE CS identified five sub-disciplines of the computing field (Shackleford, Cross, Davies, & Impagliazzo, 2006): Computer Science, Computer Engineering, Information Systems, Information Technology and Software Engineering. Reflecting this split, the most recent curricula guidelines for each discipline are: CS2008, CE2004, IS2010, IT2008, and GSwE2009. The criterion for consideration as a discipline was that an approved volume of curriculum guidelines was approved and published by an international professional or scientific society. There are on-going discussions as to whether or not the number of sub-disciplines should change.

The principles for CS2013 are stated as:

- The essential skills and body of knowledge for CS undergraduates must be identified. CS is a rapidly changing field, drawing from and contributing to a variety of disciplines. Students must be prepared for lifelong learning
- CS2013 must serve many constituents, including faculty, students, administrators, curricula developers, and industry
- Curricular guidelines must be relevant to a variety of institution types (large/small, research/teaching, 4-yr/2-yr, US/international)
- CS2013 should provide guidance on the level of mastery for topics, and show exemplars of fielded courses covering topics
- CS2013 should provide realistic, adoptable recommendations that support novel curricular designs, and attract a full range of talent to the field
- CS2013 should include professional practice (e.g. communication skills, teamwork, ethics) as components of undergraduate experience

IEEE ITBOK Guide

The IEEE Computer Society has recently embarked on a new initiative to develop a Guide to the Information Technology Body of Knowledge. The objective of the BoK is to "provide a basis for a common international understanding of the professions needed to create and maintain a successful IT organization [i.e. "Enterprise IT"], as well as a common language to facilitate communication between IT professionals and with individuals in the organizations that IT serves. This guide will also serve as a basis for vendor-neutral education and certification to facilitate the professionalization of the IT community and the better performance of IT organizations across geographic boundaries".

The initiative is being conducted in parallel with development of an IT Competency Model based on the Skills Framework for the Information Age. A preliminary list of ITBOK topics is given below:

- Introduction to Enterprise IT
- Forecasting the Need for Change
- Planning for Change
- Acquiring and Integrating (Vendor selection and vendor management / controls)
- Building and Integrating
- Assuring Solutions Quality
- Transitioning (Delivery and Deployment)
- Disaster Preparedness and Recovery
- Maintaining Currency (Maintenance / updates)
- Supporting Users
- Retirement and Replacement (Withdrawing solutions from use)
- Related and Informing Disciplines

This is an interesting proposal, although it is clearly at an early stage of development given that the call for authors only closed in April 2013.

BCS Chartered IT Professional Breadth of Knowledge Test Syllabus

This syllabus is intended to cover the full scope of the IT profession covering all specialisms and is the basis for a Breadth of Knowledge test, one of the criteria set by the BCS for Chartered IT Professional status. Unlike many other BoKs, it does not rely on technical knowledge (a separate technical interview covers that requirement). The subject areas covered in the syllabus are detailed below:

- Strategy and architecture
- Business change
- Solutions development and implementation
- Service management
- Management support and professional issues

Where practical, the syllabus for each subject area is based on other BOKs, where a dominant BOK exists for the domain (e.g. the Service Management subject area is based on ITIL). For each subject area, a description, topic areas and assessment outcomes are defined.

CIPS Guide to the Common Body of Knowledge for Computing and IT (CBOK)

The purpose of the CIPS Guide to the Common Body of Knowledge for Computing and IT (CBOK) is:

- To provide a consensually validated characterization of the bounds of the IT discipline and promote a consistent view of IT

- To provide topical access to the Common Body of Knowledge for Computing and IT (CBOK)
- To characterize the contents of the IT discipline
- To provide a foundation for curriculum development, program accreditation and for individual professional certification. The guide does not attempt to define the body of knowledge but instead "serves as a compendium and guide to the body of knowledge that has been evolving over the past four decades". The guide intentionally avoids detailing rapidly changing technologies, although does mention their general principles

The BOK is divided into eight knowledge areas:

- Professionalism and Ethics in Computing and IT
- Law and Regulations relevant to Computing and IT
- Mathematics Foundations for Computing and IT
- Technical Knowledge for Computing and IT
- Quality Issues for Computing and IT
- Process Knowledge for Computing and IT
- Business Knowledge for Computing and IT

NASSCOM Foundational Skills in IT

In 2012, The IT-ITeS Sector Skills Council NASSCOM published guidelines for a Foundation Skills in IT course (FSIT). Developed in conjunction with experts from NASSCOM members, including Accenture, Cognizant, HCL, Infosys, TCS and Wipro as well as PMI, the program's objective is "to train students on basic foundation skills to help enhance employability and to make students industry ready". In particular, it aims to address the generic industry-academia gaps in the IT/Engineering sector. The course has been designed for pre-final and final year engineering students and takes approximately 140 hours to complete.

ACS Core Body of Knowledge (CBOK)

The Professional Standards Board of the Australian Computer Society is responsible for the development of the ICT (Core) Body of Knowledge (CBOK). The CBOK is intended as a framework of ICT areas of study to inform:

- The design of programs of study and their subsequent accreditation
- Knowledge requirements for professional certification
- Supporting programs of professional development

In doing so, the CBOK will define a common core of knowledge areas of which all ICT professionals, regardless of their ICT discipline or domain, should have at least a basic knowledge, thereby facilitating improved communication between fellow professionals. CBOK includes content on (i) ICT problem solving; (ii) professional

knowledge; (iii) technology building; (iv) technology resources; (v) services management; and (vi) outcomes realization.

CS Principles Project

Although targeted at college level students (US high school), the CS Principles project is an ambitious effort to provide an academic foundation for understanding the intellectual, practical and creative aspects of computer science. The CS Principles curriculum is specified through a set of Computational Thinking Practices and Big Ideas that identify the content, practices, thinking, and skills central to the discipline of computing and computer science.

Topic specific / historical BoKs

In industry, there are also a number of related ICT Bodies of knowledge in use by ICT practitioners for specific purposes, including: Project Management BoK (PMBoK), Software Engineering BoK (SWEBOK), Information Technology Infrastructure Library (ITIL), COBIT, Capability Maturity Model Integrated (CMMI), IT-Capability Maturity Framework (IT-CMF), IT Security Essentials Body of Knowledge, TOGAF etc.

Education and training

Historically, there has been discussion of "parallel universes" when referring to industry-based training and certification provided by ICT vendors, versus formal academic degrees provided by universities. Whereas industry-based certifications were regarded as developing skills and 'product' ability, more traditional universities focused on the theoretical concepts. However, recognition of the problem has stemmed a number of initiatives aimed at bridging the gap, and fostering a 'coalescence of universes'. Central to such initiatives has been the need for partnerships between industry and academia, in order to bridge the gaps between the knowledge and skills requirements of both sides. The Microsoft IT Academy, and the SAP University Alliance are examples of initiatives that have made inroads in this area, providing materials to professors for use in their teaching. However, not all universities are keen to embrace the initiatives. Most notably, more traditional universities and research-oriented universities tend to focus on teaching conceptual matters rather than any vendor-specific content.

Certifications

There are many different ICT training courses and certifications. When the ICT Certification in Action project was initially launched, it was estimated that there were over 1300 types of certifications in Europe alone, leading to the term "certification jungle" at that time. Navigating through certifications is complex for practitioners, particularly for new entrants to the profession. Lack of transparency is often voiced as a key concern by practitioners, in that it is difficult to know precisely what competences and proficiency levels will be achieved by a specific training course/certification.

Qualifications: The European Qualifications Framework

The European Qualifications Framework (EQF) acts as a form of translation device to improve the transparency of national qualifications across Europe, thereby promoting worker mobility and facilitating lifelong learning. The EQF helps learners and employers understand and compare qualification levels of different countries and different education and training systems. Each country's national qualifications framework is mapped to the EQF and from 2012, all new qualifications in Europe have carried a reference to the appropriate EQF level.

Job profiles / career paths

Identification of career paths is important. Fewer than half of young people say that they had a good understanding of which disciplines lead to professions with job openings and good wage levels at the time of choosing what to study (McKinsey Center for Government, 2013). In many organisations and countries, there is no definitive career path for ICT professionals. However, a number of initiatives have attempted to define job profiles and possible career structures, including:

- In Europe, the CEN ICT Skills Workshop has defined a series of job profiles as part of the ICT Professional Profiles work, with each role defined in terms of the competences of the e-Competence Framework (e-CF).
- Canada has defined a series of ICT competency profiles, covering software, hardware, infrastructure, testing/quality control, documentation and training, and management. It outlines national occupation profiles for 36 ICT work streams and demonstrates the critical competences – knowledge, skills and abilities - needed by employees in each work stream to perform a job. More recently, it has developed a series of e-Health profiles, and is in the process of developing a series of Digital Media job profiles.
- As part of an initiative of the National Skills Development Corporate, NASSCOM has developed National Occupational Standards (NOS) for a variety of job roles.
- Japan has defined job categories and job profiles as part of ITSS.
- The US has defined occupational profiles for 20 roles. For each profile, it has provided a description of the occupation, a career video, information on pay conditions, knowledge, skills and abilities; tasks and activities; tools and technology; education and training.
- CompTIA has defined the IT Certification Roadmap in key technology areas for individuals new to the field and IT professionals in transition that outlines possible career paths for a number of key IT roles. For each role, it defines the related certification requirements.

Tech Skills Partnership

Tech Skills Partnership is a programme under the development of a nationwide, cross-sectoral Industrial Partnership for the Information Economy, which is currently being developed by a growing collaboration of employers, such as Accenture, Blitz Games, BT, Cap Gemini, Cisco, Direct Line Group, Government, HP, John Lewis, the Metropolitan Police Service, Microsoft, Morrisons, National Grid, O2, Quicksilva, Royal Mail, Tata Consultancy Services

and UBS.

In order to develop employees' skills, create new jobs and boost the economy, the UK government is inviting employers to establish a strategic partnership, and bid for the funding of the Employer Ownership of Skills Pilot. In line with the opportunity afforded, the Programme was set up to create the Industrial Partnership for the Information Economy. e-skills UK and the National Skills Academy for IT are co-ordinating the development of the national partnership. The target audience for this partnership are employers and other organisations with a specific focus on technology skills. The programme aims to accelerate economic and employment growth by leveraging the role of technology within society.

The four areas the programme will focus on are:

- Establishing a strengthened pipeline of talent
- Setting new standards for apprenticeships
- Enabling employers to define and recognise the educational courses and training they value
- Creating an effective skills ecosystem for the Information Economy

The total grants available in the UKCES's Employer Ownership of Skills fund is £340M, which will be given to those employers who are willing to work to improve the skill sets of their employees for short-term and long-term benefit in the UK. Two bids have now been submitted by employers and stakeholders in the technology sector. The result will be announced in July.

In the long term, apart from helping to create the technology skills the UK needs, the programme intends to focus on optimally functioning to support local economic growth by working with and supporting those local proposals that can add more value to the community, or have high potential for further development or global expansion, or those that can gain the most benefit from being within the Industrial Partnership for the Information Economy.

Evidence-based portfolios

A number of initiatives are emerging in the marketplace that aim to replace or at least supplement, the traditional CV, by recording and detailing the accomplishments that practitioners have achieved in their professional career. LinkedIn is the leading example, but its skills endorsement functionality is much-maligned. Despite the fact that over 2bn endorsements have been issued since its launch, a commentator in the Financial Times recently described the feature as "moronic, irritating and serves no purpose at all" (Kellaway, 2013).

Evidence-based portfolios could represent a potentially useful source of information to support employers in evaluating potential job candidates, and there is evidence to suggest that employers are looking for such alternatives. For example, Laszlo Bock, senior vice president for people operations at Google, commented "one of the things we've seen from all our data crunching is that G.P.A.'s [grade point averages] are worthless as a criteria for hiring, and test scores are worthless - no correlation at all except for brand-new college grads, where there's a slight correlation. Google famously used to ask everyone for a transcript and G.P.A.'s and test scores, but we don't anymore, unless you're just a few years out of school. We found that they don't predict anything".

The recent spate of new market entrants operating in this space e.g. (Accredible, Mozilla badges, and Treehouse) suggest that there is significant interest in exploiting this market. User-driven platforms, such as Github (a code repository and productivity/collaboration environment for software developers) and Stackoverflow (a Q&A site for programmers), provide real-world evidence of practitioner contributions either via the code that is shared, their answers, and/or their badge rating status. The growth in their levels of usage suggests that there is considerable demand and appreciation of the value provided. Such models may also help to tackle the challenge of adequately measuring and reflecting lifelong learning – a key aspect that does not appear to be fully addressed via the current formal qualification and certification routes.

DeveloperAuction

DeveloperAuction is an online recruitment platform that matches talented engineers with employers. It was founded in 2012 and aims to tackle the problems of the traditional recruitment model i.e. lack of transparency, lower success rate, and longer hiring cycles. The solution provided by DeveloperAuction is to let employers bid on developers. Employers have two weeks in which to bid. Within this time, DeveloperAuction will filter the profiles of both employers and engineers, and match them effectively. After the 14-day cycle, top coders will receive approximately 5 to 15 job offers. They can then make the decision whether or not to accept interviews.

DeveloperAuction provides an innovative mechanism for matching developers with job opportunities at tech companies, while potentially delivering improvements in recruitment efficiency for employers. In the company's first auction, 88 engineers received more than $30m in job offers from 142 start-ups, including Quora and Dropbox. Since its launch up until March 2013, 400 enterprises have signed up with DeveloperAuction and the job offers totalled $225m (Levi, 2013). DeveloperAuction receives a funding of $2.7m from NEA, Sierra Ventures, Google Ventures, Crosslink, SoftTech, and Step Partners. At the moment, the company mainly operates in San Francisco, New York and Boston, and will be extended to Seattle, Denver and London. DeveloperAuction also plans to expand its source candidates beyond developers, to include web designers and data scientists (Colao, 2012).

Accreditation for Higher Education Institutes

Accreditation is most commonly defined as a process to certify the competency, authority, or credibility of an organization. There are numerous agencies that have an important role in the accreditation of higher education at a national and regional level, including ABET (formerly known as the Accreditation Board for Engineering and Technology); Computing Sciences Accreditation Board (CSAB initiated by IEEE CS and ACM and now part of ABET); European Association for Quality Assurance in Higher Education (ENQA), European Consortium for Accreditation in Higher Education (ECA); Consejo CentroAmericano de Acreditacion de la Educacion Superior (CCA in central America); Red Iberoamericana para la Acreditacion de la Calidad en la Educacion Superior (RIACES); Network of Central and Eastern European Quality Assurance Agencies in Higher Education (CEEN); and the International Network for Quality Assurance Agencies in Higher Education (INQAAHE).

Recognising the importance of international collaboration in this sphere, many of these agencies are forging links with one another. Most recently, a memorandum of understanding between the Asia-Pacific Quality Network (APQN) and the European Consortium for Accreditation in Higher Education (ECA) was signed in June 2013 with the following objectives:

- Mutual learning from each other and regular sharing of ideas and experiences
- Mutual recognition of quality assurance decisions
- Facilitation of cross-border higher education and quality assurance
- Promotion of internationalisation of HEIs and of mobility of students
- Establishing transparency tools in the area of HE and quality assurance
- Striving towards excellence and professionalism in work
- Developing modern accreditation external quality assurance systems and
- Exchanging ideas, resources and experts in quality assurance

The ECA also has cooperation agreements with the Network of Central and Eastern European Quality Assurance Agencies in Higher Education (CEEN), the International Network for Quality Assurance Agencies in Higher Education (INQAAHE), and is affiliated with ENQA, the European Association for Quality Assurance in Higher Education. However, while these specific relationships are important and indicative of the importance of collaboration, they are not specific to ICT (see Seoul Accord below). Within Europe, EQANIE (the European Quality Assurance Network for Informatics Education) acts as an accreditation agency for informatics degrees, and issues the Euro-Inf Quality Label for compliant programmes. Looking internationally, EQUANIE is a member of EASPA (the European Alliance for Subject Specific and Professional Accreditation and Quality Assurance) that signed a cooperation agreement on 31st July 2013 with its US counterpart (the Association of Specialised and Professional Accreditors).

The focus of these various agencies appears to be predominantly on formal education, more specifically university-based engineering-style degrees. As such, they do not appear to consider non-formal ICT education. There are also a number of important trends in progress that may dictate changes to the current accreditation system in future years. For example:

- The growth in lifelong learning and the emergence of MOOCs. Alternative educational channels may require that accreditation agencies consider a wider range of educational institutions
- Educational reform, such as that proposed under the current Obama administration, proposes awarding credits based on learning rather than seat time (i.e. a competency-based model).

Such changes, if implemented widely, are likely to require significant amendments to accreditation processes.

Seoul Accord

In 2007, representatives from Australia, Britain, Canada, Japan, Korea and the US (ABET) developed an accord for the trans-national recognition of accredited educational programs and ICT-related disciplines. This became known as the Seoul Accord. In doing so, it established a draft set of graduate attributes expected of students entering the ICT profession. However, examination of the website (as at June 2013) only makes reference to conference proceedings for the group in 2011. It is not clear what progress has been made since this date.

Certified ICT professionals – a global initiative: IP3P

IFIP formed the International Professional Practice Partnership (IP3) in 2007 with the objective of "creating a global IT profession" (Johnson & Roche, 2008). Current members of IP3 include the Australian Computer Society (ACS), Canadian Information Processing Society (CIPS), Computer Society of South Africa, Computer Society of Zimbabwe, IFIP, Information Processing Society of Japan, ABEK/KIISE/KAIST (Korea), and the Institute of IT Professionals New Zealand. Membership of IP3 is open to those organisations that have made a commitment to supporting professionalism in IT and/or are actively working towards IP3 accreditation.

IP3 has also initiated a program to accredit organisations wishing to certify individual ICT practitioners (IP3P). In this way, IP3 will accredit organisations (e.g. national informatics societies) wanting to grant public recognition of professional status to suitably qualified practitioners. The defined IP3P professional standard criteria are listed as:

- Mastery of the core body of knowledge is set at the appropriate standard for professional certification
- Competence requirements are set at an appropriate level (SFIA Level 5 or equivalent)
- Cognitive and practical skills requirements are set at an appropriate level
- Appropriate requirements are in place to ensure continuing professional development
- An appropriate enforceable code of ethics and conduct is in place

As at July 2013, CIPS and ACS have fulfilled the necessary IP3P criteria and are now accredited societies.

Certified ICT professionals / Licensed ICT professionals – national initiatives

The British Computer Society, working closely with the UK government, has created a Chartered Engineer title that allows its holders to be accepted as full members of the UK engineering community, using criteria set out in the UK standard for Professional Engineering Competence by the Engineering Council. Similarly, in the US, the Texas Board of Professional Engineers has recently introduced a Software Engineering Principles and Practice of Engineering exam, in order to facilitate the future licensing of software engineers in the United States, akin to the process adopted for other

engineering bodies. For example, under the Texas Engineering Practice Act "only duly licensed persons may legally perform, or offer to perform engineering services for the public". In this respect, Mitch Thorton, vice-chair of the IEEE Licensure and Registration Committee commented that only those whose programs might "endanger the public health or safety, security, property, or the economy will need to be tested".

The first exams were scheduled to take place in April 2013. The initiative stemmed from five organisations that partnered in 2009 to form the Software Engineering Consortium: IEEE-USA Licensure and Registration Committee, the IEEE Computer Society, the National Council of Examiners for Engineering and Surveying, the National Society of Professional Engineers, and the Texas Board of Professional Engineers. According to Mitch Thornton, in addition to "basic knowledge" of the subject matter, applicants must have four to six years of experience as a practitioner in software engineering. 10 states have indicated that they will offer the test: Alabama, Delaware, Florida, Michigan, New Mexico, New York, North Carolina, Texas and Virginia.

Some countries, for example Malaysia, have experienced negative reactions to the introduction of professional licensing (see vignette below).

Malaysian Computing Professionals Bill 2011

In December 2011, the Malaysia government introduced a new Computing Professionals Bill (CPB2011). The intention of this move was, as stated by the government, to strengthen the administration of the IT profession by registering and/or regulating IT industry sources and IT-services related entities. It was proposed to set up a Board of Computing Professionals Malaysia (BCPM) to implement the operation.

This Bill triggered a sizable public outcry. Articles were published in some of the main papers, and comments and messages were sent via the media. Some people pushed for the Bill, while some were against it, especially those from the IT industry.

Several positions were expressed to support and promote the Bill. The representatives were mainly from government, the public sector or official associations of the professions. The arguments in support of the Bill were Asohan, (2011 and Leong and Leong (2011):

- Be in line with international recognition by having an IT certification
- Raise professional standards and enhance the value of the IT profession
- Enhance the supply of ICT manpower and leverage the national economy
- Convene IT professionals and IT practitioners and serve as a central repository
- Provide assurance as to the quality of IT professionals and enhance the job prospects of IT graduates

From the main points above, it is clear that the aim of the Bill was to regulate the IT industry and increase the quality of IT professionals and IT practitioners, and to ensure minimum standards were met for critical IT implementations. Having an IT passport was meant to be one of the ways of improving IT professionalism and enhancing IT mobility.

Strong public criticism was also expressed. The main concerns were:

- Ambiguity, arbitrariness and uncertainty – the scope of the critical ICT infrastructure was defined widely and ambiguously, which lead to arbitrariness and uncertainty.

- Government and political interference – the BCMP would be a superpower body of government regulation, rather than peer-led and self-regulatory.
- Innovation lost – the Bill would stifle innovation and creativity by regulating the IT industry, and would also raise the barriers of entry and discourage hobbyists and informal IT practitioners.
- Impractical accreditation – the quality of IT professionals could not be measured effectively, given its highly dynamic nature and the fluidity of the IT industry.
- Increased costs – IT companies and their staff would not be allowed to carry out their services before accreditation had been acquired. This would also inflate the costs of projects.

Apart from these potential negative effects, some reasons stemming from failures in the IT sector were also mentioned. The educational system, for example, could not educate sufficient qualified graduates, and the failed IT projects were mainly due to mismanagement, rather than IT individuals.

From the situation in Malaysia regarding the introduction of the Malaysian Computing Professionals Bill, one can see the significance of the IT industry in the development of local economies and culture. It also shows that the way towards global IT professionalism is still far off and requires more time and effort. In addition to ambitions, adequate consultation and transparency are also indispensable (Goan, 2011).

Certification, licensing or professionalism generally cannot guarantee the safe application of ICT. This is worth mentioning as professionalism is oft positioned as a panacea for every ICT related risk. In practice, a more mature profession will most likely reduce the probability of a system being delivered late, over cost, or faulty. Similarly, by understanding the constraints on the design of a new ICT solution, a committed ICT professional would likely help to reduce the probability of a major systemic failure causing major economic harm or threatening life. However, they would not automatically eliminate the risks entirely. The benefits of a more mature profession are substantial and should be promoted widely, but it is important not to set unrealistic expectations.

National initiative – Nasscom Assessment of Competence / Job-role tests

NASSCOM Assessment of Competence (NAC-Tech) is a test devised by NASSCOM to determine the competencies of students wishing to work in the Indian IT industry. It is predominantly targeted at final year and pre-final year students wanting to work in IT. Over 137,000 students have sat the exam and the test has a validity period of one year. The test lasts approximately 90 minutes and is broken into two parts:

- Part A: verbal ability, reading comprehension, analytical reasoning, attention to detail;
- Part B: domain-specific test (engineering disciplines) - IT, electrical, electronics, mechanical, civil, chemical, textile, bio, technology, telecommunications.

The test is used among large recruiters such as TCS, Wipro, Infosys, HCL and Cognizant and has recently become a pre-requisite for students wanting to join these companies. In this way, it is trying to become adopted as a standard test across the

industry, replacing individual company exams for students wanting to be considered for employment. However, while the test has gained support in the companies listed above, there are some notable exceptions not using the exam in this fashion, e.g. IBM and Cap Gemini (Venugopal, 2013).

NASSCOM National Occupational Standards and qualification packs

In 2013, the NASSCOM IT-ITeS Sector Skills Council announced that they are now introducing supplementary tests that will assess and certify students for skills needed for a particular job (Times of India, 2013). NASSCOM has developed National Occupation Standards (NOS) for a variety of job roles such as analyst, web developer, language translator and technical writer. In total, 510 job roles (67 entry-level roles; 313 middle layer roles; and 130 top layer roles) have been identified by NASSCOM across four areas: IT services (ITS), business process management (BPM), engineering and R&D (ER&D), and software products (SPD). The new test looks at the functions, sub-functions and tasks for each job, and there is a test for each task. NASSCOM will initially make tests available for 5-10 job roles, but will expand the number of tests over a 3-5 year period to cover all job roles. Students and their scores will be recorded in a database to facilitate recruitment by NASSCOM members.

NASSCOM, together with the Quality Council of India (QCI) and the National Accreditation Board for Certification Bodies (NABCB) will assume the role of a standards-setting body, to determine whether or not a course conforms to the required standards. Separate vendor organisations will be invited to offer the content and certification.

ICT skills register

Typically schemes to certify ICT professionals (as outlined in the preceding sections) also operate a register of ICT professionals so that people who have attained this level of competence can prove their abilities to potential employers. However, people who have not yet attained the required level of competence are not registered on the system, thereby limiting its use by employers as most people working in ICT do not fulfil all of the requirements of professional certification/licensing schemes. However, there is also interest in the notion of establishing an ICT skills register, to allow the ICT skills of everyone working in ICT to be logged, regardless of whether or not they have formally fulfilled all of the requirements to be a certified/licensed ICT professional.

Skills registers, such as Certified ICT Professional schemes, stimulate much discussion among ICT workers. In some countries, there is strong resistance while in other countries, there is strong support. An example of where there is strong support for such a scheme is in India. NASSCOM has developed a National Skills Registry which was set-up and managed by NSDL Database Management Limited. This is intended to act as a repository on every knowledge professional working in the IT and ITeS / BPO industry in India, capturing personal (including biometric), educational and employment details about each person registered. It enables employers to access credible data on current and potential employees, without the need to run their own verification checks on each individual as NSR conducts its own background checks

on each registering professional. The data is owned by the employee who can authorize prospective employers to validate the details and avoid duplication of background checks. Given that many BPO services require employees to handle highly sensitive client data, the register is intended to reassure potential service buyers that employees are properly vetted.

International collaboration organisations

In this section, a small number of organisations and initiatives aimed at fostering communication between different national and international ICT societies, with the aim of maturing the ICT profession, are described. IFIP and CEPIS are the two most widely known associations with an impressive membership reach, but it is also worth mentioning two other more focused organisations that may contribute to the discussion.

International collaboration between professional informatics societies – Council for European Professional Informatics Societies (CEPIS)

CEPIS is the representative body of national informatics associations throughout greater Europe, and now represents over 300,000 professionals in 32 countries. Its main aim is to promote the development of the information society in Europe. It has three main areas of focus: (i) promotion and development of IT skills across Europe; (ii) active promotion of professionalism in IT practice; and (iii) education and research.

International collaboration between IT societies – International Federation for Information Processing (IFIP)

Established in 1960 under the auspices of UNESCO, IFIP represents IT societies from 56 countries/regions, covering five continents with a total membership of over half a million, and with an internal structure that comprises over 100 working groups and 13 technical committees. It links over 3500 scientists from academia and industry, and sponsors more than 100 conferences yearly as part of its education programme.

Collaboration between scientific ICT societies

The European Forum for Information and Communication Sciences and Technologies (ICST) was established on 2011 in Milan, with the intention of establishing an open platform for cooperation among the scientific ICT societies in Europe. The following societies are members of the group:

- ACM Europe
- European Association for Programming Languages and Systems (EAPLS)
- European Association of Software Science and Technology (EASST)
- European Association of Theoretical Computer Science (EATCS)
- European Coordinating Committee for Artificial Intelligence (ECCAI)

- European Research Consortium for Informatics and Mathematics (ERCIM)
- Informatics Europe

The Mission statement of the group is *"the development of common viewpoints and strategies for ICST in Europe and, whenever appropriate or needed, a common representation of these viewpoints and strategies at the international level".*

It is important to note that the group is not intended to possess its own legal structure, but is instead a lightweight platform to facilitate the exchange of viewpoints between the respective ICT societies on common issues relating to the development of Informatics/ICT in the "Innovation Union". The related URL for the organization is: http://www.eficst.eu

Collaboration on education

Formed in 2011, the Partnership for Advancing Computing Education (PACE) is an initiative that emerged out of earlier related initiatives and events (Computing Education Coordinating Council, Future of Computing Education Summit, and Coalition for Advancing Computing Education) with the following objectives:

- High quality, diversity and capacity of the computing workforce
- High quality of computing education at all levels, and
- Increased stability of enrolments in computing programs at levels compatible with demand

Although the intention of PACE is to act on a global basis, its membership appears to be mostly focused in the US at this stage (although ACM Europe is involved). The partnership facilitates the exchange of information and collaboration on activities that advance the state of computing education, address its challenges and improve its quality.

The following organisations are members of PACE:

- Association for Computing Machinery (ACM)
- Association for Information Systems (AIS)
- Computer Science Teachers Association (CSTA)
- IEEE Computer Society (IEEE-CS)
- National Centre for Women and Information Technology (NCWIT)
- Computing Research Association

In terms of its specific aims, it has stated the following:

- Present a unified, respected view of the nature, content, and achievements of computing education through an organization that is widely acknowledged to represent the entire field of computing. The Council will provide an on-going sense of vision, purpose, and leadership in addressing the challenges to computing education. It will have an important role in setting educational priorities

- Support the processes for securing the resources necessary to meet the challenges facing computing education
- Provide a structure for the various computing organizations to communicate about common interests and to act in a united way to address those interests

In the future, the group aims to be open to all organisations with an interest in computing education including small and large organisations, national and international, pre-university education, undergraduate and graduate education, professional training, and all fields of computing. (See: http://www.ncwit.org/member/partnership-advancing-computing-education-pace).

Skills matching and job matching: finding the right training, finding the right role

In the Brookings Institute report "Using data to improve the performance of workforce training" (Jacobson & Lalonde, 2013), a proposal is put forward to help workers in making better choices of training to facilitate improved employment and salary prospects. The proposal recognizes that the individuals who can benefit most from training are often those who have least awareness of the type of training that is likely to provide the greatest benefit for them. Although not specific to ICT, it highlights the importance of providing insight to individuals on the types of skills that are most likely to be in demand in the future and what training opportunities will most enhance their future employment prospects. Given the current mismatches in supply/demand of ICT practitioners in Europe and elsewhere, the demand for such initiatives is likely to grow.

Similarly, once people have acquired skills, there is a need for these skilled workers to understand what roles are available to them – a job matching scheme. An important step in the provision of such services is a greater level of adoption of ICT competence frameworks – in this way, ICT practitioners can describe their levels of proficiency in specific competences, and employers can describe job roles in terms of the competences/proficiency levels required. It is interesting to note that a social network for medical professionals; Doximity (akin to a LinkedIn for physicians) facilitates the rapid identification of relevant specialists for patient conditions. It is possible that similar domain-specific professional networks will evolve for ICT to support the just-in-time identification of relevant skilled professionals to participate on ICT projects. To some extent Kaggle is one such example, but it adopts a gamification approach rather than a competence based approach.

Kaggle + Codetoki

Kaggle was founded in 2010, initially in Melbourne, and moved to San Francisco in 2011. Kaggle is the largest community of data scientists in the world, aiming to bridge the gap between data problems and data solutions. Kaggle Connect is a tool-supported consulting platform that connects companies to its large talent pool of data scientists. Through collaboration and competition among the data scientists, Kaggle delivers projects and provides state-of-the-art data results to companies. Kaggle's community of data scientists come from more than 100 countries and 200 universities. They compete with each other to solve real world, complex data science problems. As of October 2012, there are 55,000

contestants registered with Kaggle (Hardy, 2012). Kaggle has helped 16 major companies e.g. GE, Allstate and Merck, Ford, and Facebook. It is also involved in projects for some enterprises, such as the Heritage Provider Network, Tesco, and Tencent.

In a similar vein to Kaggle, a Philippines start up, Codetoki, has used a gamification approach to establish a link between IT professionals and future employers. The Codetoki gamed-based platform is to help individual IT workers to find an employment opportunity, particularly to match IT practitioners with their ideal employers. Codetoki works with IT and Business Process Outsourcing companies. These companies generate challenges and design tests and games. Aspiring applicants choose the company and perform the tests. The results will be visible to their potential employers. Through Codetoki's game-like platform, employers are able to advertise their requirements, test their candidates and find the right employees. 3 schools and 33 local and global companies, such as BPO specialist Accenture, CAI-STA Philippines, Asian Business Solutions Inc., Crimsonlogic Philippines, ArcusIT, and the Microsoft Philippines Academic Team, have established a partnership with Codetoki.

The changing face of the ICT profession

Traditionally, professions have emerged on a national basis before forging international links. However, reflecting the global nature of ICT itself and due to the influence of globalisation, it is likely that the ICT profession will evolve along parallel national and global paths. There are already parallel professional associations - at a national level (e.g. the Italian Associazione Informatici Professionisti - AIP) and at an international level (e.g. ACM and IEEE CS).

However, given the global, interconnected nature of ICT, it will be interesting to see how this situation evolves. For example, it is possible that there might be closer liaison between the national and international associations in the future. Certainly if trends such as the emergence of global value chains are considered, consistent practices regardless of geographic location will become increasingly necessary, and this may encourage greater levels of collaboration. However, incumbent professional associations cannot presume their role will be unchallenged.

In the same way that membership of unions and political parties is exhibiting signs of decline at least in Europe, some ICT professional associations are facing limited growth prospects from new paying-members. To counter such conditions, some professional associations are focusing on attracting corporate memberships, offering membership to all ICT employees of an organisation, rather than attracting individual practitioner members. This, along with providing a reduced price or free membership to students, seem to be effective mechanisms for attracting members, but it is important that such members become engaged in the society if the organisation is to be sustainable. Membership levels are only one measure of success, but engagement and support from members are likely to prove more effective measures from the perspective of establishing a sustainable profession.

It should also be recognised that younger generations of ICT practitioners are accustomed to forming informal, ad hoc groups around specific topics online and in person (e.g. LinkedIn forums, Stackoverflow, etc.), without the need for a formal hierarchy. Professional associations might find there is a need to adapt similar tactics in order to attract new members as possible rival groupings emerge. While

Stackoverflow is not akin to a formalised association of ICT professionals, it is a powerful self-organised community of practice, providing support to its many users, with over 5 million questions having been posted on the site. The fact that the site is free to users and run by its users underlines the enormous capability (and an appropriate culture) within the ICT community to formulate innovative mechanisms for change. Historically, professions are typically formed by practitioners rather than by governmental decree. As such, harnessing the power of such groups to become actively engaged in the maturing of the profession will be key.

Fragmentation is also another threat to an aligned ICT profession. The diversity of populations working in ICT means that some industry sectors are forming independent groupings (e.g. Health Informatics Professionals), and this trend may accelerate as ICT workers move closer to the business (e.g. particularly via shadow IT), and as professionals from other sectors acquire more sophisticated ICT skills (e.g. digital marketing). It could be that a number of vertical industry-specific professional associations emerge, but align against a horizontal ICT professional body.

A new profession

At present, there are schisms in the ICT profession. For example, some professional bodies will only recognise individuals who have pursued a course of study at an approved university as an "ICT professional". This is to be expected as many established national profession bodies in other domains (such as law and medicine) have adopted similar requirements with respect to required levels of initial professional education. However, it could also be argued that most other professions were founded before social networks and online professional communities of practice were formed, before online education was freely available, before best practices could be shared globally almost instantaneously, before open source platforms were conceived, and before lifelong learning became a necessity rather than a concept. Such trends suggest that the future ICT profession will be a different profession from existing professions. In this respect, it will be interesting to see to what extent the ICT profession embraces the opportunities afforded by these ICT-enabled trends to support the creation of a more flexible, adaptable, and vibrant community of fellow professionals.

An agile profession

In recent times, there is growing awareness and recognition among ICT practitioners of the potential benefits of open innovation and agile methodology. In many organizations, ICT practitioners have fully embraced such approaches and they are now recognized as the norm in some environments. However, it is yet to be witnessed any similar attempts to adapt the ICT profession itself and the way it is constructed. Perhaps, looking into the future, the ICT profession may benefit from a more collaborative and rapid-iterative approach, exploiting open innovation strategies and an open source mentality, where possible. ”Open” in this context, does not necessarily mean that there will not be commercial opportunities stemming from such a profession (e.g. possibly in the same way that many companies use Linux, but they pay organisations such as Red Hat for related services).

The anticipated growth in MOOCs, for undergraduates as well as for experienced professionals wanting to maintain their skills, is likely to improve consistency, scalability and quality of ICT education. In turn, the opportunities to create a shared understanding of ICT and promotion of a common language for ICT competences may subsequently help to foster creation of a global ICT profession.

Professionalism is not a topic that can be dealt with frivolously, and relative to other professions the ICT profession is in an immature state. However, the scale and pace of change being effected across society and economies by ICT suggests that we cannot wait for a "perfect" solution to emerge. Rather, a functional solution that is designed to evolve rapidly through successive iterations is more realistic.

The devil is in the detail

Ultimately, the basic components of an ICT profession are unlikely to be in doubt - most stakeholders will accept that BoKs, education and training, competences, and ethics form the cornerstones of the ICT profession, if not all professions. Some will break the model down into a more atomic composition but most will agree on the overarching concepts. However, the problem lies in agreeing the scope, the detail and the implementation. For example, what is precisely meant by the term "ICT" in this context and what is its scope? What knowledge of the domain must every professional acquire (i.e. the Body of Knowledge on which the profession is based)? What type of education must be undertaken (e.g. university, vocational, informal etc.)? How should competences be identified and assessed? How can codes of conduct/ethics meaningfully and consistently shape practitioner behaviour? How is the profession managed?

These are fundamental questions that are difficult to answer, and have been debated by many experts for many years. However, there are several reasons to be optimistic that significant steps will be taken to mature the ICT profession in coming years.

A burning platform…

Ultimately, it is hoped that international stakeholders can work collaboratively to mature the ICT profession and tackle ICT skills gaps, with the aim of creating a platform for improved economic productivity and reduced risks posed to society from unskilled ICT workers. However, in practice, the road to collaboration will be complex and long. Many stakeholders and individuals have tried to mature the ICT profession over a period of years, and while some limited success has been achieved, we are still far from possessing confidence in the ICT profession. However, timing is essential, and at present, much of the world is confronted with low economic growth prospects, and high levels of unemployment, at the same time as a burgeoning demand for ICT skills fuelled by large-scale technological shifts in the form of cloud, mobile, cyber security and big data. Given the pressure to stimulate growth and reduce unemployment, the political weight behind achieving a solution for the ICT profession has never been greater. Similarly, companies seeking improved growth prospects are now increasingly recognizing that ICT must be an integral and strategically core part of their business, as they transition to the era of pervasive computing and digitalization.

The spectre of unemployment has raised awareness amongst existing and future workers of the importance of possessing relevant e-skills - regardless of industry, grade or role - and that these ICT competences must be maintained over time if their professional currency in the global job market is to be maintained. Together, these factors represent the greatest and most important factor to maturing the profession and promoting e-skills more widely, namely, a burning platform. All stakeholders presently recognize that maintaining the status quo is not in their best interest, and are therefore prepared to contemplate the necessary investments in time, money, effort, and political capital that would previously have been unattainable.

In parallel, new technologies are now providing unprecedented opportunities to collaborate internationally, and to deliver education (e.g. MOOCs). Given this unique combination of circumstances, the opportunity to change should not be lost.

Technological trends

ICT investment: a return to growth

The environment in which ICT is operating appears to be changing. A recent 2013 analyst report suggests that 78% of CEOs are planning to increase investment in IT, outnumbering cost cutters by 4:1 (Eddy, 2013). In some instances, this pattern is occurring even in a recessionary climate, reinforcing the notion that the business is now realising the potential value that can be delivered by investing in new technologies such as cloud, mobile, big data and social business. Such patterns contrast with recent years where the economic environment has created a continual focus on cost-cutting, dampening the level of discretionary spend on innovative technologies. As a transition into a growth climate is experienced, it is likely that this will significantly impact on the nature and volume of skills in demand. However, it is also worth emphasising that future demand for jobs appears to be increasingly software focused, if recent trends from the US are repeated elsewhere. Computerworld (Thibodeau, 2013), analysing US Labour Data, suggests that "the number of electrical engineers in the workforce has declined over the last decade. It's not a steady decline and it moves up and down, but the overall trend is not positive".

ICT is currently undergoing a period of radical change, or as IDC refers to it, a period of "hyper-disruption". IDC refer to a "third IT platform" (IDC) and a "nexus of forces" (Gartner, 2013) when discussing the new interdependent IT trends including cloud, mobile, big data and social business. Reflecting the scale of change that is envisaged, IDC estimates that 40% of the ICT industry revenues will stem from such technologies, almost twice the current estimate of 22%. These figures are significant given the inevitable cannibalisation of existing technological spend that will most likely occur. Similarly, a global 2013 survey of over 2000 CIOs confirmed that the top four Technology priorities for CIOs were: analytics and business intelligence; mobile technologies; cloud computing; and collaboration techniques (Gartner, 2013).

From a geographical perspective, IDC estimates that IT spending in 2013 in emerging markets will grow by 8.8% to over $730bn, twice the growth rate of developed markets, and 51% of all IT growth. The bulk of this spending is likely to stem from

increased domestic demand in emerging markets rather than increased spending from offshoring activities.

Convergence / inter-dependency

The reality is that many technological trends are inter-dependent, and this level of convergence and inter-dependence is increasing. For example, virtualisation created the platform for cloud computing; mobile platforms have sparked the demand for information anytime, anyplace, anywhere; and as cloud computing becomes more prevalent, collaborative work environments are flourishing, as are the opportunities to mash disparate sources of "big data", increasing the potential impact of threats posed from inadequate information security.

In this section of the report, a brief overview is provided of some of the key technological trends that are changing the ways in which organisations operate, creating a demand for new skill sets, and in turn, changing the shape of the ICT profession.

Internet of Things/Everything

The earlier conceived concept – the Internet of Things is so-called because it referred to the fact that the Internet is now dominated by "things" or devices such as smartphones, rather than people (Evans, 2011). It is estimated that 2 billion people use the internet daily. At the same time, it is estimated that there are over 10 billion devices connected to the Internet, growing to 50 billion devices by 2020 assuming continuing growth rates (Cisco IBSG). This number may underestimate the actual number of devices in 2020, as new types of technologies and sensors are being developed that could change the volume of connected devices by orders of magnitude.

The Internet of Things is important as it is changing the way in which data is obtained: the type of data, the volume of data, and the way the data is structured. The transformation of this data into information, knowledge and wisdom provides the basis for new societal and business opportunities. This in turn, will drive further opportunities and demand for the types of analytical tools and skill sets used for manipulating "big data". In many respects, the IoT is one of the manifestations of "big data".

However, the future Internet is not restricted to "things" as services will also be provided over the internet. It is the plethora of sensors available that will drive contextually aware services that can be exploited by people and businesses. Cisco terms this the 'Internet of Everything' and defines it as "the intelligent connection of people, processes, data and things" (Cisco, 2013). The term "future internet" is also used by some to describe a similar convergent internet of things, people and services.

The European Commission announced in 2013 proposals for a new investment package worth €25billion over the next 7 years to drive innovation and production in the areas of electronic components and systems design, including Nano-electronics. It is likely that much of this research will contribute to significant innovation in the IoE domain. Cisco estimates that the potential economic impact resulting from the emergence of the Internet of Everything is as much as $14.4 trillion for private sector businesses worldwide, with "the potential to increase global corporate profits by

approximately 21% in aggregate over the next 10 years" (Cisco, 2013). This estimate does not include the potential value to citizens, communities and countries. However, it is worth underlining that the Internet of Things is not a distant, far-off trend. A 2013 survey of over 700 senior business executives conducted revealed that over three-quarters of companies are either actively exploring or using the Internet of Things.

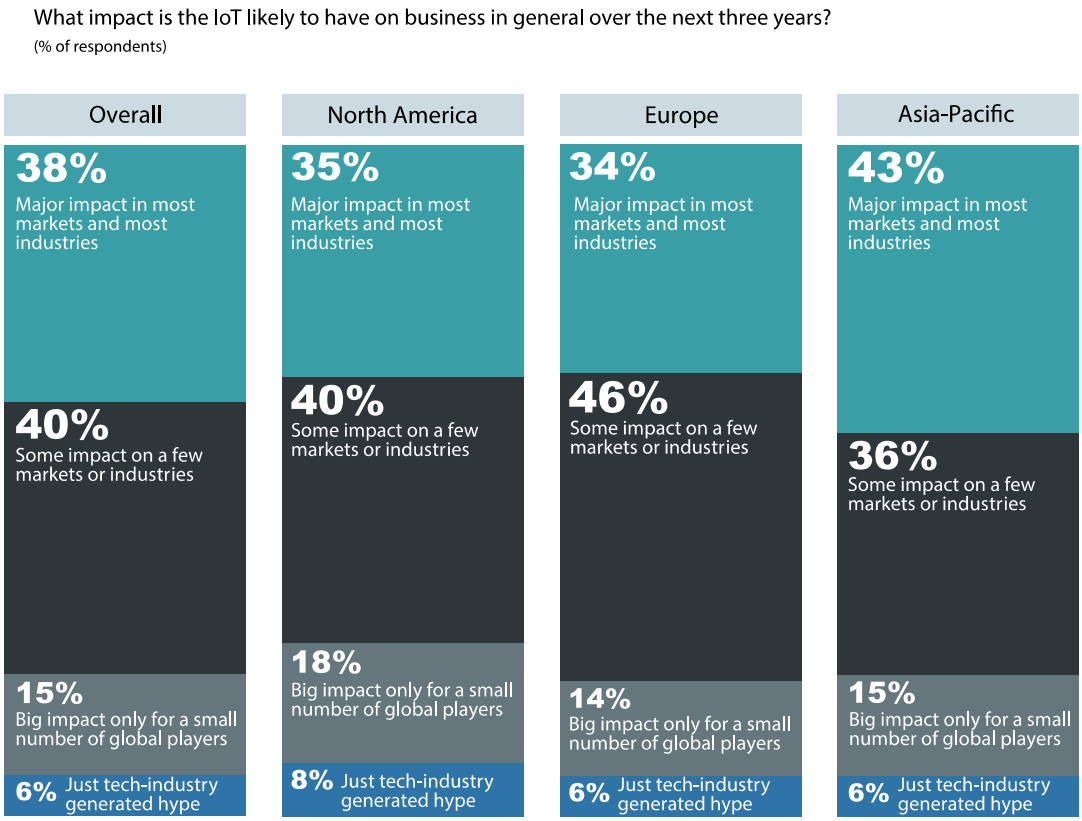


Figure 20: Future impact of the Internet of Things - industry level; percentage of respondents (Source: Economist Intelligence Unit, 2012).

The opportunities available from the internet of everything are far reaching, and many enterprises will have to adapt radically in order to participate and compete in the new global value chains that will emerge. Doing so will require access to workers with relevant skills. A recent report by the Economist Intelligence Unit illustrates the extent to which a deficit of skills may be impacting on the potential exploitation of the Internet of Things. E-leadership and digital entrepreneurship skills are likely to play a key role in supporting exploitation of the 'Internet of Everything'.

Figure 21: Chief obstacles to the organisational use of the Internet of Things (Source: Economist Intelligence Unit, 2012).

Big Data

In 2010, Erik Schmidt remarked that the world now creates 5 exabytes of data every day (Siegler, 2010), and the trend will inevitably continue upwards, given the continuous stream of new content 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, for finance, for operations, for strategy, and for economies and societies as a whole. There is no single, agreed definition of 'big data', however, it has been defined as 'The massive amounts of data that collect over time that are difficult to analyze and handle using common database management tools. (PC Magazine (2014). Analytics is often positioned as being synonymous with big data, and it is certainly described as the most "sexy" part of big data. However, in practice, big data reflects a much wider proposition as outlined by the list of challenges in the paragraph. Figure 22, extracted from a community white paper, outlines this bigger picture with the top row showing the major steps in the analysis of big data, and the lower row highlighting some of the big data needs that make the various tasks challenging. It is helpful to understand this bigger picture as each task requires specific skills, and some are more likely to be impacted by automation than others.

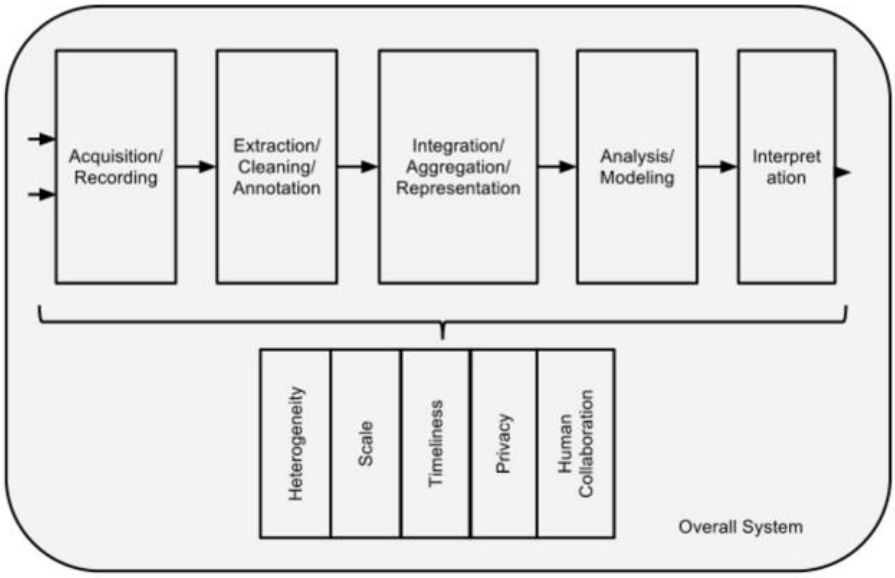


Figure 22: Big data analysis pipeline. (Source: Challenges and Opportunities with Big Data, 2012).

It is worth mentioning that while cloud services are often used to handle big data (and in this respect, technologies such as Hadoop often have a vital role to play in supporting data-intensive distributed applications), it is not essential to use cloud services in order to exploit big data. Although big data comprises a wider series of skills, most surveys focus on the analytics piece. An Accenture survey of 600 senior executives in enterprise-level companies (1000+ employees) in the US/UK revealed that one third are actively using analytics across the enterprise, and less than ten percent of companies were not making any use of analytics (Accenture, 2013). However, lack of skills is a key issue: 41% of over 750 senior executives polled in a 2012 survey responded that a lack of skilled staff hampers their efforts to process data more widely (Economist Intelligence Unit, 2012).

In terms of its potential organizational impact, McKinsey estimates that European public sector administration could save €250 billion per year, equivalent to approximately 0.5 percent annual productivity growth, from the use of big data (McKinsey, 2011). Although this is a single sector, it provides an indication of the level of interest in the topic.

Big data is also providing the basis for a new series of jobs, and more importantly, jobs that are in high demand from industry. The Harvard Business Review recently proclaimed one such role, 'Data Scientist' as "the sexiest job of the 21 century" (Davenport and Patil, 2012). In essence, data scientists are the experts who know how to devise mechanisms for extracting answers to key business questions from the quagmire of unstructured data that exists in organisations today; a role that typically demands a scientific background with computational and analytical skills. However, there are also many other roles related to big data.

Gartner predicts that 4.4 million IT jobs globally will be created to support big data, with 1.9 million of those jobs in the US (Lundquist, 2012). However, Peter Sondegaard of Gartner cautions that in practice, only one third of these jobs will be filled due to a lack of skilled big data applicants. For this reason, creating a supply of

practitioners with big data skills is likely to prove an on-going challenge. Within the US alone, McKinsey estimates a shortage of 140,000 to 190,000 people with deep analytical skills as well as 1.5 million managers and analysts to analyse big data and make decisions based on their findings. As can be seen from Figure 23, this suggests demand for talent will outstrip projected supply by 50 to 60 percent (McKinsey Global Institute, 2012).

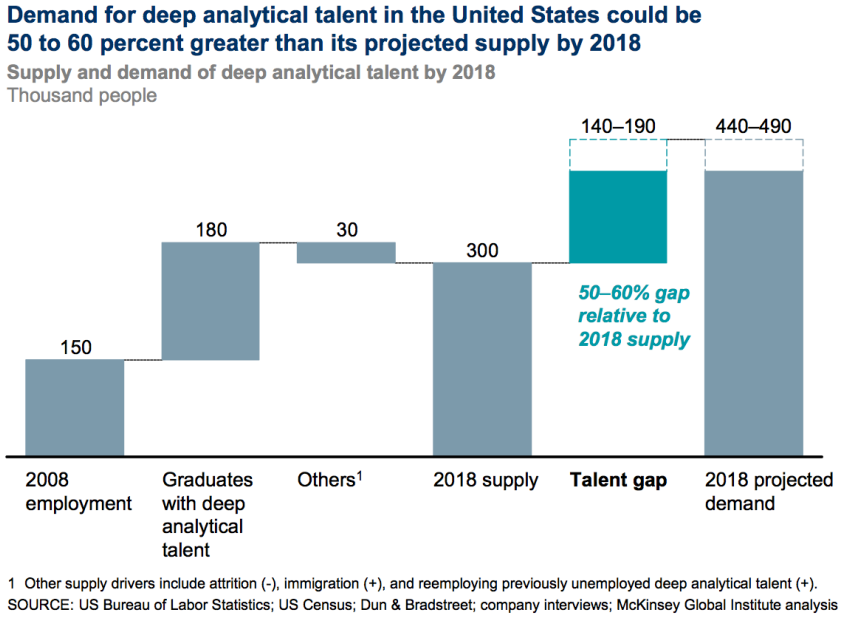


Figure 23: Chart showing demand for analytical talent in the United States. (McKinsey, 2011).

Growth in demand for analytics jobs is not confined to the US. The problem is likely to be present in many economies as illustrated in Figure 24 (for six industries only), and in some of these countries the rate of growth in demand for these analytics workers is higher than in the US, implying that the patterns might change significantly over a longer time horizon.

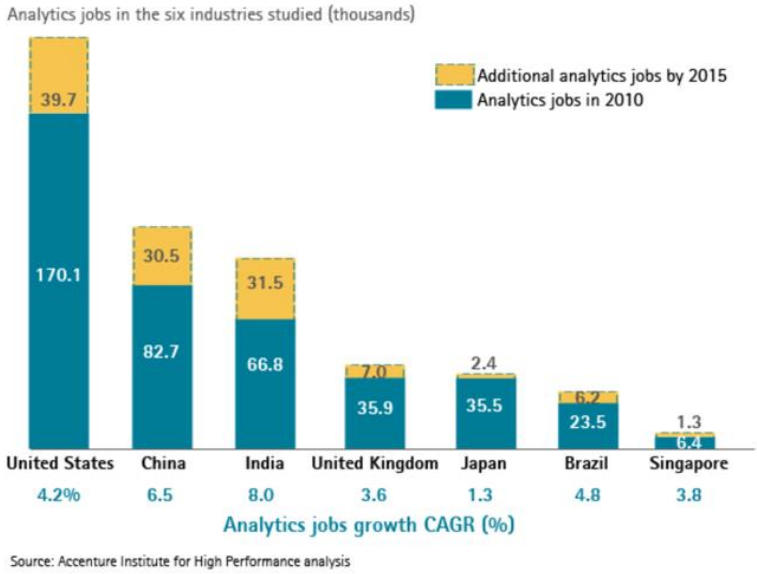


Figure 24: Analytics job growth (thousands) in 2010/2015 for six industries studied (Source: Accenture, 2012).

The Accenture study (Craig et al, 2012) looked at demand across six industries in seven countries for three role types: analytics specialists, analytics experts and analytics scientists. Their study suggests:

- Net shortage of analytics scientists in most countries, with greatest shortfalls in the US, Brazil and UK (with only China recording a small surplus)
- 86% of the new analytics specialists jobs will be in the US, UK and Japan, yet 74% of the new analytics specialists will be produced in India, China and Brazil.
- US would account for approximately 44% of the new jobs for analytics experts but only 23% of the supply, leading to a shortfall of approximately 32,000 workers across the six industries. For Brazil, a shortfall of 19,000 workers was predicted due to a 5% share of the new analytics expert jobs but only 1% of the new talent supply.
- India and China were perceived as being net suppliers of talent for analytics experts, due to a surplus of 72,000 and 18,000 for India and China respectively.
- 86% of new analytics specialists jobs are expected to be in the US, UK and Japan, but 74% of new analytics specialists will be produced in India, China and Brazil, suggesting a potential geographical talent mismatch.

A separate report by McKinsey also predicted a shortage of deep analytical talent would be a global phenomenon. In examining the number of graduates with deep analytical training, the United States produces by far the greatest number, but as stated previously, its projected demand profile is also far higher. Some other countries have a much higher proportion of deep analytical talent, and might therefore offer their services via offshoring solutions to countries where a deficit exists, or alternatively, immigration paths might be attractive to the workers with the relevant skills.

In considering the future demand for big data expertise, Madan Sheina, an analyst with Ovum, suggests the following patterns (Sheina, 2012):

- A broad need for IT professionals proficient in technology platforms, infrastructure and data management, along with analytics and business process/vertical domain expertise
- Growth in demand for analytics skills around predictive modelling, data mining, natural language processing, content analysis, social network analysis, and sentiment analysis and skills in related product offerings)
- Similarities between many data management tasks around Hadoop and existing relational database and data warehouse environments will facilitate retraining of DBAs
- Experienced Java and C++ programmers could increase their marketability by acquiring MapReduce skills

However, most surveys of organisations predict difficulties in finding staff with the requisite skills. Recognising the difficulties in finding skilled talent and matching it to the required job, there has been an emergence of niche matching services (e.g. Kaggle). In addition, the Institute for Operations Research and the Management Sciences (INFORMS) is establishing itself as the first professional society to offer certification specifically targeted at the analytics market, with the introduction of its Certified Analytics Professional exam in an attempt to facilitate practitioners with evidence of their competence.

Cloud Computing

There is considerable hype around the term 'cloud computing' and many definitions exist. The definition below was created by researchers trying to formulate a complete definition for the cloud, based on the main characteristics associated with the paradigm.

Clouds are a large pool of easily usable and accessible virtualized resources (such as hardware, development platforms and/or services). These resources can be dynamically re- configured to adjust to a variable load (scale), allowing also for an optimum resource utilization. This pool of resources is typically exploited by a pay-per-use model in which guarantees are offered by the Infrastructure Provider by means of customized SLAs (Vaquero et al, 2009).

Cloud is perceived as highly important by most businesses. A 2011 Accenture/LSE survey of over 1000 senior executives revealed that more than 50 percent of business respondents believed that cloud would "enable us to focus on transforming our business and not our IT" (Willcocks et al, 2011). As suggested by the above definition, cloud computing has a number of characteristics that distinguish it from traditional resource provision models:

- On-demand
- Internet based
- Resource-pooling
- Infinite capacity
- Demand-driven billing

IDC estimate that cloud computing could contribute up to €250 billion to EU GDP in 2020 and create 3.8 million jobs, with a cumulative impact for the period of some €940 billion as described under the same scenario (Bradshaw et al, 2012).

The benefits of cloud computing resonate particularly strongly with SMEs as such companies are able to exploit the possibilities to rapidly alter, for example, the required levels of computing and storage capability almost instantaneously, mirroring the demand cycles of SMEs. This ability to tailor supply of computing performance without the requirement for high levels of investment in server farms and on-going maintenance greatly facilitates the potential opportunities for so called gazelles, rapid growth SMEs. For this reason, Cloud Computing has particular relevance within Europe due to the high number of SMEs. It is this facet that could potentially be

responsible for the high levels of cloud adoption in developing nations, especially those in sub-Saharan Africa, as noted in a recent Gartner study.

The same features also make cloud computing appear attractive to business units within larger companies, as it provides the opportunity to pilot and validate new solutions without major upfront investment. In this way, cloud computing is seen to spur the growth of shadow IT.

There are three basic cloud service models, which differ according to the level of abstraction offered, the type of services provided, and the degree of automation and customization.

Cloud Service model	Typical scenario
Software as a Service (SaaS)	User employs a browser to access an application being provided by the service provider, being run on a cloud infrastructure (e.g. Google docs, Microsoft office web apps, salesforce.com)
Platform as a Service (PaaS)	User develops specific services using various components provided by the vendor (e.g. Microsoft Azure, Google app engine)
Infrastructure as a Service (IaaS)	User operates a virtual machine (i.e. the hardware itself is abstracted), which operates similarly to a local server (e.g. Amazon Compute Cloud)

Table 10: Cloud service models

There are three basic cloud deployment models:

- Public cloud – services and infrastructure are provided from over the internet (low cost, but increased security risk)
- Private cloud – services and infrastructure are maintained on a private network, operated for a single organization (high cost, but improved security)
- Hybrid cloud – mix of public and private options from multiple providers (mix of cost and security)

The reality is that many organisations opt for a hybrid cloud environment. This allows them the opportunity to host company-sensitive applications on the private cloud, and more generic services on the public cloud, thereby providing an appropriate balance of cost, risk and flexibility. In addition, virtual private clouds are also evident - these are computing resources provided within a public cloud environment but with additional security features embedded to provide a solution from other organisations using the same public cloud. Amazon virtual private cloud is an example of a VPC.

Research undertaken by the UK IT recruitment site, CWJobs.co.uk suggests that over two-thirds of IT professionals are unsure how to become skilled in cloud computing, despite recognizing that there are career opportunities in cloud (Flinders, 2013). An article in Forbes magazine cited eight essential skills for cloud computing (McKendrick, 2012):

- Business and financial skills
- Technical skills
- Enterprise architecture and business needs analysis
- Project management skills

- Contract and vendor negotiation
- Security and compliance
- Data integration and analysis skills
- Mobile app development and management skills

While this list gives an indication of the general categories of skills, in reality, the precise skills required are likely to vary according to the cloud service model and cloud deployment model. A separate research study undertaken by DTI for the European Commission investigates skills requirements for cloud computing, cyber security and green IT in greater detail (Søndergaard Laugesen et al., 2012).

In a 2012 white paper on cloud jobs (Anderson & Gantz, 2012), IDC found that certification, training and experience were three of the top four most important characteristics used by hiring managers in selecting candidates for cloud-related jobs (the fourth criteria was "potential"). IDC remarked that due to the anticipated high levels of growth in the market, possibly up to 7 million cloud related jobs in IT worldwide by 2015, and the relatively low numbers of professionals with cloud experience, it was likely that training and certification would play an important role in preparing candidates for new roles in the organization.

Social tools and technologies

Although no formal agreed definition exists, social tools and 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, video conferencing, blogs, collaborative document editing, wikis, podcasts, and crowdsourcing. In practice, there are innumerable examples, as potentially social functionality could be added to any application that involves interactions among people. In terms of the usage of such tools, it is estimated that almost 1.5 billion people used social networks regularly in 2012, with one billion members joining since 2009 (Israel, 2012). The same author also estimates that over the period 2006 to 2012, social media has enjoyed the fastest rate of adoption in the history of technology.

Adoption within businesses has not been so rapid, and was first met with opposition within companies. However, nowadays it is commonplace for organisations to use social technologies for activities such as marketing communications, support, internal and external collaboration, product development, talent sourcing, and even to raise finance (e.g. Kickstarter). It is estimated that approximately 70% of companies use social technologies, with 90% of those companies using social technologies reporting some business benefit from them (Chui et al., 2012). However, it is also believed that most organisations are far from capturing the full potential value of such technologies at this point in time. A recent study commissioned by Google EMEA found:

- A third of professionals are using external social media (e.g. Google+, Facebook, LinkedIn) for work related purposes every day
- 25% are using in-house social tools daily, and over 50% use them at least once per week

- Among the population of users, senior managers were using them more frequently than staff in more junior roles (71% versus 49%)

The potential benefits of such technologies are significant. For example, the McKinsey Global Institute and International Data Corporation (IDC) estimate that the use of "social technologies to improve collaboration and communication within and across companies could raise the productivity of interaction workers by 20 to 25 percent" (Bughin et al, 2012). McKinsey also estimated in the four industry sectors they examined, social platforms could unlock $900bn to $1.3 trillion in value annually. As companies start to embrace digital technologies, and as companies engage within digital global value chains, it is possible that social computing will become even more important as a mechanism for supporting relationships between enterprises in a digital ecosystem.

There appears to be differences in the level of support for social tools in different countries. For example, a 2013 survey (Microsoft, 2013) revealed that in China and India, greater numbers of users feel that social tools have increased their productivity in comparison to some countries in Europe. In this respect, there appears to be some correlation with the level of usage, in that the countries where the tools are most common appear to derive the greatest perceived benefit.

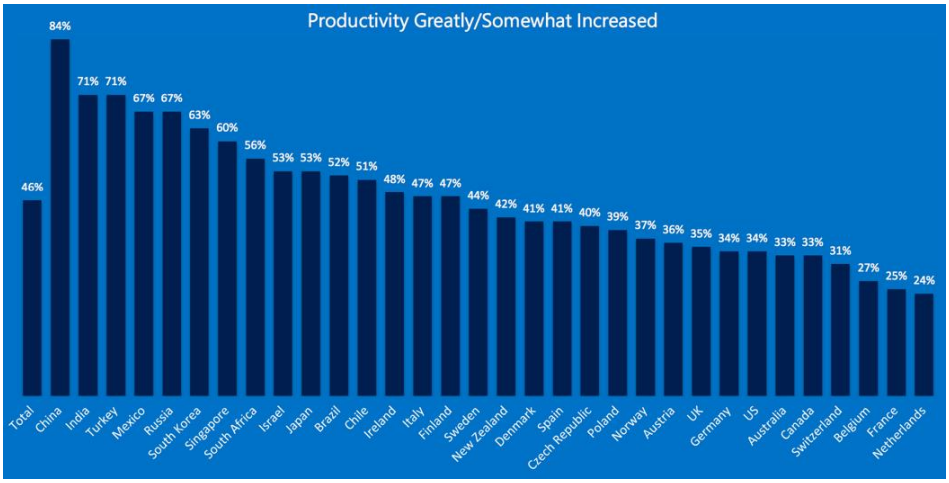


Figure 25: Impact on productivity (by country) - "productivity greatly/somewhat increased".

In terms of basic skill sets, there are relatively few technical skills required in order to utilize social technologies in the business, as typically off-the-shelf packages are used (e.g. Yammer). Some configuration management and operational management activities are required as well as appropriate governance policies. Relevant user skills for social media are essential in order to derive value from the tools. For example, users must understand expected behaviours, such as encouraging a positive attitude to sharing and collaboration, in addition to more specific functional skills, such as digital marketing. Reflecting this situation, companies do not appear to be prioritizing hiring in this area, with only 6% of companies rating social/collaboration as one of their top

two priorities, and only 16% planning to rely mostly on hiring to meet the need for such skills (Murphy, 2012).

In this respect, social technologies are often combined with analytical tools in order to provide additional insight into the social interactions and behaviour of employees, suppliers and customers in order to improve the effectiveness of such communications. Similarly, social tools are now moving increasingly into the mobile domain. One survey suggested 65% of companies use at least one social tool on mobile (Bughin and Chui, 2013), requiring a relevant mix of social and mobile skills in order to deploy the technology appropriately.

When using tools to encourage collaboration, the main concerns of company leaders related to the risk of confidential information or intellectual property being leaked, or misuse of social sites reflecting negatively on company reputation.

Cyber security

Cyber security is the measures taken to protect a computer or computer system against unauthorized access or attack (Merriam-webster.com). There is undoubtedly an increasing awareness of the importance of cyber security. In 2009, President Obama stated "it's now clear this cyber threat is one of the most serious and national security challenges we face as a nation". Within Europe, the Cyber Security Strategy of the European Union states that "across the EU, more than one in ten Internet users has already become victim of online fraud" (European Commission, 2013b).

A 2013 report into the economic impact of cybercrime and cyber espionage (Center for Strategic and International Studies, 2013) identified six components to losses from cyber-crime and cyber espionage:

- Loss of intellectual property and business confidential information
- Cyber-crime
- Loss of sensitive business information, including negotiation strategies
- Opportunity costs, including service and employment disruptions, and reduced trust for online activities
- Additional cost of securing networks, insurance and recovery from cyber attacks
- Reputation damage to the hacked company

The report estimates that the cost of cyber espionage and crime could be as high as 0.5% to 1% of national income, and states that globally the losses could be worth $100 billion to $500 billion. On the basis of a $100 billion loss, it estimates that this could equate in the US to approximately 508,000 lost jobs and if these jobs are in high paying roles, there would also potentially be a knock-on effect on other workers.

In an international, IBM survey of IT decision-makers (IBM Center for Applied Insights, 2012), security concerns ranked "as the most significant barrier to adoption across mobile, cloud computing and social business". "Securing and controlling access to data was placed as the number 2 barrier to adoption for business analytics". This response reinforces the importance of cyber security reaches across the

enterprise, with corresponding implications for policy and process development. As Europe continues its transition to a knowledge-intensive economy, reliance on the security of information and knowledge increases. This poses risks to economic and societal wellbeing in the event of inadequate information security practices.

The 2013 Global Information Security Workforce Study (Frost and Sullivan, 2013) surveying over 12000 respondents found the following:

- 56% of respondents believed there was a workforce shortage
- Almost 70% view certification as a reliable indicator of competence

Skills in demand are typical skills but all with specialist security expertise including applications development, security monitoring, network engineering, enterprise architecture, information assurance and regulatory compliance, and mobile device management, as well as more specialist security skills including security information event management, intrusion detection, data loss prevention, ethical hacking, and digital forensics. Given the parallel technological trends underway, it is no surprise that there is increasing demand for cyber security experts with experience in BYOD/consumerisation, mobile and cloud, as well as expertise in active defence mechanisms, such as placing false information, and decoy servers. While most press coverage relates to corporate firms falling victim to hacks, SMEs are increasingly becoming the target of hackers and cyber criminals, in many cases, because they are perceived as "soft" targets (Hayes and Bodhani, 2013). For this reason, SMEs will also require access to security expertise, even if they do not retain such expertise on a full-time basis in-house.

Bearing in mind the sensitive nature of cyber security work, it is work that is unlikely to be offshored, as most organisations (particularly larger organisations) are keen to retain control over decisions on risk management.

Mobile

In 2013, both the Apple App store and Google Play exceeded the 50 billion downloads threshold. In both cases, half of the total downloads occurred in the past 12 months. Mobile technologies are changing society and business. IDC estimates that smart mobile devices will generate 57% of the IT industry's overall growth worldwide (Gens, 2013). Given the proliferation of mobile devices and acceptance of them as business tools, enterprise mobility is an important trend driving new skills requirements for ICT practitioners.

While there is an organizational 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 (Murphy, 2012). Only 17% of companies planned to rely mostly on hiring new workers to address this skills deficit. While this tactic may reflect the dearth of available skilled workers in the marketplace, it is also likely that this tactic reflects the desire for companies to exploit the industry and company knowledge residing in existing workers, and also suggests the up-skilling effort to mobile environments is perhaps not as great as in some other technological domains.

Organisational impact – shadow ICT

Although not strictly a technological trend, many observers are predicting significant changes in the way in which ICT is managed and exploited within organisations. Shadow IT refers to the proliferation of IT solutions and systems that are created and used within an organization without approval or support from the centralized IT function. Shadow IT has grown substantially in recent years, spurred by more advanced ICT skills in younger workers entering the job market, from the availability of cloud-based solutions not requiring extensive upfront capital expenditure, from improvements in the ease-of-use of key technologies, and from a desire from the business for quicker and more tailored ICT solutions. Moreover, some organisations believe that ICT is now synonymous with their brand identity, according to John McCarthy of Forrester, and do not want "to abdicate responsibility to IT departments" (Schectman, 2013).

In some organisations, shadow IT is perceived negatively as in some cases it has led to the creation of separate IT fiefdoms and data silos that do not collaborate with other areas. Conversely, due to its proximity to the business, it is also perceived as being more responsive to business needs. According to analyst reports "more than 90% of business units are spending their own funds, outside the formal IT budget on technology" (Schectman, 2013). Similarly, Gartner estimates that in the year 2000, only 20 percent of technology spend was taking place outside of IT. In contrast, it predicts that the figure will be 90% by the end of the decade. Even in the absence of shadow IT, fundamental changes in the activities of IT departments have been predicted for many years, with a shift from operational "keep the lights on" IT to increasing the amount of time spent on more value add activities such as IT-enabled innovation, business processes, design and build, and client relationships (Curley, 2004; INSEAD & CIONET, 2013). The trend is important as the types of skills that people working in the business possess are likely to be different from the traditional IT environment, and require a far greater understanding of the business. Some suggest that IT will become more akin to a consulting services facility helping to provide advice, as well as dictating policy and enforcement to facilitate greater consistency and sharing between business units. In this respect, the on-going examination of e-leadership and digital entrepreneurship and intrapreneurship skills is likely to prove particularly relevant in this emerging organizational landscape. This is reinforced by the emerging new breed of IT leader, the Chief Digital Officer (CDO). The emergence of the CDO may also bring about changes in future careers for ICT professionals. A recent analyst study revealed that only 1 of 229 CEOs believed that the CIO was primed to be their successor. In contrast the CDO, with a far greater contribution to the business from ICT, might fare much better, and in turn be well placed to provide future opportunities for ICT workers (Schuchart, 2012).

Offshoring of emerging technology markets

A research note issued by Nomura bank suggests that Indian IT outsourcing providers are not pursuing emerging technology markets such as cloud and analytics as actively as global competitors. Instead, Indian companies appear to be more focused on acquisitions in established markets such as technology platforms, IT services and industry solutions (Swabey, 2013b). IBM and Accenture acquired 20 companies in

new tech markets and 9 in established markets. In contrast, the top five Indian suppliers acquired just four companies in emerging markets, but eight in established markets. The analysts responsible for the research, Mehta and Pappan, posited that Indian companies are more focused on building capacity for "geographical expansion and greater depth in industry solutions" (Swabey, 2013b).

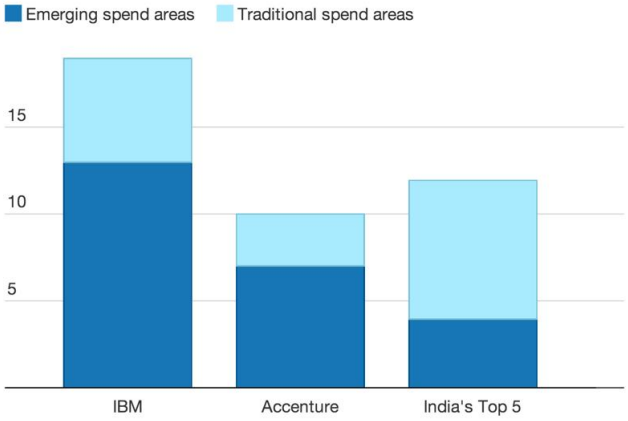


Figure 26: Acquisitions in new technology markets versus traditional established markets (Source: Swabey, 2013b).

Macro-economic and societal trends

In this section, the macro-economic and societal trends that are likely to impact on the future need for skilled workers are examined. These include economic growth rates, global demand for labour, salaries, educational attainment, and youth unemployment. Understanding these trends is valuable as it helps to provide some insight into how globalisation may evolve over time. In examining the various trends, this section of the report is divided into three basic segments: Landscape, Terrain and Horizon:

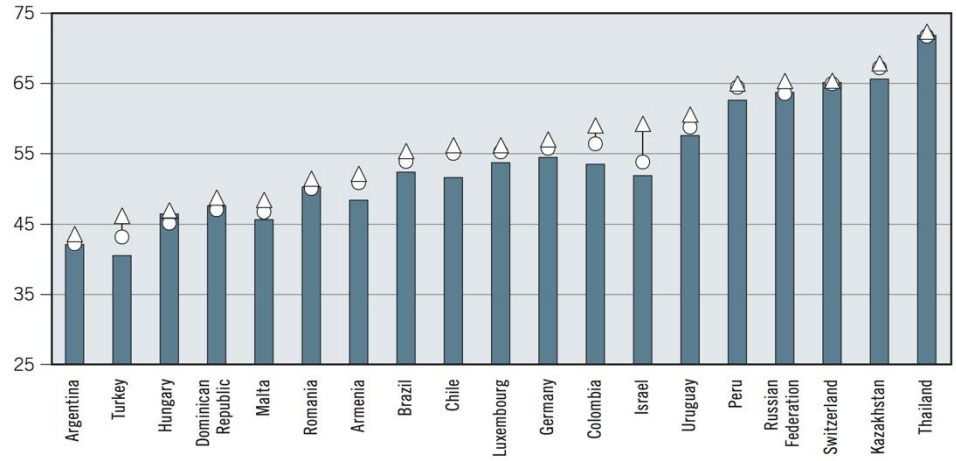
In order to provide the reader with an overview of the current picture, the overall landscape is examined initially.

Landscape describes the current global macro-economic and societal landscape

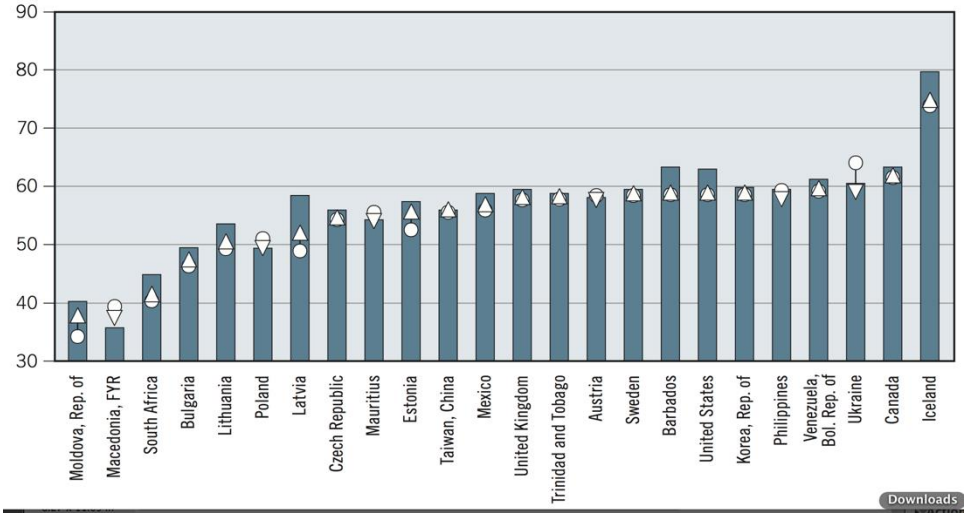
Global labour market

The International Labour Office estimates that there was an accumulated total of 197 million people without a job in 2012 (International Labour Organisation, 2013). A different study from the same organisation reports that employment rates across emerging and developing economies will return to pre-crisis levels in 2015 based on current trends, whereas in advanced economies this will only occur after 2017 (International Labour Organisation & International Institute for Labour Studies, 2013), underlining a slower rate of recovery in these developed economies. This pattern can be seen clearly in Figure 27 (Panels A, B and C), showing the different rates of recovery in three different economic groupings.

Panel A: Countries above pre-crisis levels



Panel B: Countries with improved rates but below pre-crisis levels



Notes: Employment rates represent employed persons aged 15 or more as percentage of the same-age population.
Data for Barbados, Mauritius, Russian Federation, South Africa and Ukraine correspond to third quarter, for Sri Lanka and Switzerland, to second quarter and for Trinidad and Tobago, to first quarter.

■ 2007 Q4
○ 2010 Q4
△ 2012 Q4

Source: IILS estimates based on Eurostat, ILO Department of Statistics and national sources.

Panel C: Countries with continued deterioration

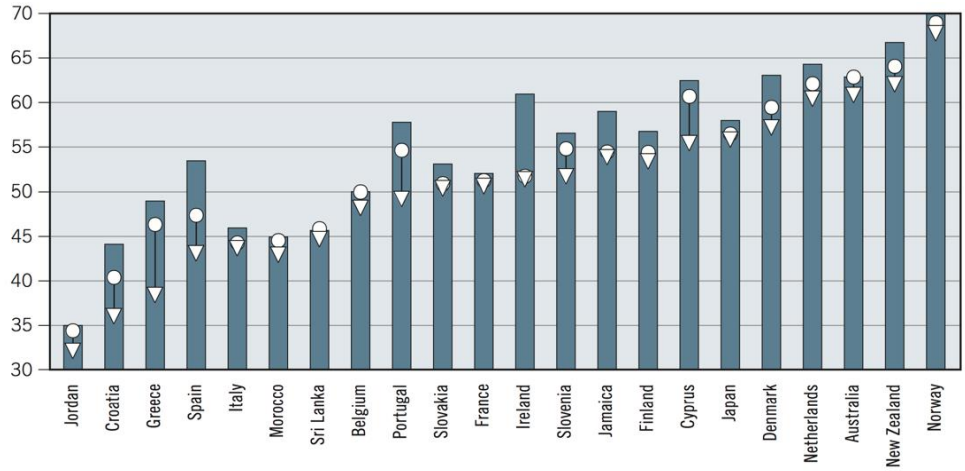


Figure 27: Employment percentage rates in the fourth quarters of 2007, 2010 and 2012 (Source: ILO/IILS, 2013).

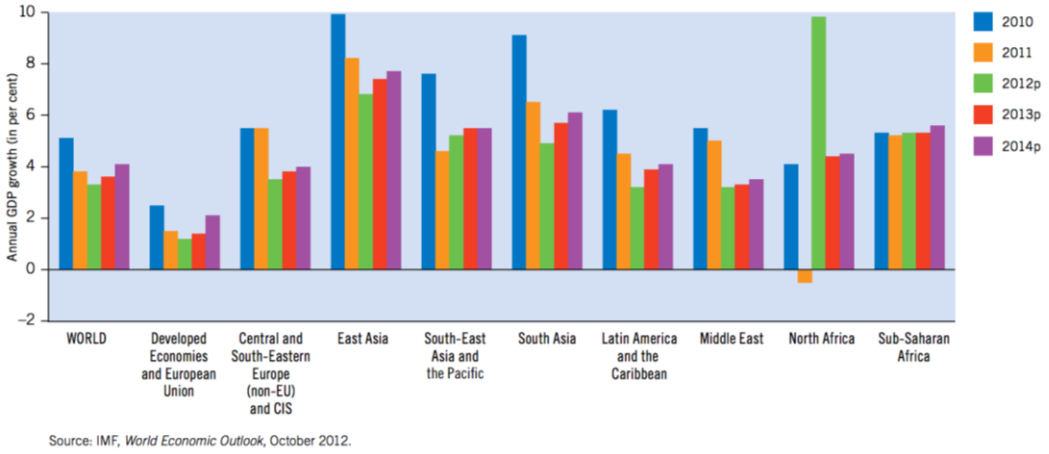
In parallel with increasing numbers of people in employment, there will also be increasing numbers in unemployment in the world. It is estimated that approximately 208 million people will be unemployed in 2015 unless policies change course (International Labour Organisation & International Institute for Labour Studies, 2013). The ILO also report that labour force participation rates decreased in the period 2007-2012 in more than half of the countries analysed, suggesting that some workers have become discouraged and are no longer actively looking for employment. Certainly, in advanced countries, spells of unemployment have lengthened and this may be driving disillusioned workers out of the labour market.

In a 2012 discussion paper, McKinsey estimate that there are 40 million workers across advanced economies that are unemployed, at a time when businesses are complaining that workers lack the skills they need. Their conclusion is that "labour market institutions and policies have not kept up with the changes in business practices and technology that are defining what kind of jobs will be created and where they will be located" (McKinsey Global Institute, 2012a).

Looking to the future, it is estimated that the world needs to create over 500 million new jobs by 2020 to provide career opportunities for people who have jobs now as well as youths who will join the workforce (International Labour Organisation, 2013). However, it is also recognised that new jobs will typically require competences that the unemployed do not possess. Consequently, it is important that effective supporting policies are put in place to re-skill jobseekers.

Global growth rates

Figure 28 illustrates the different rates of economic growth that world economies are experiencing – the slow rates of growth of developed economies are only a fraction of the growth rates being experienced in developing countries, underlining the important shifts that are occurring in economic importance.



Source: IMF, *World Economic Outlook*, October 2012.

Figure 28: Global and regional GDP growth estimates (annual % change) and projections 2010-2014 (Extracted from ILO/IIL, 2013).

Rates of growth are experiencing dramatic changes in different regions. For example, East Asia which has experienced high growth rates 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. Figure 29 illustrates some of the emerging trends at an individual country level (PWC, 2013).

The global growth leaderboard is changing

Growing but susceptible to disruption

Poland	3.4%	France	1.2%
Australia	3.1%	Japan	0.9%
Canada	2.3%	United Kingdom	2.1%
United States	2.4%	Netherlands	1.1%
Germany	1.3%	Ireland	2.2%

Growing and accelerating

Indonesia	6.2%
Brazil	4.0%
South Africa	3.6%

Struggling to grow

Italy	0.3%
Spain	0.9%
Portugal	0.5%
Greece	0.6%

Growing but decelerating

China	7.3%	South Ko rea	3.6%
India	6.6%	Mexico	3.7%
Saudi Arabia	4.2%	Russia	3.8%
Turkey	5.1%		

Aggregates Eurozone 1.0% Global (market rates) 3.0%

All percentages are projected 2013-15 average growth rates. Sources and methodology: PwC analysis, national statistical authorities, Thomson Datastream and IMF. The tables above form main scenario projections and are therefore subject to considerable uncertainties.

Figure 29: Global growth leaderboard (Source: PWC, 2013).

These changing patterns of growth are important, as they are likely to influence the levels of domestic demand and salary levels in each country, which in turn can impact on its attitude to offshoring, both as a provider or buyer.

Salary differentials

Although GDP growth is not necessarily an indicator of growing salaries due to differences in the distribution of wealth, there is growing evidence to suggest that the wage differentials that existed between European and developing countries has narrowed, and is continuing to decrease. The Financial Times recently commented that wages are increasing by at least 10 percent per year for skilled and semi-skilled workers across all industries. Nonetheless, the differences are still substantial. For example, the same article stated that "an engineer in India is about 10 times less expensive than his or her equivalent in Germany. An entry-level salary for a graduate coming into an IT outsourcing company in a big city is about 9,000 rupees ($180) a month" (Lamont et al, 2013).

However, there are also local dynamics shaping the domestic labour market. For example, in China a 2011 survey revealed that nearly half of college graduates who found employment started at wages below those of migrants working in factories and construction sites (Davis, 2013). On the one hand, this trend illustrates the high demand for relatively unskilled labour to work in manufacturing in China, but it also suggests that the market for highly skilled labour is relatively immature. In this respect, the Chinese government's understandable desire to up-skill its population in the longer term may be ahead of actual demand in the marketplace for such skills.

Youth unemployment

The global situation regarding youth unemployment gives some cause for concern. Using figures from ILO, OECD and 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" (The Economist, 2013). In Greece, Spain and South Africa, more than half of young people are unemployed (McKinsey Center for Government, 2013). The impact of this trend is likely to be felt for many years as this population is likely to find it more difficult to develop the skills necessary to advance in the future. There is also the risk that the next wave of school-leavers/graduates will be perceived as more attractive to employers than a group who have remained unemployed for a prolonged period of time. In essence, there is a risk that much of the current generation of young unemployed will be "leapfrogged", remaining unemployed for a significantly long time period, with a corresponding attenuation of any skills acquired in the past, creating a repeating vicious circle.

In 2011, Mr Laszló Andor, EU Commissioner for Employment, Social Affairs and Inclusion estimated that the burden on society of current youth unemployment levels is approximately €2bn each week, or just over 1% of EU-27 GDP (European Commission, 2011). Putting this figure into context, John Vasallo (VP of EU Affairs for Microsoft) noted that "absorbing just 20% of youth who aren't in employment or training into the European labour market would thus save Member States more than €21 billion per annum collectively." (Vassallo, 2012)

At the same time, a McKinsey report identified that across the nine countries it polled - Brazil, Germany, India, Mexico, Turkey, Morocco, Saudi Arabia, UK and the US, only 43 percent of employers surveyed agreed that they could find enough skilled

entry-level workers (McKinsey Center for Government, 2013), potentially impacting on economic productivity. Figure 30 shows the extent to which employers believe that skill shortages are the leading reasons for entry-level vacancies – on average 39%.

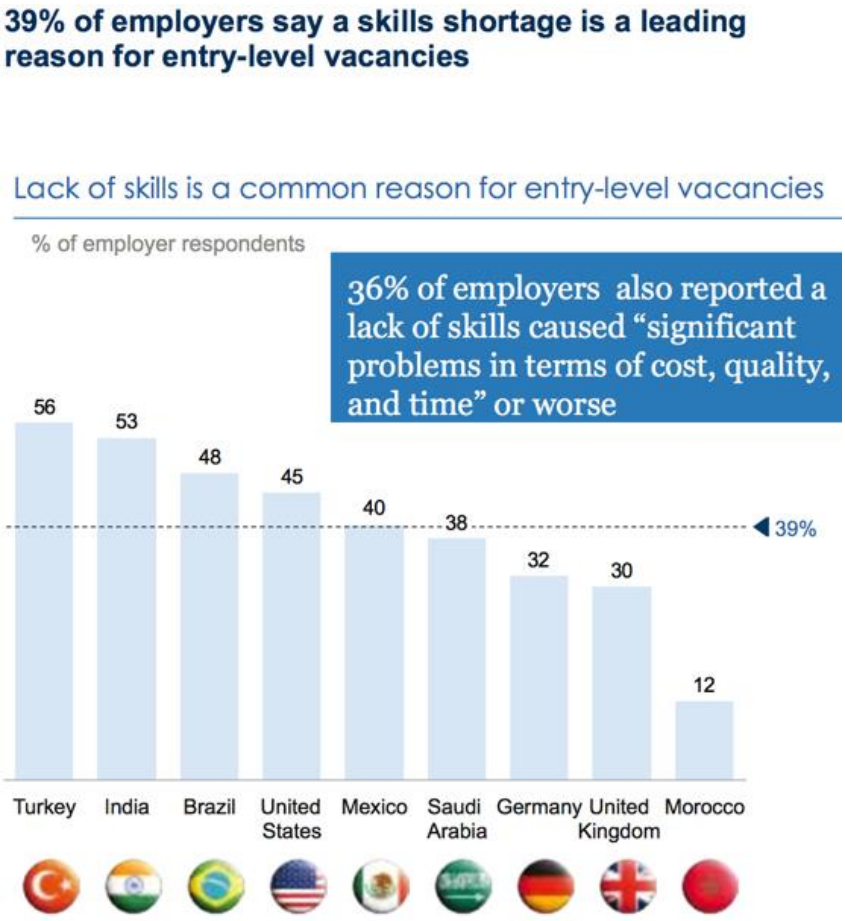


Figure 30: Employers citing lack of skills as a cause of entry-level vacancies (Source: McKinsey, 2012).

Together, these two divergent patterns of youth unemployment and inadequate availability of skilled entry level workers illustrate the nature of the current skills gap and underline the importance and need to improve skills development for this age group, in parallel with efforts to create jobs. The same report also identified a pattern that may have contributed to employer views on skill shortages, namely that less than 45% of both students and employers felt that graduates/new hires were adequately prepared for entry level positions in the job market. In contrast, 72% of education providers felt the same (McKinsey Center for Government, 2013). Such divergence of opinions may suggest that education providers are not as sufficiently close to the market as might be required.

Terrain Describes some of the key factors shaping the landscape

Global demand for skilled workers

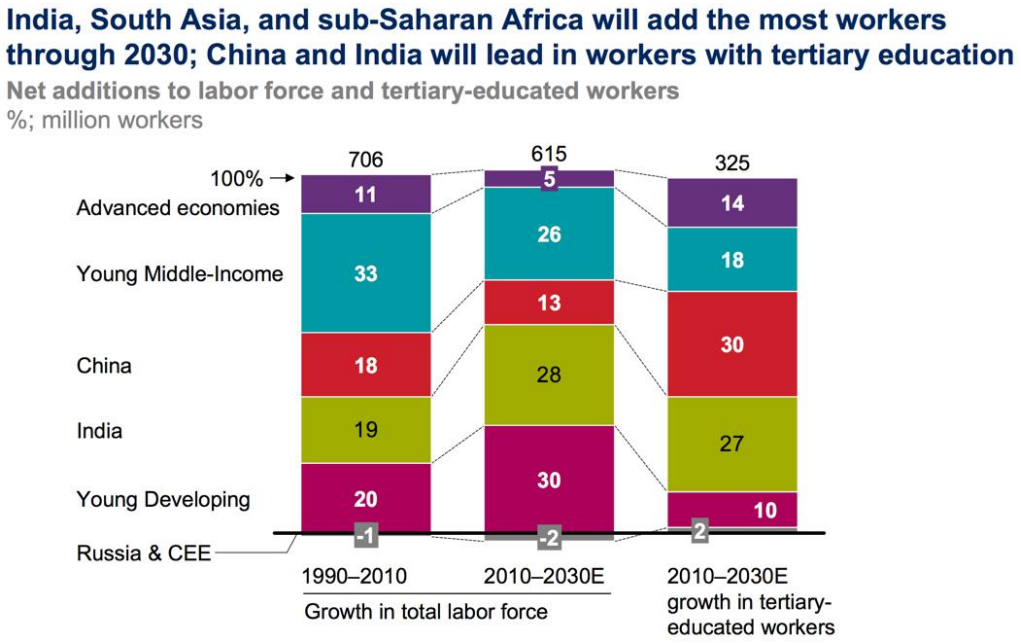
The World Economic Forum report on global talent was clear in its diagnosis of the problem: "the Northern hemisphere faces talent shortages in a wide range of occupational clusters largely because populations are ageing rapidly and educational standards are insufficient….Many countries in the Southern 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" (World Economic Forum & Boston Consulting Group, 2011).

In setting out its view of the likely supply and demand of labour over the next twenty years based on current patterns, the McKinsey Global Institute reported that "there will be far too few workers with the advanced skills needed to drive a high productivity economy and far too few job opportunities for low-skill workers" unless concerted public and private efforts are put in place (McKinsey Global Institute, 2012). Although not specific to ICT, the report estimates that there will be a potential shortage of approximately 38 million high-skill workers, equivalent to 13 percent of demand for such workers. Equally alarmingly, it projects a potential surplus of approximately 90 million low-skill workers.

The impact of such trends in advanced economies include more long term joblessness, more young people without post-secondary education failing to get employment in the job market, older workers failing to quality for new jobs due to lack of relevant skills, and increasing polarization between high-skill and low-skill workers. Together, such trends are likely to slow the advance in national living standards, increase public sector burdens, and foster social tensions. The impact of such trends in developing economies will differ from country to country. In some countries (e.g. China), the shortage of highly educated workers will hamper the move into higher-value industries and hinder productivity gains. In other regions (e.g. India, sub-Saharan Africa), the surplus of over skilled workers will trap many in subsistence agriculture or urban poverty.

Figure 31, showing growth in the global labour supply, highlights some of the important demographic changes taking place. China's labour force growth will shrink dramatically, contrasting with high growth rates in India and the "young developing economies" of South Asia and Africa. However, while China's role as a provider of cheap low-skilled labour will decline, it will have a key role as a source of college-educated workers, contributing 30% of the global total reflecting the progress that China is making educationally (Note: Countries classified as "Aging advanced" are Japan, Germany, the Netherlands, Belgium, Sweden, Austria, Switzerland, Hong Kong, Denmark, and Finland. Countries classified as "Young advanced" are the United States, France, the United Kingdom, South Korea, Canada, Australia, Israel, Singapore, Norway, Ireland, and New Zealand. Countries classified as the "Southern Europe cluster" are Italy, Spain, Greece, and Portugal. Countries classified as the "Russia and Central and Eastern Europe cluster" are Russia, Ukraine, Poland,

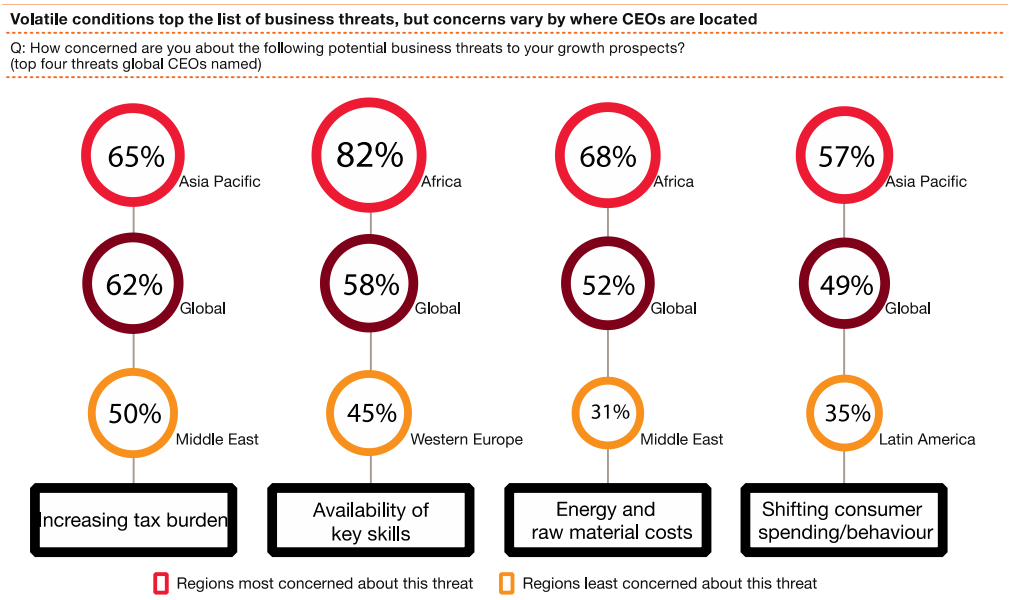
Romania, Czech Republic, Hungary, Slovakia, and Croatia. 63 Countries classified as part of this "Young Middle Income cluster" including Brazil, Mexico, Colombia, Argentina, Venezuela, Peru, Chile, Nicaragua, Iran, Egypt, Algeria, Saudi Arabia, United Arab Emirates, Jordan, Indonesia, Vietnam, the Philippines, Thailand, Turkey, South Africa, Malaysia, Sri Lanka, Kazakhstan, and Botswana. Countries classified as the "Young developing," mainly from South Asia and sub-Saharan Africa, are Pakistan, Bangladesh, Nigeria, Ethiopia, Tanzania, Kenya, Morocco, Uganda, Ghana, Mozambique, and Côte d'Ivoire).



Includes Young Advanced, Aging Advanced and Southern Europe clusters. NOTE: Numbers may not sum due to rounding. Source: United Nations Population Division (2010 revision); International Labor Organization (ILO); Global Insight; Oxford Economics; Economist Intelligence Unit; local statistics for China and India; McKinsey Global Institute analysis

Figure 31: Net additions to the labour force and tertiary-educated workers

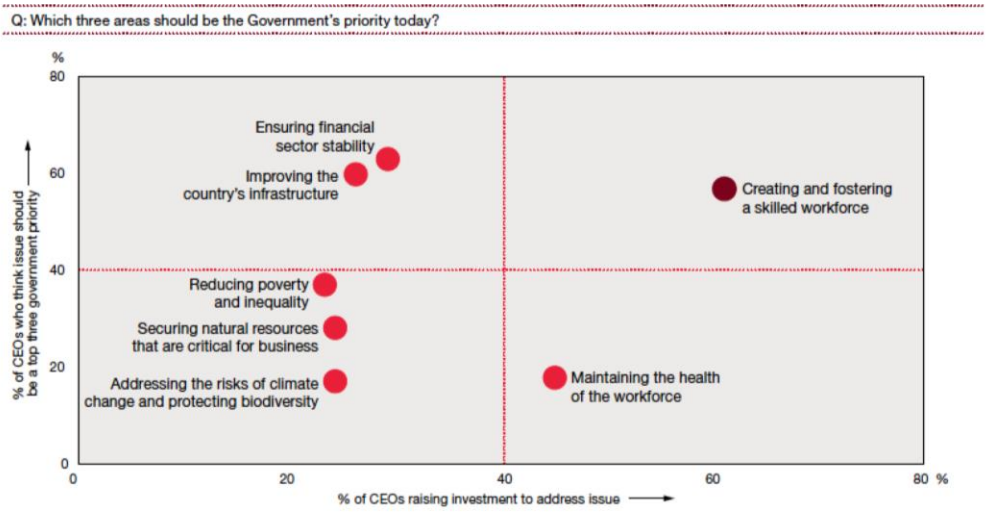
Although the concerns of CEOs varied by region, a recent survey of 1330 CEOs in 68 countries confirmed the high degree to which they view the lack of skills as a major concern (PWC, 2013).



Base: All respondents (Western Europe=312; Asia Pacific=449; Latin America=165; Middle East=32; Africa=50)
Source: PwC 16th Annual Global CEO Survey

Figure 32: Top four threats named by global CEOs. (Source: PwC, 2013).

Moreover, it is evident that CEOs feel that tackling the skills gap is a responsibility that should be shared between industry and government.



Base: All respondents (1,330)
Source: PwC 16th Annual Global CEO Survey

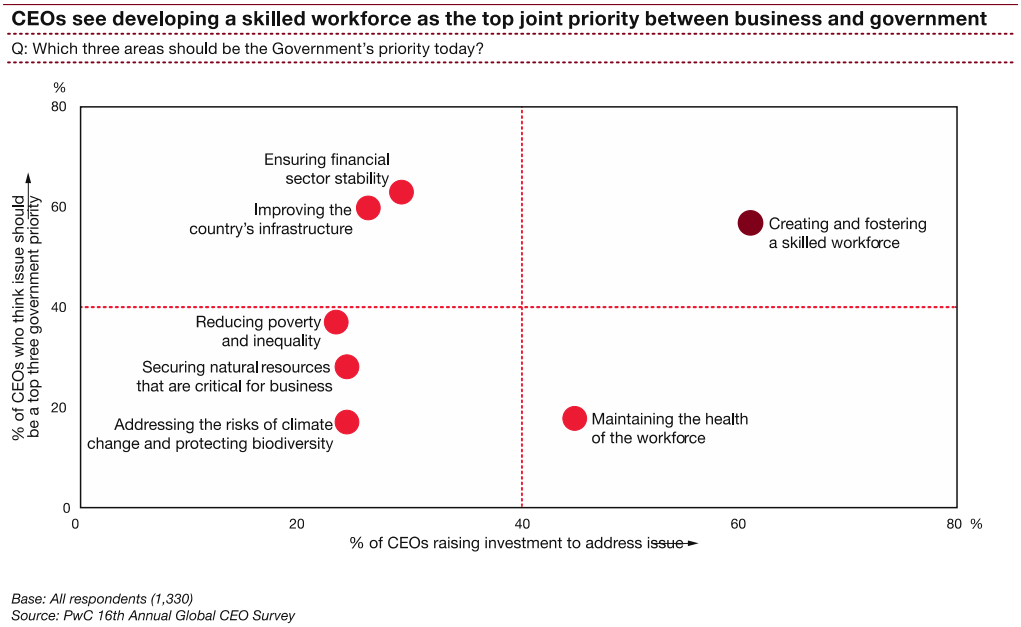


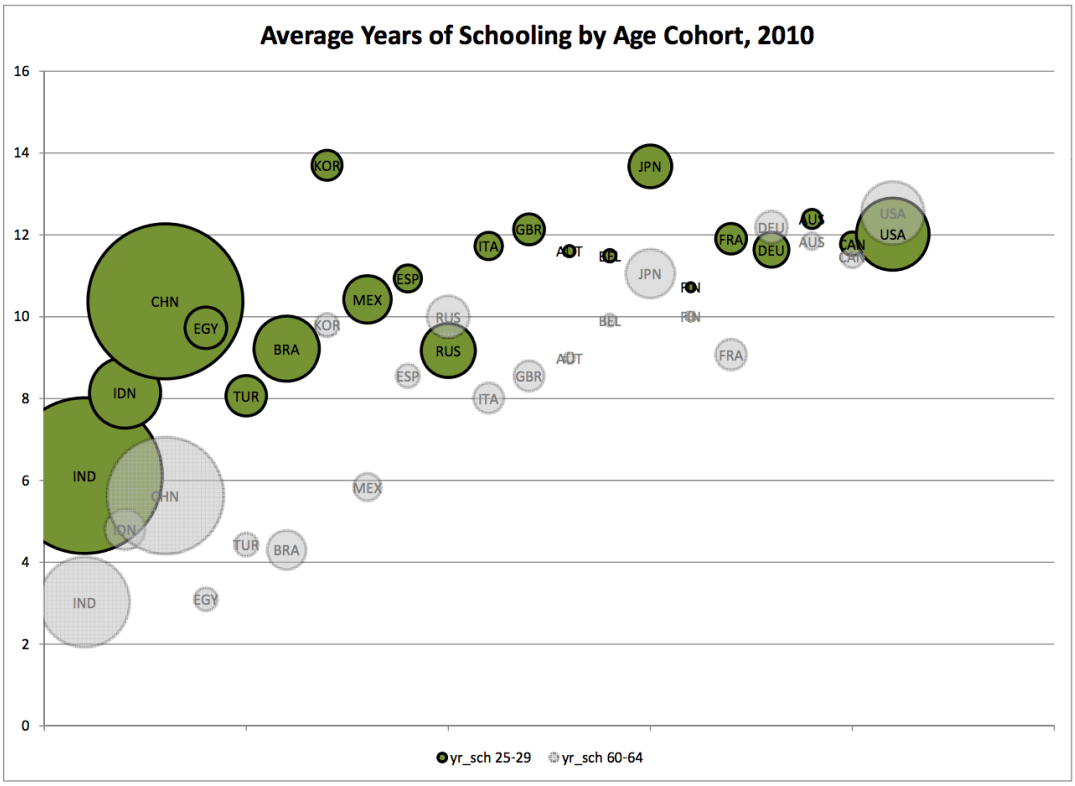
Figure 33: CEO views on investments and government priorities. (Source: PwC, 2012).

The growth of women in the workplace

The number of women in the workforce in advanced economies rose by 77 million from 1980 to 2010, accounting for 61% of the 122 million net additions to the labour forces in advanced economies. Notably, women make up a substantial portion of the percentage of college graduates in emerging economies (Hewlett and Rashid, 2010): 47% in China; 60% in Brazil; and 65% in United Arab Emirates. In Russia, 86% of women aged 18 to 23 are enrolled in tertiary education. Despite these promising statistics on growing capability, in many cases women are not permitted the opportunity to leverage this knowledge and talent in these countries often due to the prevailing cultural bias in these emerging states (e.g. women as householders and family carers; sexual discrimination in the workplace). In addition, 89% of women who voluntarily leave their jobs due to, for example, maternity leave want to return to work but only 40% have been able to find full-time, mainstream jobs (World Economic Forum and Boston Consulting Group, 2011).

Shifts in education

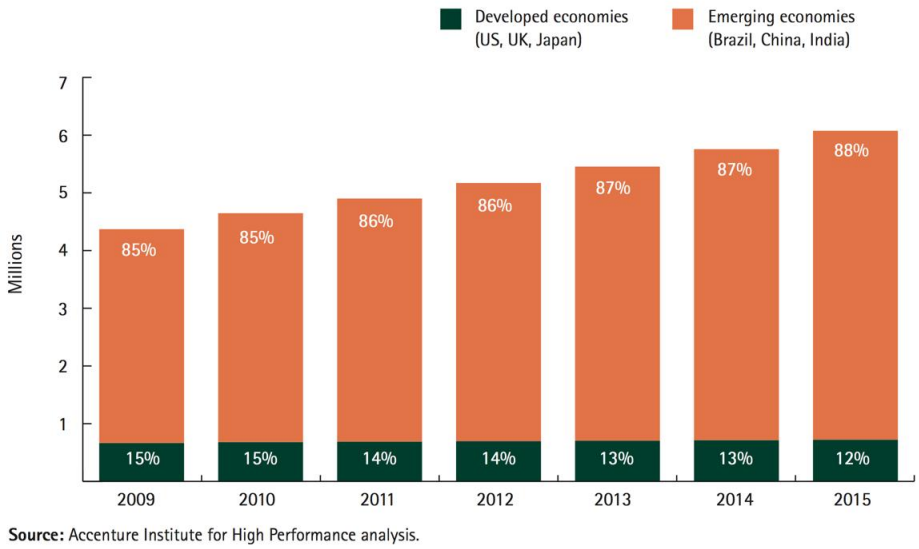
Over time, significant changes have occurred in the duration of schooling provided in developing countries (Jensen, 2011). Figure 34 outlines how the average number of years schooling differs for two age cohorts: aged 25-29 (shown in green) versus aged 60-64 (shown in grey).



Key: Years schooling for 25-29 year olds (green circles); Years schooling for 60-64 year olds (grey circles)

Figure 34: Average number of years schooling by age cohort, (Source: Peterson Institute for International Economics, 2010).

The number of years of schooling has expanded considerably in many emerging countries, but there has also been significant improvement in Japan, France and Italy, whereas US education duration appears to have declined slightly. The pattern also coincides with continuing growth in the proportion of STEM graduates in emerging countries (e.g. Brazil, China, and India) versus developed countries (e.g. US, UK, and Japan) (Craig, Thomas, Hou, & Mathur, 2012). This is an important trend as STEM students are perceived one of the main sources of IT workers.



Source: Accenture Institute for High Performance analysis.

Figure 35: Share of STEM talent in emerging and developed economies (Accenture, 2012).

The same report noted that in 2011, China produced 41% of all new university degrees awarded in science and engineering, and India produced 26%, in comparison to the other countries examined.

Age demographics

In many countries, the ageing population will be encouraged to work beyond current retirement ages. 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 and a firm that doesn't change its attitude to older workers will be left behind". These comments stem from the current DWP projections that employers will need to fill 13.5 million job vacancies over the next ten years, at a time when only 7 million people will be leaving school and college over the same period (UK Department for Work and Pensions, 2013). Many other countries are facing similar demographic challenges. China is also confronting an ageing population. By 2030, 43% of the population will be aged 55 years and older, a 26% increase on current levels (McKinsey Global Institute, 2012b). In the US, the over-60 age group is expected to increase by 32% by 2020 (Accenture, 2011).

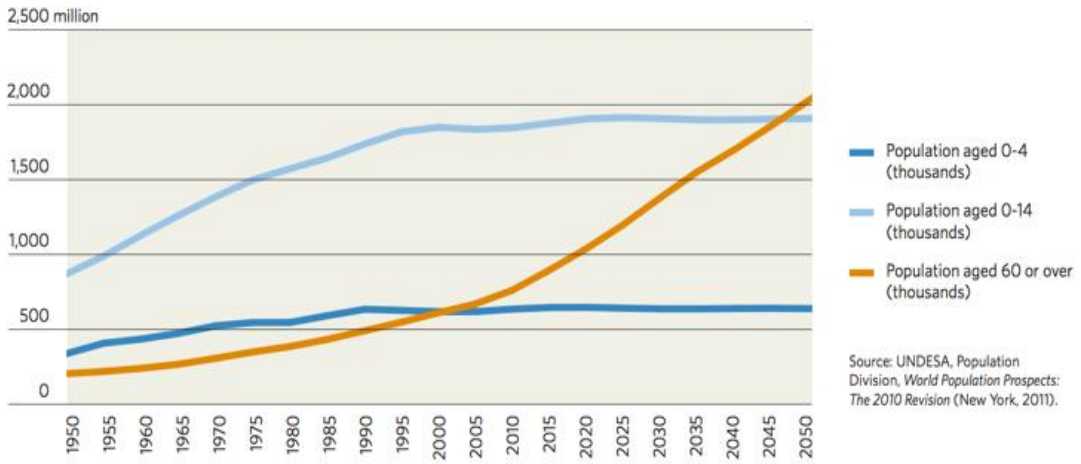


Figure 36: Population aged 0-4, 0-14, and aged 60 or over, 1950-2050. (Source: United Nations, 2012).

However, as the shape of new jobs is changing and as these new jobs become increasingly technical, it seems essential that older workers must be trained in the relevant technologies in order to facilitate their inclusion in the skilled workforce, rather than risk creating a generational subclass of cheap labour with minimal e-skills.

In contrast, India's profile is different. Representing almost one fifth of the world's population, its population is predominantly young with half of the country's population under 25 years (Accenture, 2011). While this can be an opportunity for India, the reality is that educating so many individuals is likely to prove a challenge, and the task of creating employment for this group will also be difficult.

Different roles of government

It is important to recognise that governments and businesses interact in different ways across the world, with complex interdependent relationships, in some instances stemming from government investments in business organisations. Similarly, many developing countries have poor reputations for corruption and cronyism. The World Bank rates China (91), Hong Kong SAR (2), Australia (10), Canada (17), South Africa (39)), Russia (112), Brazil (130), and India (132) (The World Bank, 2013).

Horizon Describes trends likely to form part of the landscape in the future

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. Brent Wilton of the International Organisation of Employers remarked that "by 2020, the African economy is projected to add 220 million people to the workforce, creating a continent wide labour force of more than 500 million" (Eroke, 2013). Although the majority of new employment is likely to reside in retail, hospitality, manufacturing and agriculture, the ability of Africa to engage in the ICT

industry is often understated, and is likely to change significantly in the future given the language and education levels available in some countries on the continent.

The digitalisation of SMEs

It is difficult to overstate the importance of SMEs to the European economy. There are approximately 20.7 million SMEs in Europe, representing greater than 98% of all enterprises, and these SMEs are responsible for employing over 87 million workers (67% of total employment) and 58% of gross value added (Ecorys, 2012). However, potentially more significant is the importance of SMEs to job growth. "85% of net new jobs in the EU's private sector are created by SMEs" (European Commission, 2013a). Similarly in America, "small businesses account for half of the labour force, and young firms defined as one to five years old still account for roughly two-thirds of job creation" (Kauffman Foundation, 2009). A 2010 report from the same institution concluded that when it comes to job growth in the US, start-ups "aren't everything, they are the only thing" (Kauffman Foundation, 2010).

Given the contribution of SMEs to national economies, the way in which these companies might change in coming years is important to understand, as this will impact on demand for certain types of e-skills. As reported in the World Economic Forum Global Information Technology Report 2013 (Bilbao-Osorio et al, 2013), the role of digitization i.e. "the mass adoption of connected digital services by consumers, enterprises and governments", has boosted world economic output by nearly $200 billion over the past two years and created 6 million jobs. Given that most companies remain at a low level of maturity with respect to digitization, there is considerable scope for further value-add in future years.

"Digitise and digitalise are often used interchangeably. Digitise is commonly used as a term to refer to the process of creating a digital version of a physical/analogue copy. Strictly speaking, digitalization does not exist as a word, but is now gaining currency in the business context, as a term used to refer to the broader transformation to a digital enterprise (incorporating corresponding changes to its business model, processes, products, relationships, etc.)" (McDonald, 2012). The capability to envision and create value from the process of digitalisation is likely to be an important source of change in the required skill sets of SMEs, particularly, but not exclusively relating to ICT skills.

As stated in the 2012 'Communication on a Stronger European Industry for Growth and Economic Recovery' "anticipation is essential to investments in human capital….one of the main challenges remains to define the employment and skills needs and invest accordingly" (European Commission, 2012b). The Commission also highlighted that in this respect, "high-growth small and medium size businesses capability to anticipate employment and skills needs is much more limited as compared to large companies, hence the compelling need to boost their capacity to anticipate and make the appropriate choices in terms of human capital investments….with a view to fully tapping their potential to drive innovation and growth in Europe".

However, while SMEs, including start-ups, have the potential to benefit substantially from digitalization and from harnessing ICT in general more effectively, the reality is that many such organisations find it difficult to attract people with the right skills, as

larger organisations are better placed, in many instances, to offer improved remuneration.

Appetite for entrepreneurialism

Given the growing importance of SMEs to global economies, there will be a continuing need for entrepreneurs to start new enterprises, particularly digital enterprises. As such, it is vital that cultural attitudes foster and support a positive view of entrepreneurs as a career choice.

A recent study (Zhang et al, 2013) comparing 800 engineering students at elite universities in China and the USA identified significant differences in students' plans to join a start-up or work in the state/government sector. While both students from China and the US expressed a strong interest in starting or joining a start-up business (50% and 65% for China and US respectively), very few (less than 3%) Chinese students ranked this in their top career plans in contrast with 22% of American students indicating this. While this difference may be attributable to the current start-up climate and support infrastructure for start-ups in China, the finding is significant, particularly if China is hoping to repeat the pattern of innovation-fuelled growth experienced by developed countries in recent years to sustain its own growth plans over the next 15 years. Currently, there appears to be limited appetite for risk among students, with many preferring a role as a civil servant than as an entrepreneur.

Moreover, concerns have been voiced over the ability of Chinese students to innovate. Li Hongbin, an economist at Tsinghua University specialising in education, remarked "the current education system does not produce people who are innovative….that makes it harder for the country to reach its long-term goal of building an innovative society" (Davis, 2013).

Changing employment perspectives

While large numbers of graduates can be beneficial for an economy, this is only true if the relevant employment opportunities exist. In China, there appears to be a disconnect between the number of graduates being produced and the number of jobs available. Although unemployment among college graduates of all ages is approximately 3% (Davis, 2013), the figures for recent graduates are substantially worse. Commenting on statistics from the Ministry of Human Resources and Social Security, Forbes magazine reported that only about half of the current year's 7 million graduates had found jobs in May (Chang, 2013). It suggested that this disconnect may have stemmed from a rapid expansion of the university system at the end of the 1990s, coinciding with a decline in Chinese growth rates. The growth in Chinese graduates is remarkable. The annual number of graduates has increased by more than five million in a single decade. Putting this into perspective, the United States produces only three million graduates per annum (Bradsher and Wong, 2013).

Citing Beijing as an example, official statistics indicate a year-on-year decrease in job vacancies for graduates in Beijing of 14%, representing 98,000 jobs (Sharma, 2013). It seems possible that the Chinese economy has not progressed as rapidly up the value-chain transformation as might have been anticipated, creating a divergence between the skill-sets of graduates and the less sophisticated skill sets required in the

current job market. This disconnect is reinforced when examining the differing rates of unemployment by educational attainment. A 2012 study found that 16% of men and women with college degrees aged 21-25 were unemployed. In contrast, only 4% of those with an elementary school education were unemployed, reflecting the continuing demand for lower-skilled, manufacturing related employment (Bradsher and Wong, 2013). This pattern lies in sharp contrast to employment trends found in America and other developed economies, where college educated graduates consistently enjoy higher rates of employment and remuneration than lower skilled employees. However, it is a pattern that other economies such as those in Latin America, Korea and India have experienced in the past. In those instances the excess number of skilled graduates often resulted in a "brain drain" where graduates emigrated to the US and Europe seeking employment opportunities. According to Chinese government statistics, between 1996 and 2011, 2.2 million Chinese students went overseas to study and only one-third returned (Davis, 2013). Similarly, in India, the market has changed dramatically in the past year. Nasscom estimates that IT companies hired only 200,000 people in the past year, approximately 50,000 less than the previous year (Sachitanand, 2013). This contrasts sharply with the period 2003-2008, when the industry grew at a compounded annual growth rate of 33% (Mishra, 2013).

The Boston Consulting Group (Boston Consulting Group, 2012) believes that annual consumer spending in China and India combined will reach $10 trillion by 2020, with 1 billion middle class citizens, including 135 million of these college-educated. This will radically change levels of domestic demand, inevitably spurring increased wage costs.

The risk from protectionism

The Financial Times (2013) reported that "globalisation is the great economic theme of the past three decades". It highlights the considerable changes that have occurred in the world as a consequence of this trend, but also at the same time, identifies threats to its advance, in particular increasing financial re-regulation and a slowdown in trade liberalisation. As many major economies slow down, there is the possibility that additional barriers will be constructed in an attempt to "protect" jobs from perceived overseas threats. However, such measures seem unlikely to be effective in the longer term, given the growing evidence of the need for organisations to participate in global value chains in order to remain competitive.

The evolving division of labour

An inquiry into the Nature and Causes of The Wealth of Nations (Smith, 1776) included a discourse on the potential economic benefits of the division of labour, one of the key drivers behind economic progress for over two hundred years. A recent article in the Harvard Business Review (Malone et al, 2011) posited that we are likely to see the atomization of knowledge worker jobs into complex networks of people performing highly specialised tasks spread across the world, foreseeing "the age of hyper specialisation".

To date, the offshoring of ICT skills has mainly been confined to large software projects, and mostly with a single offshore provider involved. However, there is now

an emerging series of market solutions (e.g. TopCoder) that attempt to split work down into further smaller chunks or micro-tasks, that can be assigned to individuals that specialise in that particular and typically narrow domain. Solutions such as these allow individuals, not just SMEs, to participate in global value chains, and allow workers to develop deep expertise that can be leveraged by organisations worldwide wanting to use the skills of such experts on a temporary basis. Such solutions can create a more level playing field for competing experts, but the additional overhead of talent identification, verification and management can diminish potential benefits to organisations using this approach. However, there is considerable interest in this type of micro-task provision, and it is reported that even Google may be entering this space via Google Helpouts.

Reverse relocation

Typically, workers from developing economies migrate to developed economies in search of work. However, some companies are now encouraging workers to consider the opposite. For example, IBM established "Project Match" as a means of offering recently laid-off IBM workers with travel and visa assistance to facilitate their move to developing markets such as India, China, Brazil, South Africa and Russia (Frayter, 2009).

The conditions being offered to workers are local conditions, rather than their original contract terms. As such, there is often a substantial wage differential. This is often interpreted as an indication that the companies are solely searching out the lowest cost location, but it can also be argued that the companies want the best skilled workers located in the markets that are growing fastest so they can better understand local customer needs.

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, (Jensen, 2012), is likely to require the provision of substantial engineering, design, technical and business services. Assuming that appropriate service trade liberalization policies are in place, developing countries will be able to leverage the concentration of such skill sets in Europe to help develop their own infrastructure. Clearly, in such a situation, the potential benefits would be shared by both developing and developed countries.

Impact of globalisation on demand for ICT skills

Emerging globalisation trends

IDC estimates that the worldwide offshore IT services market (which was €29.5 billion in 2011) will increase to nearly €60 billion by 2016, with a five-year CAGR of 15.2%. The bulk of these services in 2011, approximately 68%, were captured in the

US while the EU contributed to less than 28%. This geographical split will not change dramatically in the short term. By 2016, the US will still account for the largest share of spending and the EU will remain the second largest geography.

Despite some cutbacks in the second half of 2011, IDC doesn't expect EU spending to shrink as experienced during the financial downturn of late 2008 to late 2009. Although the EU economy is still uncertain, and governments and enterprises are under renewed financial pressure, spending has been under control since the beginning of 2009 and most end users have already cut from their IT functions what was not strictly necessary. There is therefore much less room for significant spending cuts. Moreover, the economic uncertainty could accelerate the use of offshoring to gain efficiency. Other drivers include:

- IDC's user survey results show an increasing acceptance of offshoring in continental Europe. The UK has traditionally led offshoring spending and currently represents the largest spender in the EU. Other continental EU countries, Germany and France in particular, are now considering how they can use offshoring to decrease IT operational costs. Eastern EU countries are still perceived as a "provider" region rather than a buyer of offshore services. With economic conditions becoming more challenging, even companies in these countries have started considering different sourcing strategies.
- The increasing acceptance of the offshore sourcing model is also helped by the efforts offshore vendors are making to build local profiles and presence, for example recruiting "native" local Europeans for sales, marketing, consulting, and delivery functions and/or supplementing centres already located in EU countries such as Poland, Hungary, or the Czech Republic.
- Offshore providers' value propositions around high-quality services delivered at low cost resonates well with EU end users, especially in a time of economic uncertainty.

From a services perspective, IDC research shows that application-related services (e.g. application outsourcing and custom application development) accounted for the largest share of Europe's offshore IT spending in 2011. Infrastructure outsourcing will grow rapidly to 2016, while demand for custom application development is expected to soften overtime.

From a general (IT and non-IT) supply-side perspective, in a recent presentation, CSC outlined that Asia leads in delivery centre setup and expansion, led by India with the Philippines, Malaysia, and China strong and Vietnam emerging. Eastern EU countries also continue to expand and Poland is now considered a mature geography, with Hungary and the Czech Republic close behind. Other EU buoyant markets are found in Estonia, Latvia, and Lithuania. Political developments in the Middle East and Africa are causing slower growth, and Egypt has shown some drawbacks in the recent past. The UAE, Jordan, Tunisia, and South Africa are emerging. Locations such as Mexico, Uruguay, and Costa Rica remain generally attractive markets, while unfavourable currency has impacted Brazil, Chile, and Malaysia. High inflation makes Argentina and Columbia less attractive.

For the offshoring of manufacturing China is by far the most important destination. With its extensive supply of IT and engineering graduates and its English skills, India

leads in services, including IT services. Six of the ten leading cities for off-shoring are Indian (Oshri et al, 2009). IDC analysis shows that:

Intra-EU:

- German speaking countries prioritise on intra-EU engagements with such countries as Poland, Hungary and the Czech Republic.
- Romania is quite attractive to French and Italian customers.
- Due to strong ties, Baltic countries are appealing to customers in the Nordics.

Extra EU:

- India is the most attractive market for the "offshore crescent" of the UK and Nordic countries.
- Africa is popular with some French-speaking customers.
- Middle East locations including Egypt and Morocco are also being considered, because of availability of language skills, proximity to Europe and cost advantages. Geo-political issues will not significantly impact this trend.
- China is a small location for IT offshoring, in part due to language and cultural issues.

In the longer term, IDC expects low-cost EU countries to be increasingly expensive. Generally, a cost differential is still expected for the next 7–10 years. Beyond that, intra-EU engagements will become less appealing from a pure cost perspective. Moreover, an IDC's end-user survey in 2011 showed that enterprises on average rated the Indian vendors more highly than their onshore competitors in terms of their industry expertise, their cost-effectiveness, their ability to provide innovation, and their willingness to provide an excellent customer experience. Indian vendors' reputation for cost-effectiveness, service ethic, and reliability/quality give them a strong competitive advantage at a time when enterprises are still cost conscious and risk averse.

Evidence of impact

There are several debates on how global sourcing models are impacting employment in the EU. Fears around the scale of job losses strengthened when traditional outsourcers in Western developed economies rushed to hire in India as a response to the success of Indian offshore providers. EU companies can choose to offshore directly to a firm headquartered in India or indirectly to a Western firm with an offshore presence in emerging countries.

Generally speaking, more demand for offshore services creates new jobs at offshore locations. However, jobs creation in India or in any other country offshore doesn't necessarily mean that the same number of jobs is lost in the EU. Many EU companies rely on offshoring to free up resources that can be leveraged in other more critical IT or business activities. As outlined in a 2012 study from the London School of Economics and Political Science on the impact of offshoring and immigration on the employment of native workers in the US (Ottaviano et al, 2012), there could be two opposite effects:

- A direct “displacement effect" reducing the demand for native workers
- An indirect “productivity effect" where cost savings associated with offshoring increases the efficiency of the production, "raising the demand for native workers—if not in the same tasks that are offshored or given to immigrant workers, then certainly in tasks that are complementary to them".

Other analyses focus on relocation of jobs and their overall impact on employment, but overall they show a more optimistic view compared to what was feared only a few years ago. Mr Blinder of Princeton University was one of the first prominent economists to give early warning about the impact of services offshoring. In an article in Foreign Affairs in 2006, he stated that up to 42 million US services jobs could eventually be lost. However, this picture doesn't seem to have materialised. A recent study from the Hackett Group based on confidential data from corporate clients estimated 3.7 million potential job losses in the US and European business services segment between 2002 and 2016. 2.1 million of those will have been due to offshoring.

In detail, the Hackett Group estimates that large corporations in the US and Europe will move an extra 750,000 jobs in IT, finance, and other business services to India and other low-cost geographies by 2016. For IT alone, the research identified 270,000 jobs in the US and Europe would be moved offshore by 2016, of which approximately a half (135,000 jobs) would be from Europe. This decline would be almost completely attributable to offshoring, though some decline is also likely to occur as companies buy IT capacity in the form of cloud-based services. According to this study, the levels of offshoring will begin to moderate by 2014, and in the next 8 to 10 years, the flow of jobs offshore is likely to soften, as companies run out of jobs suitable for moving to low-cost countries. In addition, McKinsey stated in 2006 that 11% of service jobs around the world could "in theory" be carried out “remotely”. The study outlines how more customer-facing functions are less likely to be offshored. As such, the lowest potential is in retail, for example, where 3% of employment may be globally resourced, while packaged software could see 49% of its services work performed remotely.

In practice though, the study perceived only approximately 650,000 jobs per year across all services segments would be affected, a far lower figure than those that "in theory" could be carried out remotely. Moreover, with Asia-Pacific, Latin America and Middle East-African economies growing much faster than Western ones, the strongest driver to create a presence in emerging countries doesn't seem to be the creation of offshore locations anymore, but being close to fast-growing new markets. McKinsey estimates that by 2025, developing economies will account for almost 70% of demand for manufactured goods. Although this ratio is not applicable to all ICT goods, there is no doubt that demand in emerging countries will be much stronger than in developed regions. Hence, while in the past firms treated such emerging countries as sources of cheap labour, they are now increasingly looking for a strong local presence to benefit from their growing domestic demand.

At the same time, firms in emerging markets will increasingly want to create a presence in the most developed regions. The Rhodium Group, a consulting firm, stated that Chinese investment in the US has already created nearly 30,000 jobs there, and that by the end of the decade Chinese firms will employ up to 400,000

Americans. Overall re-shoring could generate 2-3 million jobs in manufacturing by 2020, up to 1 million of which would come direct from factory work and the rest from support services such as construction, transport and retail. According to NASSCOM, the trade body for India's IT sector, the industry has doubled the number of locals it has hired in the US in the past five years. It now employs 280,000 people there and is planning to recruit many more in the next few years. A similar trend is evident also in the EU. Establishing a presence in the EU has become a key part of offshore providers' strategy and a key driver for their success. Although there are no estimates available, there is no doubt this move has resulted in the creation of new ICT jobs in the EU region. The focus of these new hires is usually on high-level skills related to customer engagement and management of complex projects, while routine tasks remain at the off-shore location.

Consideration of determinant factors

The key factor to offshoring of ICT talent still resides in lowering costs. Nonetheless, this will need to be balanced against skills pools, secure location, and service levels. Quality is of course a key requirement. An unacceptable level of quality and customers' complaints resulted in re-shoring of some activities in the call centre business, for example. Some EU companies, primarily in the finance sector, have decided to re-locate their call centres in the EU, as engaging with customers is of critical importance and companies need to address this engagement effectively.

When Harvard Business School surveyed companies that were moving activities outside the US, 70% of them stated lower wage rates were the main attraction, but a relevant 30% also stated that they were moving to secure better access to skilled labour. As the gap in wage rates is expected to narrow, other factors will become more important. Such factors include availability of skills, structure of labour law and labour flexibility, clusters of industries/digital ecosystems, connection with universities, infrastructure, tax and regulation. Overall, the factors could be clustered in four key elements:

- Financial/cost opportunity
- Labour pool based on specific ICT skills but also language skills, and hence highly correlated to supporting the educational system
- Business environment, including elements such as infrastructure, data security/protection, digital ecosystems, government support
- Law environment, including labour law and flexibility, legal maturity and protection, taxes and specific regulations

In addition to these, companies usually take into consideration the political and economic environment and cultural compatibility.

Concluding remarks

Based on a desktop analysis of existing research, this chapter has provided a view of key issues relating to the topics of ICT professionalism and e-skills, including major global technological, social and economic trends and developments, as well as the impact of globalisation on the demand for and nature of required e-skills. What has

been presented serves to highlight a number of the complexities in this space, with differing views being held across different geographies and several new and emerging trends. As such, this chapter serves to lay the foundations for subsequent sections which examine the international dimensions of e-skills and the impact of globalisation at a more granular level.

CHAPTER 4: PRIMARY RESEARCH FINDINGS

Introduction

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. This chapter presents an overview of the main results from this research.

What sector would you describe your organisation as operating in?

Manufacturing and mining	22	0.0%
ICT and media	9	0.0%
Financial Services	11	0.0%
Professional services	6	0.0%
Government, education, health, defence	6	0.0%
Construction and real estate	1	0.0%
Distribution and hotels	2	0.0%
Retail	8	0.0%
Wholesale trade	5	0.0%
Utilities	2	0.0%
Arts and Recreation	0	0.0%
Agriculture, forestry, fishing	0	0.0%

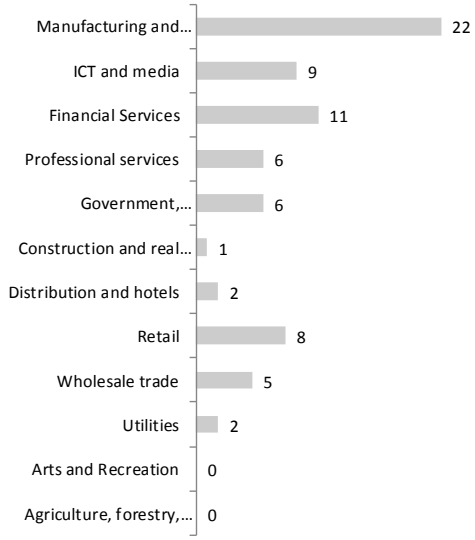
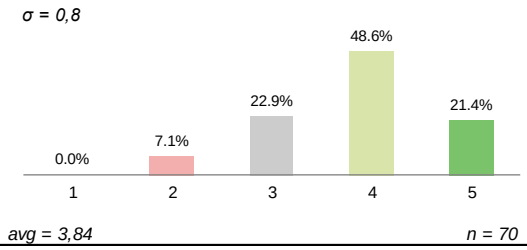


Figure 37: Profile of survey respondents

Stakeholder Vision and Strategies

Skills gap

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".		
Strongly disagree (1)	0	0.0%
Disagree (2)	5	7.1%
Neutral (3)	16	22.9%
Agree (4)	34	48.6%
Strongly Agree (5)	15	21.4%



"In our organization, a lack of availability of high-level ICT skills is negatively impacting on our ability to grow the business".		
Strongly disagree (1)	1	1.4%
Disagree (2)	13	18.1%
Neutral (3)	24	33.3%
Agree (4)	23	31.9%
Strongly Agree (5)	11	15.3%

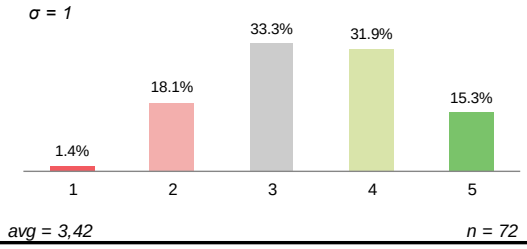
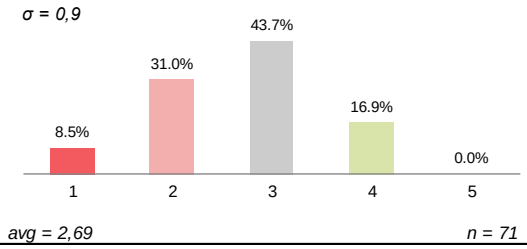


Figure 38: Perceived ICT skills gap/mismatch by survey respondents

Key Finding: Findings indicated that the majority (70%, n=49) of respondents believe there is a serious ICT skills gap/mismatch that is hampering the growth of companies. Further, almost half (47%, n=34) of all respondents felt that the lack of availability of high-level ICT skills is impacting on their ability to grow their businesses.

Impact of Offshoring and automation

What level of impact will offshoring have on the future demand for ICT skilled workers in your organisation in your country?		
No impact (1)	6	8.5%
Low impact (2)	22	31.0%
Moderate impact (3)	31	43.7%
High impact (4)	12	16.9%
Very high impact (5)	0	0.0%



What is your view on the likely impact of automation on the future demand for ICT skilled workers within your organisation in your country?		
No impact (1)	3	4.2%
Low impact (2)	14	19.7%
Moderate impact (3)	30	42.3%
High impact (4)	19	26.8%
Very high impact (5)	5	7.0%

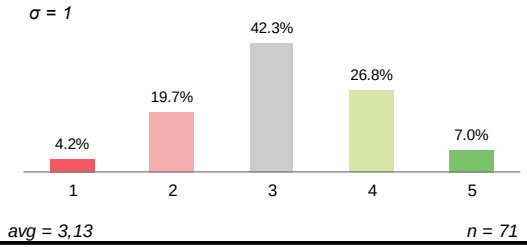


Figure 39: Perceived impact of offshoring and automation by survey respondents

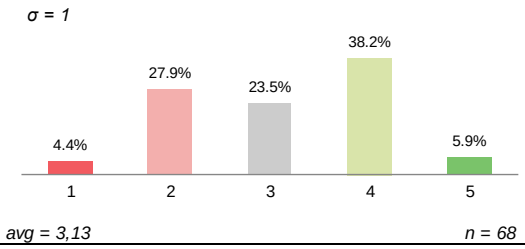
Key Finding: The majority (61%, n=43) of respondents felt that offshoring is likely to have a moderate or high impact on the future demand for ICT skills in their organization. Interestingly, however, more than three quarters of all respondents (76%, n=54) felt that 'automation' is likely to impact on the future demand for ICT skilled workers within their organization. Although this research has focused on identifying the impact of offshoring, given the anticipated levels of impact from automation on demand for ICT skilled workers, it is recommended that additional studies are undertaken to assess the impact of automation on demand for e-skills.

Impact of key professional trends

What is your opinion on the following statements

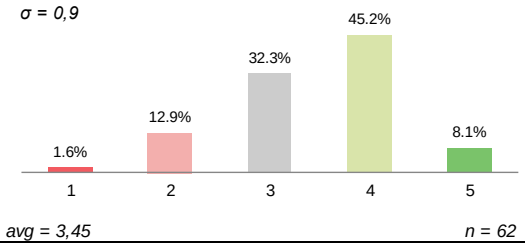
It has been suggested that new technologies, such as cloud computing, will result in a decline in the number of ICT professionals working in traditional ICT departments; this will coincide with increased demand for ICT professionals working across the enterprise.

Strongly disagree (1)	3	4.4%
Disagree (2)	19	27.9%
Neutral (3)	16	23.5%
Agree (4)	26	38.2%
Strongly Agree (5)	4	5.9%



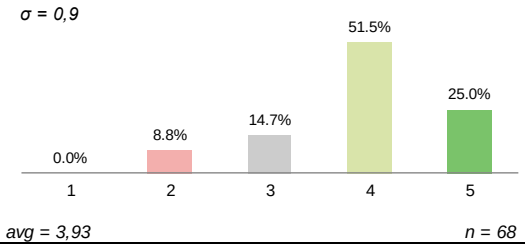
Massive Open Online Courses (MOOCs) will substantially change the way in which we deliver continuous professional development opportunities to ICT practitioners within the next three years.

Strongly disagree (1)	1	1.6%
Disagree (2)	8	12.9%
Neutral (3)	20	32.3%
Agree (4)	28	45.2%
Strongly Agree (5)	5	8.1%



The ICT profession is a global profession, and national efforts must align on a global basis (as opposed to seeking a purely regional solution) in order for the ICT profession to mature successfully.

Strongly disagree (1)	0	0.0%
Disagree (2)	6	8.8%
Neutral (3)	10	14.7%
Agree (4)	35	51.5%
Strongly Agree (5)	17	25.0%



Do you believe that all ICT Professionals in the world should share a common understanding of foundational ICT Body of Knowledge (i.e. a core set of knowledge that we must all be familiar with)?

Strongly disagree (1)	1	1.4%
Disagree (2)	6	8.6%
Neutral (3)	7	10.0%
Agree (4)	38	54.3%
Strongly Agree (5)	18	25.7%

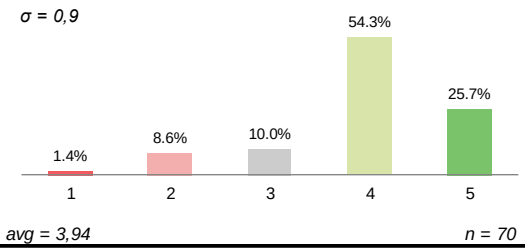


Figure 40: Perceived impact of key professional trends by survey respondents

Key Findings: A significant minority of respondents (44%, n=30) felt that in the future there would be fewer ICT professionals in traditional ICT departments, coinciding with more ICT professionals working across the enterprise. More than half of respondents (53%, n=33) felt 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%, n=52) of respondents believe that 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%, n=56) 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).

ICT competence frameworks

Do you use an ICT competence framework in your organisation (such as the European e-Competence Framework (e-CF) or SFIA, the Skills Framework for the Information Age, or in-house equivalent)?			
Yes	17	25.4%	
No	50	74.6%	

Figure 41: Use of ICT competence frameworks by survey respondents

Key Finding: Approximately one quarter of organisations were using an ICT competence framework in their organisations. This shows a significant increase from an earlier 2011 study on ICT professionalism, suggesting that the use of ICT competence frameworks may be becoming more widespread.

Graduate readiness

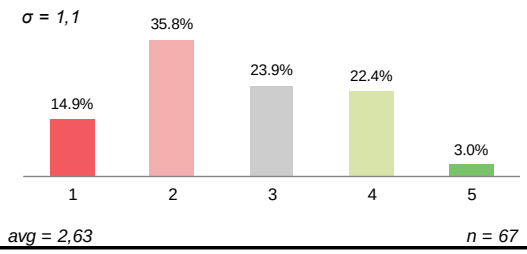
What is your opinion on the following statements			
"Recent ICT graduates joining our company possess the necessary combination of technical, business and interpersonal skills to contribute to our business without further retraining"			
Strongly disagree (1)	10	14.9%	
Disagree (2)	24	35.8%	
Neutral (3)	16	23.9%	
Agree (4)	15	22.4%	
Strongly Agree (5)	2	3.0%	

Figure 42: Perceived readiness of graduates by survey respondents

Key Finding: More than half of the respondents surveyed felt that recent ICT graduates lacked the necessary combination of skills to contribute to the business without additional training. Only one quarter believed that they did possess the required skills. This result suggests that there may be a need to improve the level of industry-academia alignment in the development of curricula.

Continuing Professional Development

What is your opinion on the following statement		
"Experienced ICT practitioners working in our organisation are successful in keeping their ICT skills up to date through continued training?"		
Strongly disagree (1)	1	1.5%
Disagree (2)	7	10.3%
Neutral (3)	12	17.6%
Agree (4)	31	45.6%
Strongly Agree (5)	17	25.0%

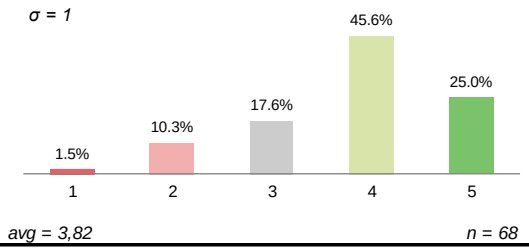


Figure 43: Perceived view of CPD by survey respondents.

Key Finding: 71% (n=48) of CIOs/senior managers felt that experienced ICT practitioners in their organisations were successful in keeping their ICT skills up to date.

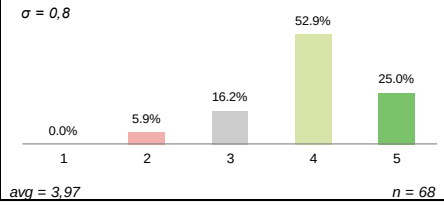
Impact of key technological trends

As outlined in Figure 44, the technological trends that are most likely to drive future growth in the demand for skills as identified by respondents as most likely to drive future increase in the growth of 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).

For each of the technological trends below, indicate the level of growth in demand for expertise in your organisation that you foresee over the period 2013-2020:

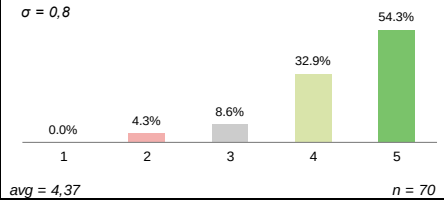
Cloud

Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	4	5.9%
Flat / Unchanged (3)	11	16.2%
Increase in demand (4)	36	52.9%
Strong increase in demand (5)	17	25.0%



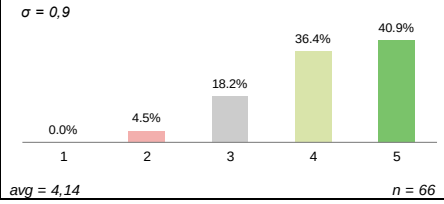
Mobile

Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	3	4.3%
Flat / Unchanged (3)	6	8.6%
Increase in demand (4)	23	32.9%
Strong increase in demand (5)	38	54.3%



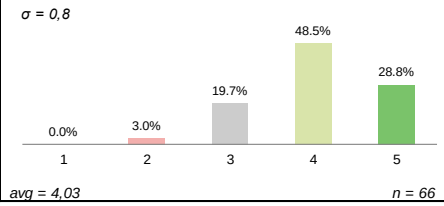
Big Data

Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	3	4.5%
Flat / Unchanged (3)	12	18.2%
Increase in demand (4)	24	36.4%
Strong increase in demand (5)	27	40.9%



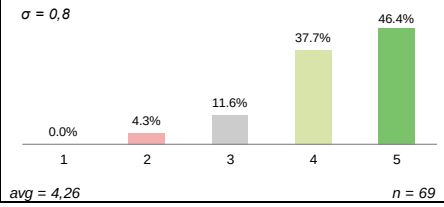
Social Business

Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	2	3.0%
Flat / Unchanged (3)	13	19.7%
Increase in demand (4)	32	48.5%
Strong increase in demand (5)	19	28.8%



Cyber Security

Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	3	4.3%
Flat / Unchanged (3)	8	11.6%
Increase in demand (4)	26	37.7%
Strong increase in demand (5)	32	46.4%



Consumerisation / BYOD

Sharp decline in demand (1)	1	1.6%
Decline in demand (2)	2	3.2%
Flat / Unchanged (3)	18	28.6%
Increase in demand (4)	31	49.2%
Strong increase in demand (5)	11	17.5%

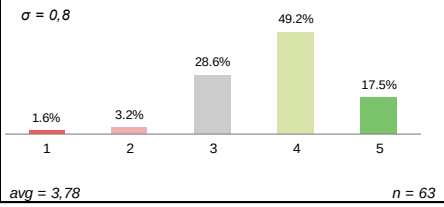


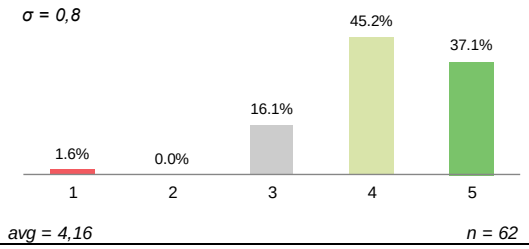
Figure 44: Perceived impact of key technological trends by survey respondents.

Impact of demand for skills / likelihood of offshoring

For each of the skills below, indicate the level of growth in demand for expertise in your organisation that you foresee over the period 2013-2020 (using the left hand columns); indicate the likelihood that the skill will be offshored at some point in time in the period 2013-2020 (using the right hand columns)

Data visualization / data analysis

Sharp decline in demand (1)	1	1.6%
Decline in demand (2)	0	0.0%
Flat / Unchanged (3)	10	16.1%
Increase in demand (4)	28	45.2%
Strong increase in demand (5)	23	37.1%



Verly unlikely to be offshored (1)	18	30.5%
Unlikely to be offshored (2)	19	32.2%
Neutral (3)	12	20.3%
Likely to be offshored (4)	9	15.3%
Very likely to be offshored (5)	1	1.7%

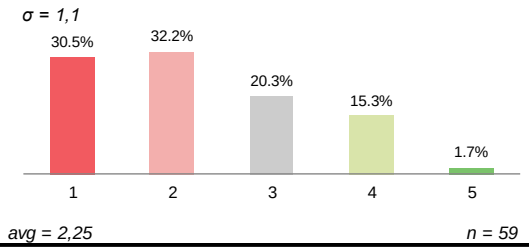
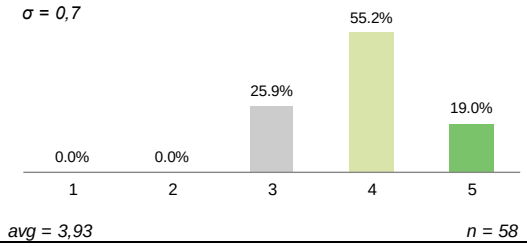


Figure 45: Perceived demand for data virtualization skills and likelihood of offshoring.

Key Finding: 82% (n=51) of respondents believe that there will be increased demand for data visualization skills in their organizations; only 17% (n=10) believe that these skills are likely to be offshored. This result is likely to reflect the high levels of interest in exploiting "big data".

User Experience Design		
Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	0	0.0%
Flat / Unchanged (3)	15	25.9%
Increase in demand (4)	32	55.2%
Strong increase in demand (5)	11	19.0%



Verly unlikely to be offshored (1)	18	31.6%
Unlikely to be offshored (2)	13	22.8%
Neutral (3)	14	24.6%
Likely to be offshored (4)	11	19.3%
Very likely to be offshored (5)	1	1.8%

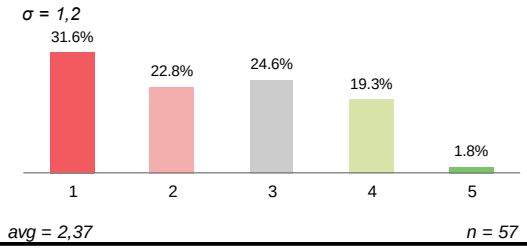
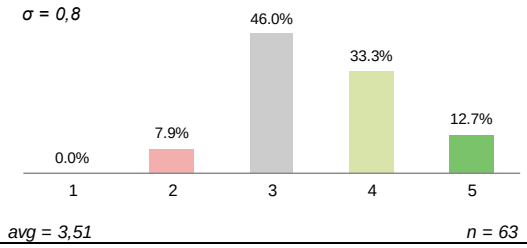


Figure 46: Perceived demand for user experience design skills and likelihood of offshoring.

Key Finding: Respondents generally believe that there will be increased demand for user experience (UX) skills in their organizations, with no respondents predicting a decline in demand. Most believe the skill will remain onshore, possibly reflecting the need for such skills to remain close to the user base. Only 21% (n=12) suggest it is likely the skill will be offshored.

Coding / Sotware engineering / App build		
Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	5	7.9%
Flat / Unchanged (3)	29	46.0%
Increase in demand (4)	21	33.3%
Strong increase in demand (5)	8	12.7%



Verly unlikely to be offshored (1)	12	21.1%
Unlikely to be offshored (2)	4	7.0%
Neutral (3)	10	17.5%
Likely to be offshored (4)	24	42.1%
Very likely to be offshored (5)	7	12.3%

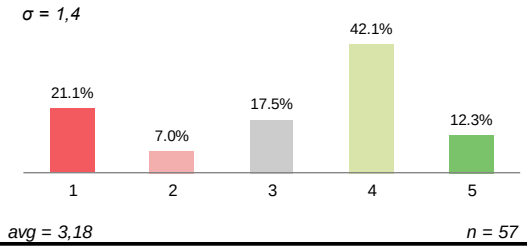


Figure 47: Perceived demand for coding/ software engineering/ app build skills and likelihood of offshoring.

Key Finding: Almost half 46% (n=29) of respondents believed that demand for coding skills will increase. 54% (n=31) believed it was likely or very likely that the skill would be offshored.

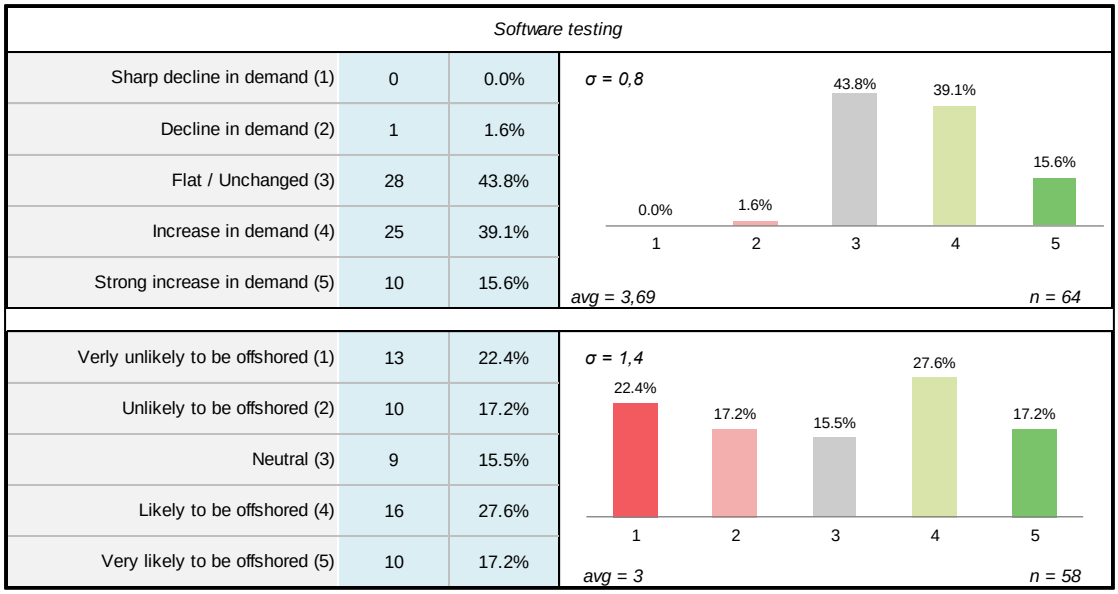


Figure 48: Perceived demand for software testing skills and likelihood of offshoring.

Key Finding: 55% (n=35) of respondents believed that there would be an increase or a strong increase in demand for software testing skills, and 45% (n=26) believed that this skill would be offshored. In future studies, it may be interesting to ascertain how many CIOs believed that this skill would be automated.

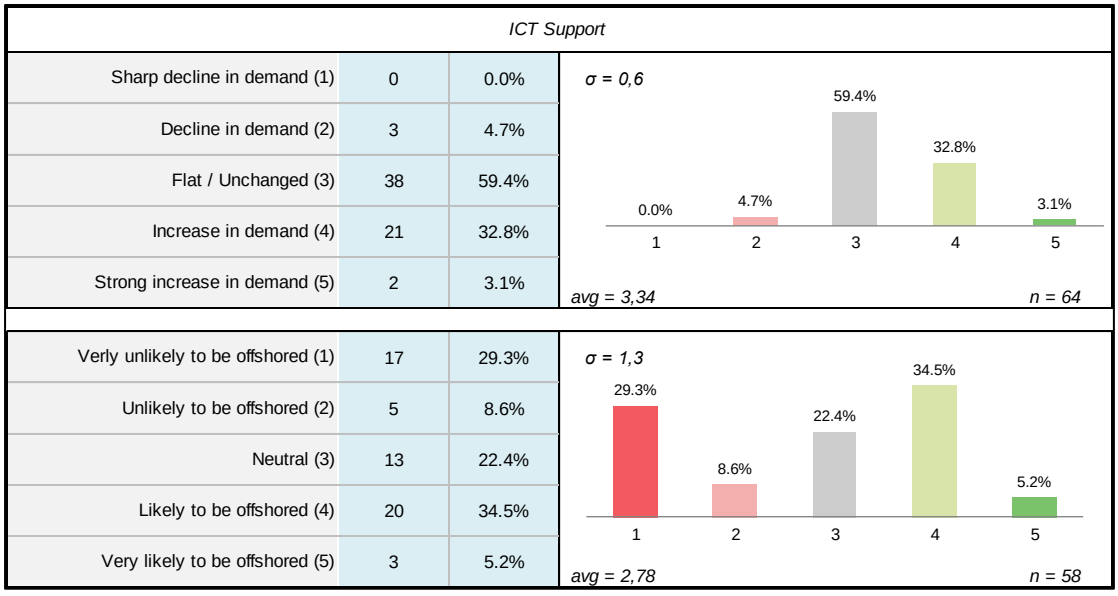
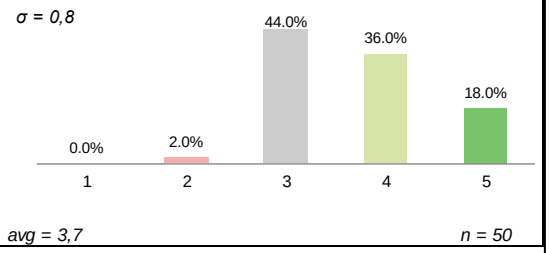


Figure 49: Perceived demand for ICT support skills and likelihood of offshoring.

Key Finding: Most respondents perceived demand in ICT as flat or increasing, with less than 5% (n=3) predicting lower demand in the future. Interestingly, a relatively high proportion of respondents (29%, n=17) believed that it was very unlikely to be offshored. This may be due to the desire for ICT support in these organisations to remain close to the user base and possibly even more so, with increasing levels of BYOD/Consumerisation.

eLeadership (T-shaped skillset)		
Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	1	2.0%
Flat / Unchanged (3)	22	44.0%
Increase in demand (4)	18	36.0%
Strong increase in demand (5)	9	18.0%



Verly unlikely to be offshored (1)	23	50.0%
Unlikely to be offshored (2)	8	17.4%
Neutral (3)	14	30.4%
Likely to be offshored (4)	1	2.2%
Very likely to be offshored (5)	0	0.0%

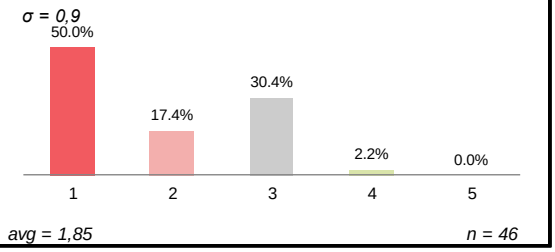
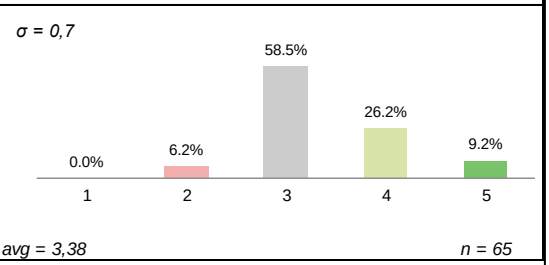


Figure 50: Perceived demand for e-leadership skills and likelihood of offshoring.

Key Finding: More than half of respondents (54%, n=27) predicted increased demand for e-Leadership skills. Only 2% (n=1) predicted that e-Leadership skills would be likely to be offshored, potentially reflecting the strategic importance of this skill set.

Infrastructure operations / management		
Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	4	6.2%
Flat / Unchanged (3)	38	58.5%
Increase in demand (4)	17	26.2%
Strong increase in demand (5)	6	9.2%



Verly unlikely to be offshored (1)	15	26.8%
Unlikely to be offshored (2)	8	14.3%
Neutral (3)	13	23.2%
Likely to be offshored (4)	15	26.8%
Very likely to be offshored (5)	5	8.9%

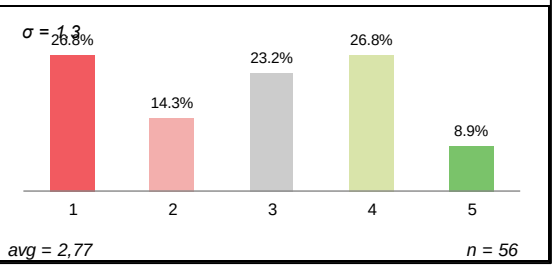


Figure 51: Perceived demand for infrastructure operations/ management skills and likelihood of offshoring.

Key Finding: Most respondents (58%, n=38) believed that demand for ICT infrastructure skills would remain flat. As a point of interest, internally the research team had expected the demand for infrastructure operations skills to decline with the predicted move to the cloud, but this did not appear to be the case. Greater than one third of respondents predicted increased demand in their organisations. Further, a relatively high number (41%, n=23) believed that it was unlikely that these skills

would be offshored, possibly reflecting the need for high levels of security for corporate assets.

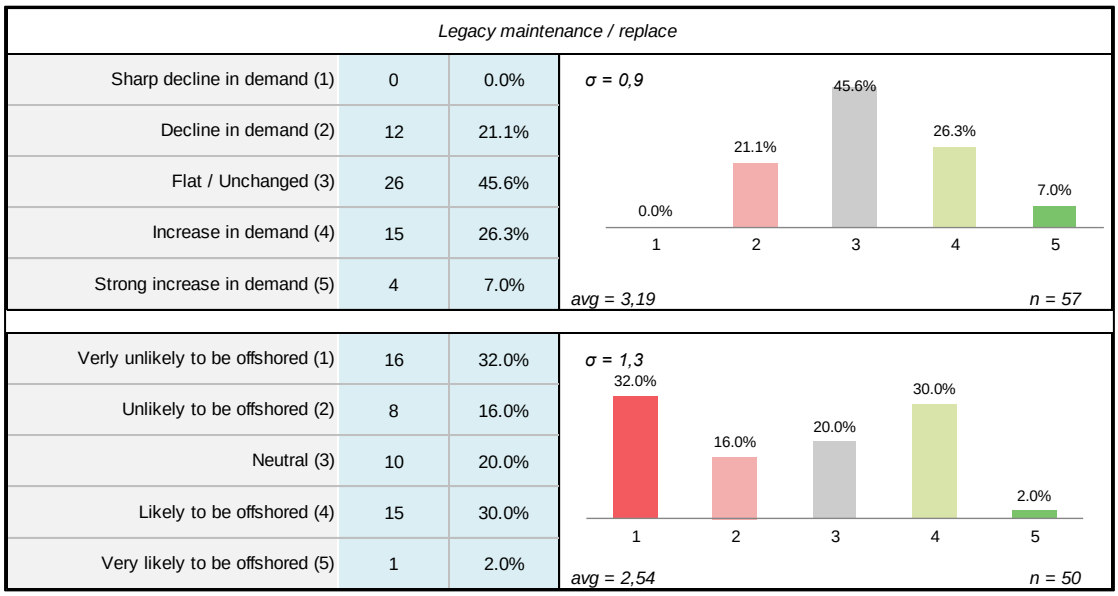
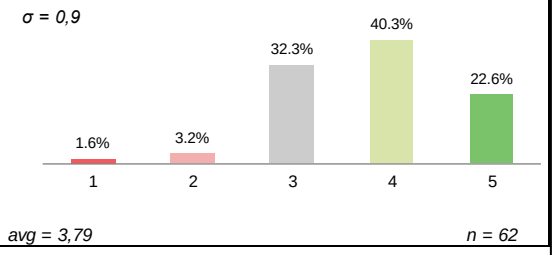


Figure 52: Perceived demand for legacy maintenance skills and likelihood of offshoring.

Key Finding: Over one third of respondents (n=19) predicted increased demand for skills in maintaining legacy systems and/or replacing them. This was a skill set where almost one third predicted the skill being offshored. Notably, in contrast to this offshoring pattern, almost one third (32%, n=16) perceived this as an area where the skill set was very unlikely to be offshored, with a further 16% (n=8) viewing it as unlikely. One possible cause of such a pattern may be that the legacy systems are applications that are essential to business operations (e.g. banking transaction applications), written many years ago and that have evolved organically over many years. Consequently, the task of updating/maintaining such systems is so risky that the task must be performed by people working in a core team who have a high degree of knowledge relating to the systems. This typically resides in the location where the applications were first developed.

Business Process Management		
Sharp decline in demand (1)	1	1.6%
Decline in demand (2)	2	3.2%
Flat / Unchanged (3)	20	32.3%
Increase in demand (4)	25	40.3%
Strong increase in demand (5)	14	22.6%



Verly unlikely to be offshored (1)	24	42.9%
Unlikely to be offshored (2)	17	30.4%
Neutral (3)	11	19.6%
Likely to be offshored (4)	3	5.4%
Very likely to be offshored (5)	1	1.8%

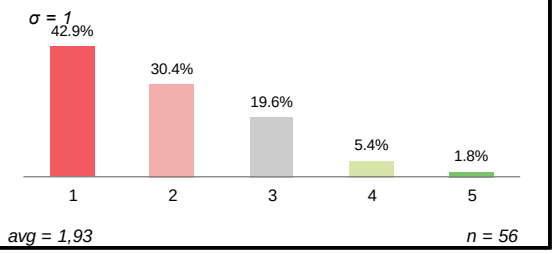
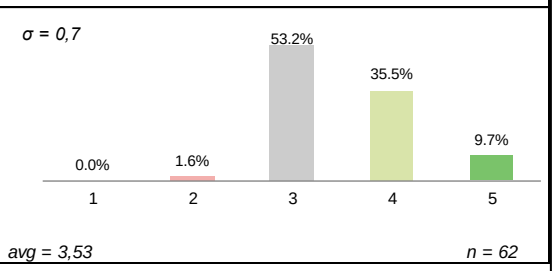


Figure 53: Perceived demand for business process management skills and likelihood of offshoring.

Key Finding: The majority of respondents (63%, n=39) believed that there would be increased demand or strong increase in demand for Business Process Management (BPM) skills. Less than 5% (n=3) believed that demand would decline. Further, 73% (n=41) did not believe the skills would be offshored.

ICT Supplier Management		
Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	1	1.6%
Flat / Unchanged (3)	33	53.2%
Increase in demand (4)	22	35.5%
Strong increase in demand (5)	6	9.7%



Verly unlikely to be offshored (1)	32	59.3%
Unlikely to be offshored (2)	9	16.7%
Neutral (3)	10	18.5%
Likely to be offshored (4)	3	5.6%
Very likely to be offshored (5)	0	0.0%

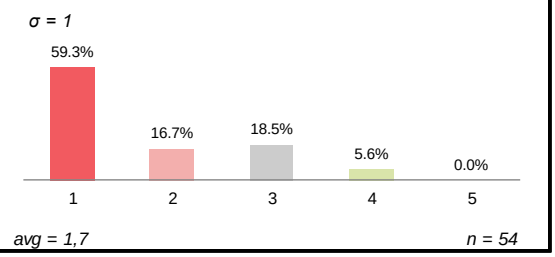


Figure 54: Perceived demand for ICT supplier management skills and likelihood of offshoring.

Key Finding: ICT supplier management appears to be a skill that is becoming increasingly important to organisations, with almost half of respondents (46%, n=31) predicting increased demand. Only one respondent predicted a decline in demand for supplier management skills and very few (6%, n=3) believed this skill could be offshored, possibly reflecting the perceived strategic importance of managing

suppliers in a cloud environment or using a selection of providers as part of a global value chain.

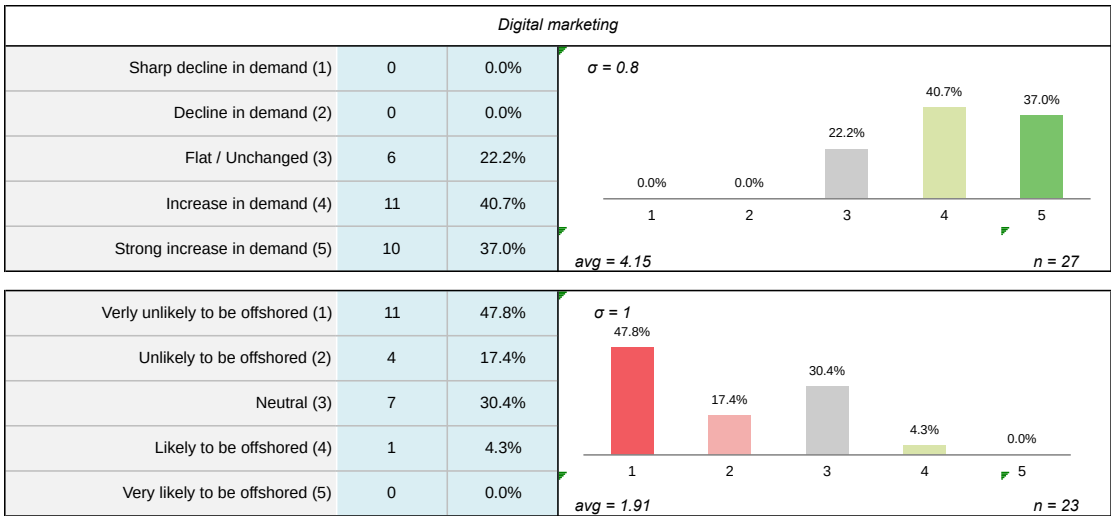


Figure 55: Perceived demand for digital marketing skills and likelihood of offshoring.

Key Finding: Digital marketing is an area that appears likely to experience significant growth, with 78% (n=21) of respondents predicting strong growth in this area. This was also an area where few CIOs predicted offshoring (less than 5%, n=1), possibly reflecting the need for marketing skills to remain close to the business and the market.

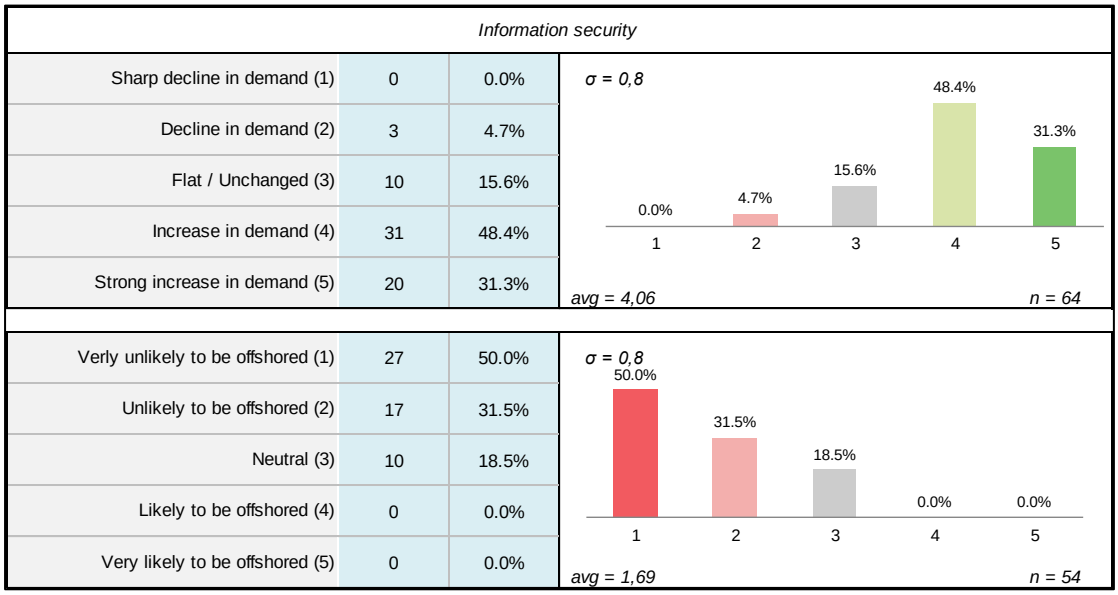
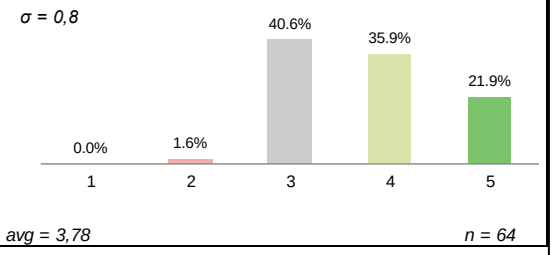


Figure 56: Perceived demand for information security skills and likelihood of offshoring.

Key Finding: 80% (n=51) of respondents predicted increased demand for information security skills. Interestingly, and perhaps understandably, this was the skill least likely to be offshored, with no respondents planning to offshore information security skills.

Enterprise Architecture		
Sharp decline in demand (1)	0	0.0%
Decline in demand (2)	1	1.6%
Flat / Unchanged (3)	26	40.6%
Increase in demand (4)	23	35.9%
Strong increase in demand (5)	14	21.9%



Verly unlikely to be offshored (1)	27	49.1%
Unlikely to be offshored (2)	15	27.3%
Neutral (3)	12	21.8%
Likely to be offshored (4)	1	1.8%
Very likely to be offshored (5)	0	0.0%

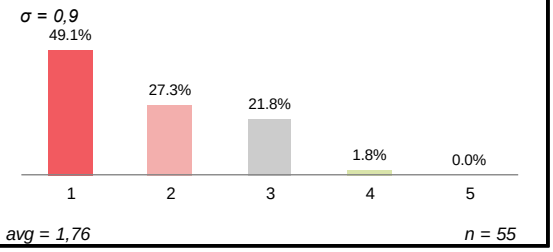
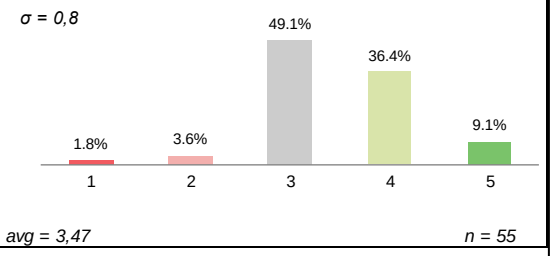


Figure 57: Perceived demand for enterprise architecture skills and likelihood of offshoring.

Key Finding: More than half of respondents (58%, n=37) predicted an increase or strong increase in demand for Enterprise Architecture skills in their organisations, with only 1 respondents predicting a decline. Most respondents (76%, n=42) believed the skills would remain onshore, with only 1 respondent predicting that the skill might be offshored.

High Performance Computing (inc parallel)		
Sharp decline in demand (1)	1	1.8%
Decline in demand (2)	2	3.6%
Flat / Unchanged (3)	27	49.1%
Increase in demand (4)	20	36.4%
Strong increase in demand (5)	5	9.1%



Verly unlikely to be offshored (1)	21	42.9%
Unlikely to be offshored (2)	7	14.3%
Neutral (3)	15	30.6%
Likely to be offshored (4)	6	12.2%
Very likely to be offshored (5)	0	0.0%

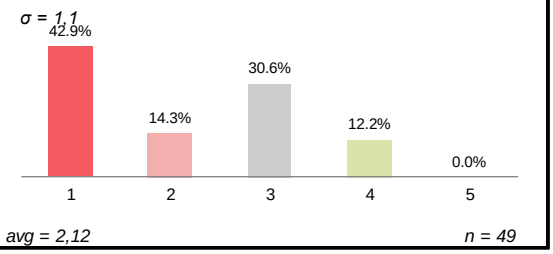


Figure 58: Perceived demand for high performance computing skills and likelihood of offshoring.

Key Finding: 45% (n=25) of respondents predicted increased demand in their organisations for High Performance Computing skills, and most believed that the skill was unlikely to be offshored. Only 12% (n=6) of respondents regarded it likely that the skill would be offshored.

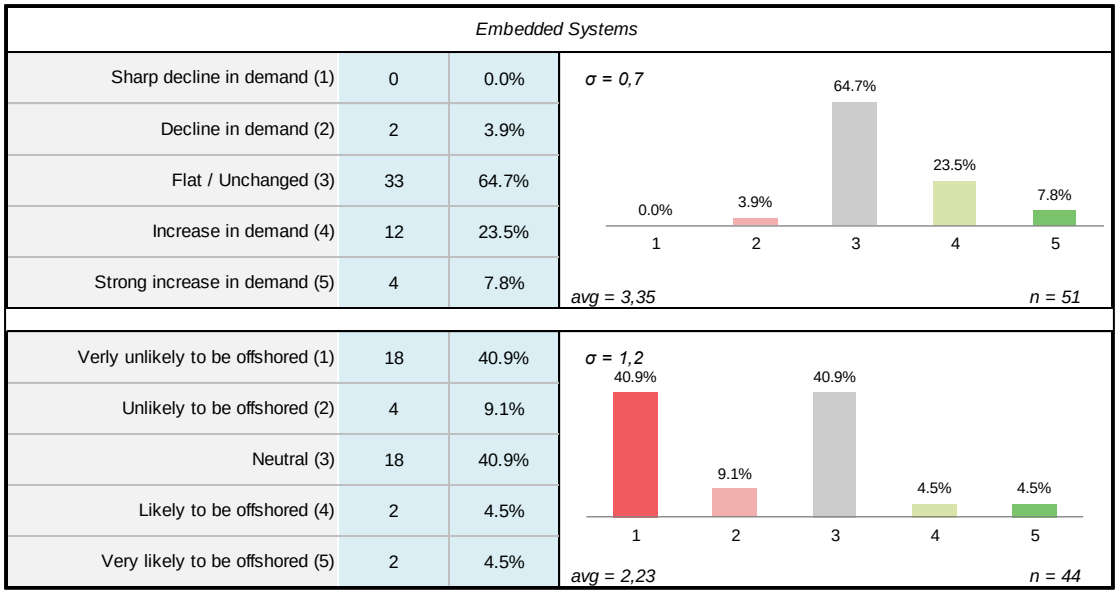


Figure 59: Perceived demand for embedded systems skills and likelihood of offshoring.

Key Finding: 31% (n=16) of CIOs believed that demand for skills in embedded systems would increase. This is relatively low, but may reflect that most have not yet considered the implications of the 'Internet of everything', and that the technology is still immature. Less than 10% (n=4) predicted the skill set would be offshored.

Summary of impact on skills

Table 12 summarises the expected trends for each individual skill set, in terms of the likely growth pattern of each skill, and the likelihood of offshoring.

Skillset	Decline in demand	Growth in demand	Unliketo offshore	Likely to offshore
Data Visualisation	1.6	82.3	62.7	16.9
UXD	0	74.1	54.4	21.1
Coding	7.9	46	28.1	54.4
Software testing	1.6	54.7	39.7	44.8
ICTsupport	4.7	35.9	37.9	39.7
Infrastructure ops	6.2	35.4	41.1	35.7
BPM	4.8	62.9	73.2	7.1
ICT Supplier management	1.6	45.2	75.9	5.6
Digital Marketing	1.7	58.6	63.3	8.2
Information security	4.7	79.7	81.5	0
Enterprise Architecture	1.6	57.8	76.4	1.8
High performance comput	5.5	45.4	57.1	12.2
Embedded systems	3.9	31.4	50	9.1
eLeadership skills	2	54	67.4	2.2
Legacy maintenance	21.1	33.3	48	32

Note: To create each entry, positive responses were summed (i.e. "likely" +"very likely"), and negative responses were summed ("unlikely" + "very unlikely"). Neutral respondent were omitted. For each column, the box with the deepest colour contains the highest value.

Table 11: CIO perspectives on demand for skills / offshoring

Concluding remarks

Although some divergence exists in stakeholder views, in general, a number of key themes emerged. Most notably, the majority of stakeholders perceived there to be a serious ICT skills gap/mismatch and perceive this to be hampering company growth. This is compounded by the fact that the majority of stakeholders perceive ICT graduates to 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 organizations 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 organizations in planning business operations, and for government in establishing supporting policies. . A more in-depth analysis of the possible future impact of offshoring on specific skills is discussed in Chapter 6 and Chapter 7.

CHAPTER 5: KEY 'PHASE ONE' FINDINGS

Introduction

The key objective of 'phase one' of this research was to describe the current international landscape for e-skills and ICT professionalism. In doing so, it has become clear that the landscape is complex: there is no single truth that resonates in all countries, in all regions, or across all stakeholders. However, this lack of concordance does not mean that there is little basis for collaboration. It could be argued that it is precisely because of the multitude of divergent paths that efforts to foster collaboration should be strengthened. In this chapter, some of the key themes that have emerged in the course of the 'phase one' research are reflected. In addition, some current and emerging policy actions are reviewed and a narrative is presented that outlines how international stakeholders may collaborate going forward.

Assessment of the current landscape for e-skills and ICT professionalism

World trade and technology

Introducing the 2013 World Trade Report, Pascal Lamy, the Director General of the World Trade Organisation stated "technology has not just provided the wherewithal to make globalization possible in a physical and virtual sense, but it is also the key source of increased productivity associated with innovation and growth…Likely developments in respect of many of the sectors and issues…depends crucially on what happens on the technology front…New technologies and innovation will emerge with greater vigour from the services sector. Technology could also change much of what we take for granted today in terms of production and consumption patterns. Technology and trade are both recognized as disruptive forces in terms of income distribution. It is trade that faces the strongest political opposition even if in reality it is a lesser force for change than technology. In either case, long-term policies for education and training, and short-term policies to manage these transitions are indispensable to future growth, stability and social harmony" (Lamy. 2013). Such a statement encapsulates the importance of technology to the global economy, and in turn, reinforces the need for ICT skills that allow technology to be exploited successfully.

Jobs crisis

The world is confronting a jobs crisis. Over 197 million people are without a job in 2012. In the advanced economies, over 40 million are unemployed at a time when businesses complain of a dearth of skilled workers. As McKinsey conclude "labour market institutions and policies have not kept up to date with the changes in business practices and technology that are defining what kind of jobs will be created and where they will be created". The situation is particularly alarming for young people. For

example, in Greece, Spain and South Africa, more than half of young people are unemployed. There is a risk that this cohort will remain unemployed for a long time period, as the next wave of graduates/school-leavers are likely to be perceived as more attractive to employers than a group who have been unemployed for a prolonged period. The pattern is particularly worrying as the high levels of youth unemployment coincide with reports from many employers that a skills shortage is a cause of entry-level vacancies. Together, this pattern underlines the need to improve skills development for this age group in parallel with efforts to create jobs.

Technological change

A series of major, interconnected technological trends are evident: cloud computing, big data, cyber security, social business and internet of everything. The trends represent important shifts in the application of ICT, and are likely to act as the main drivers of increased demand for ICT practitioners over the period under examination.

Impact of globalization on the demand for e-skills

Offshoring is most commonly used as a form of cost arbitrage, given the lower salary costs. While this differential has narrowed in recent years, there is still a significant difference in costs, with an entry level graduate to an Indian IT outsourcing firm costing approximately one-tenth of the equivalent in Germany. It is likely that usage of offshore providers could accelerate in Europe, given the prevailing, strong cost focus within organisations. In addition, offshore vendors are making investments to build local profiles and presence in Europe, recruiting "native" local European for sales, marketing, consulting and delivery functions that are supplemented by remote service centres in low-cost economies. This sourcing model appears to resonate well with buyers, possibly because it often results in the creation of local, high-skilled jobs by the provider, and there is evidence of a growing user acceptance of offshoring.

In the longer term, low-cost EU countries that are currently service providers, most notably Eastern EU countries, are likely to become more expensive, diminishing their appeal from a cost perspective. Asia is the leader in delivery centre setup and expansion, led by India. Another factor to take into consideration in examining offshoring trends is the level of domestic demand in developing economies. Companies wishing to establish a presence in the regions with predicted fastest growth are now targeting Asia-Pacific, Latin America and Middle East-Africa rather than Western economies. Although profit margins are currently higher in Europe and the US, the longer term trends suggest that the other markets have the greatest growth potential. ICT skills are scarce, and therefore companies may decide it is in their long term interest to focus on emerging markets than invest in developed economies experiencing limited growth. Another trend that may limit growth of offshore providers is the current re-shoring trend, particularly notable in America where a number of high-profile re-shoring activities have made headlines.

High-value, high touch jobs are perceived as less vulnerable to offshoring i.e. those requiring personal touch and judgement that cannot be provided remotely. There is strong evidence to suggest that the role of ICT in organisations is now growing in importance – the emergence of the Chief Digital Officer is testimony to this trend. Certainly, the survey conducted as part of 'phase one' suggests that while traditional

ICT departments will decline in importance, there will be growing demand for ICT professionals across the enterprise. This is an important trend as high-value, high touch jobs are typically perceived as less vulnerable to offshoring. Therefore, it is possible that growing demand from the business for ICT solutions that are agile, requiring rapid iterations and close interaction with users, will limit offshoring of such ICT roles.

Changing demand for ICT skills

In engaging with over 70 European CIOs/senior IT managers, a picture emerged of the changing demand for ICT skills over the period 2013-2020. Key findings include:

- 70% of CIOs "agreed" or "strongly agreed" that there is a serious ICT skills gap/mismatch that is hampering the growth of companies.
- Approximately 50% of CIOs felt that the lack of high level ICT skills was impacting on their ability to grow the business.
- More than half of the respondents felt that recent ICT graduates lacked the necessary combination of skills to contribute to the business without additional training. Only one quarter believed that they did possess the required skills.
- Over 60% of respondents felt that offshoring was likely to have a moderate/high/very high impact on their organizations. However, automation was perceived as the bigger threat, with over three quarters of respondents stating it would impact their businesses.
- Three quarter of participants believed that the ICT profession is global and national efforts must align to mature the profession successfully.
- 80% of participants believed that ICT professionals should share a common understanding of a foundational ICT Body of Knowledge.

In terms of the expected trends for individual skills, Table 13 below highlights the key findings:

SKILLSET TRENDS (2013-2020) – CIO Perspectives		
Most likely to grow (% respondents)	**Most likely to be offshored (% respondents)**	**Least likely to be offshored (% respondents)**
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%)

Table 12: CIO views on skill set demand/location. (Source: primary research, 2013).

Note: It was also interesting to note that the skill set that was most predicted to experience decreased demand was 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.

- Strongest growth: The strong growth for data visualization and information security skills most likely reflects the growth in importance of big data and concerns over cyber security. Similarly, the growth in demand for UX skills is most likely related to the need to develop interfaces that are usable on different mobile devices such as smartphones and tablets.
- Likely Offshored: The result that coding, software testing and ICT support were most likely to be offshored was anticipated. However, the number of respondents who felt that these skills were likely to be offshored was higher than might have been expected. In the survey, participants were asked to "indicate the likelihood that the skill will be offshored at some point in time in the period 2013-2020", but "the extent to which the skill would be offshored" was not asked. It is therefore important to emphasise that there is no suggestion that 54% of all coding skills will be offshored.
- Unlikely offshored: The survey results suggest that information security and enterprise architecture are unlikely to be offshored, possibly because they are perceived as being too strategically important to be offshored or outsourced. Similarly, the desire to keep ICT supplier management in-house or at least onshore, suggests a desire to retain central control over suppliers.

The impetus for change

Demand for ICT workers in Europe is likely to change significantly by 2020. Many of the skills currently utilized in the IT units of European organisations will no longer be required, or at least, not desired at the current cost levels. The encroachment of automated software and cost arbitrage opportunities from developing countries suggests that the employment outlook for a significant proportion of ICT workers, particularly those working in ICT support and testing, will be challenging. A Quocirca study estimates that "30% of an IT team's time is spent on low level tasks such as responding to minor user incidents, carrying out routine procedures or checking for errors" (Tarzey and Longbottom, 2012).

At the same time, there is also likely to be rapid growth in areas related to the new technological trends of big data, mobile, cloud computing, and information security. If estimates are to be believed, the growth in demand for skills in these areas will outnumber the workers with skills that are no longer in-demand. The logical conclusion is to reassign workers from the now-defunct parts of the IT organization to the emerging technological areas. However, the reality is that doing so will require substantial re-skilling in many instances, and this will demand the engagement of all relevant stakeholders to develop meaningful, pragmatic solutions.

Diversity of current policy actions

Figure 60 (below) provides an indication of the diversity of policy actions, in some cases proposals for policy actions, being promoted in different parts of the world. A view of the overarching objectives of these policy actions, along with a brief description of each action follows thereafter.

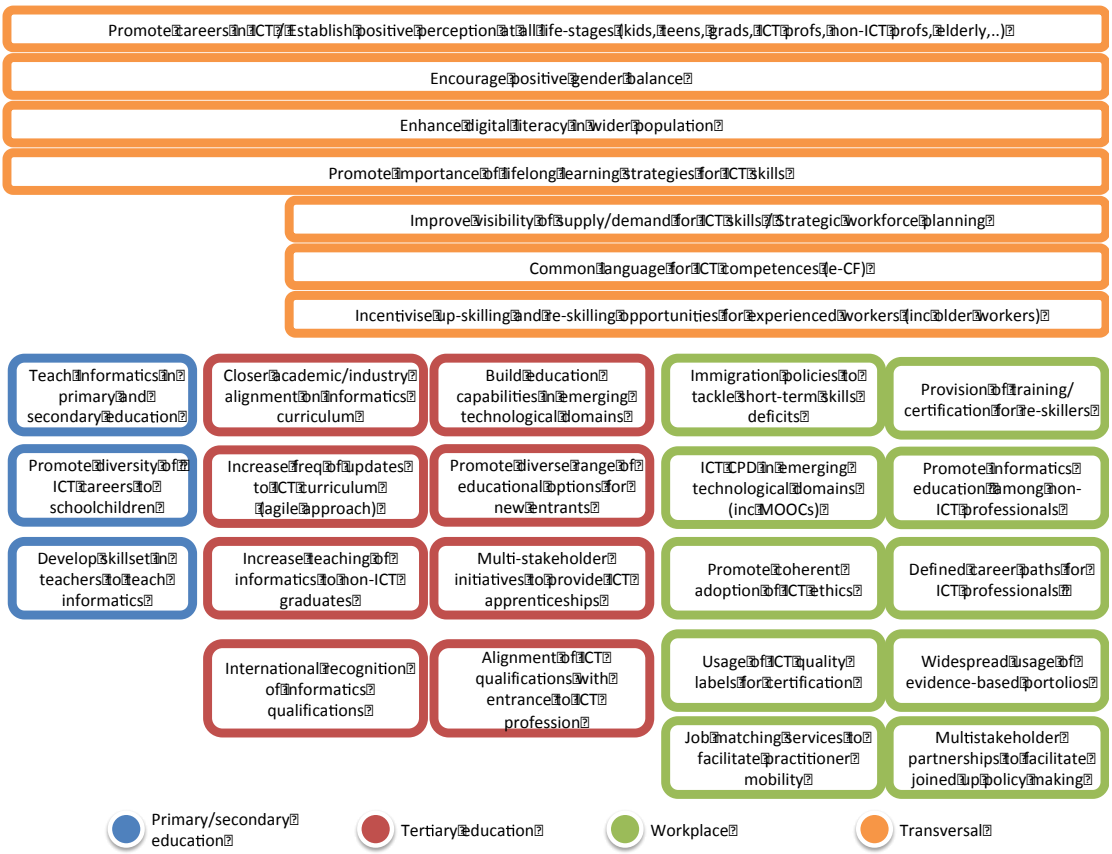


Figure 60: Policy actions / Good practices

Transversal policy action objectives

Objective	Description
Establish positive public perception of the ICT profession	The ICT profession has a negative image in many countries, impacting on the number of new entrants to the profession. By enhancing the perception of the ICT profession and related careers, more people will be encouraged to enter and remain in the profession, thereby lowering the risk of future ICT skills gaps. Policy actions such as targeted promotional campaigns to raise awareness of the importance of ICT and possible career opportunities for schoolchildren, students, graduates, and the unemployed could help to change public attitudes to the ICT profession in the longer term.
Encourage positive gender balance in ICT learner /worker populations	Low levels of female participation in ICT prevail at school, at university, and in the workplace. Successful initiatives to attract and retain women in ICT will enhance the supply of ICT skilled workers and potentially enhance the overall quality of team outputs through

	having a more diverse and balanced team profile.
Enhance digital literacy in the wider population	Low levels of ICT skills in the wider population impacts on the ability of citizens to participate in the digital economy, and acts as a form of social exclusion. Increasing participation through education will help re-integrate these members of society.
Promote importance of lifelong learning strategies for ICT skills	Learning habits are likely to change significantly in the future, due to for example MOOCs, and the ability to "bank" ICT skills acquired via formal, non-formal and informal education will become increasingly important. Initiatives to support this, such as competence frameworks and evidence based portfolios, are likely to gain popular support.
Support strategic workforce planning	Both companies and governments should be encouraged to plan ahead in terms of the ICT skills they will require in the future. By identifying shortages in advance, employers will be better prepared to implement mechanisms to counter such shortages through recruitment plans, in-house training, in-house reassignment, and immigration. Similarly, governments will be able to implement policies to better match supply and demand. In terms of time horizons, companies are unlikely to plan more than three years in advance, but governments must plan ahead on a longer time horizon in order for the desired actions to have effect. For example, implementing changes to educational policies can take over 10 years before the benefits/discrepancies are realized (as in primary school education).
Improve visibility of supply/demand for ICT skills	At a national level, few countries have granular skills data, impeding efforts to tackle the skills gap effectively. Similarly, there is no consistency in approach between countries, hampering efforts to view the problem at a global level. Establishing consistent processes for collating and disseminating statistical data on ICT skills, possibly exploiting employers/recruiters datasets and harnessing a big data mindset, will help provide insight to support a more pro-active approach to the identification, targeting and assessment of policy actions, facilitating a just-in-time approach to the provision of skills in the workforce. For example, the usage of analytics can be extended to predict future demand for specific roles and/or availability of ICT skilled workers based on datasets related to training, certifications, competence assessments undertaken, search engine analytics, etc.
Promote a common language for ICT competences	At present, different ICT skills and proficiencies have different meanings across individuals, organisations, and countries. A common language for describing ICT competences would help employers, employees and educators in for example, workforce planning, recruitment, skills assessment, course design, training plans, and career paths. Encouraging wider adoption of competence frameworks to industry will help foster usage of a common ICT skills language.
Incentivise up-skilling and re-skilling opportunities for experienced workers (including older workers)	Targeted initiatives to encourage up-skilling and re-skilling are likely to form an essential part of national/regional strategies, given the need to increase the supply of ICT workers and ensure that the skills of existing workers remain competitive. The dynamic nature of ICT, coupled with the pervasiveness of ICT, suggests that increasing numbers of people must remain *au fait* with changing technologies throughout their careers in order to enhance their employment prospects. The US example of "Lifelong Learning Accounts", which incorporate tax breaks for employers and employees, is one such mechanism.
Develop	Fostering a network of leaders and visionaries who champion e-

leaders/visionaries to champion e-skills/ICT professionalism	skills/ICT professionalism will enhance the perception of the profession, as well as foster clarity of vision for those attempting to implement a national/regional e-skills policy.
Improve access to e-skills education	The low level of participation in ICT of women, youths, and over 55s is a missed opportunity. Targeted and timely initiatives to develop in-demand skill sets in these groups can help alleviate predicted skills gaps. New education options, such as MOOCS, can play an important role in improving access.
Promote shared understanding of ICT fundamentals among professionals	Unlike other professions, there is no common shared understanding of the fundamentals of informatics. People entering the profession without a formal education in informatics may lack a broad understanding of the fundamentals but possess deep siloed knowledge. Fostering a common broad understanding of the domain, via a Foundational ICT BoK, will help to reduce risk.

Primary and secondary education policy actions

Action	Description
Teach informatics in primary and secondary education	Computers are prevalent in society, but the concepts behind the technology are not effectively being taught to children. Introducing informatics to young children will enable the key concepts to be communicated at an early stage and for skills development to occur when they are most receptive. Amending the curriculum to include informatics for children of all ages will help foster an interest and understanding of informatics that will be helpful to all students, regardless of their future chosen discipline/career.
Promote diversity of ICT careers to schoolchildren	ICT has a negative image and few children consider a career in ICT. Promoting a positive, diverse and vibrant image of the ICT profession to young people will help remove some of the negative perceptions.
Develop skill sets in teachers to teach informatics	Teachers, particularly primary school teachers who are responsible for teaching all subjects, lack adequate skills to teach informatics to children. In this respect, initiatives to encourage industry engagement to train teachers could prove helpful.

Tertiary education policy actions

Action	Description
Promote closer academia/industry alignment on informatics curriculum	Processes to foster greater engagement between industry and academia will support the educating of graduates with knowledge relevant to industry operations. This may result in enhanced graduate readiness for industry employment.
Build education capabilities in emerging technological domains	Many of the new emerging technologies are strategically important and will fundamentally change the way in which ICT is used in organisations. Further, they may fundamentally change the nature of some organisations. It is important that there is adequate educational capacity to teach these new technologies within tertiary education and a curriculum exists to support this.
Increase frequency of updates to ICT	Processes for maintaining ICT curriculum are often voluntary or best efforts. Given the growing strategic importance of ICT and its

curriculum using an agile approach	pervasiveness, increasing the frequency of updates so that the curriculum reflects current industry requirements is important.
Increase teaching of informatics to non-ICT undergraduates	Informatics education is likely to prove increasingly important in all future job roles regardless of the part of the company a role is based. As such, increasing access to informatics education to non-ICT undergraduate students will enhance the value of students to employers.
Promote a diverse range of educational options	The inelasticity of the current tertiary education system means that industry is lacking adequate numbers of ICT skilled workers. Promotion of a wider range of educational options including formal, non-formal and informal learning to potential practitioners as well as employers will help to increase the overall e-skills base, although adequate measures must be in place to enable quality.
Foster multi-stakeholder initiatives to provide ICT apprenticeships	Industry rates ICT apprenticeship schemes highly, but multi-stakeholder engagement is essential in order to foster the provision of skills that are most in demand by employers and that are of enduring value to students.
Align ICT qualifications with entrance to the ICT profession	The alignment of educational systems with professional schemes is an important factor in enabling a smooth transition of students from education into the workplace and their continual professional development. For example, one interviewee complained that an ICT professional association demanded that ICT graduates undertook an exam at further cost to the individual before their accredited university computing course would be recognized as valid for entry to the profession. Joined up policies in this respect are essential to establishing a sustainable ICT profession.
Promote international recognition of informatics qualifications (university + non university)	International accreditation schemes are in place to recognize internationally some university institutions and courses (e.g. via ABET). However, there still appears to be scope for more formalized policies recognizing non-university education, particularly apprenticeships.

Workplace policy actions

Action	Description
Develop immigration policies to tackle short term skills deficits	In the longer term, domestic supply of ICT workers is likely to prove the most sustainable option. However, most countries recognize that, at times, immigration is essential to growth, providing employers with the most in-demand skills when required. Accordingly, systems must be in place to provide a quick, simple, transparent process that welcomes immigrants (e.g. the EU Blue Card).
Provide training/certification for re-skillers	Policies to increase the provision of relevant ICT training/certification for unemployed/elderly/youths/return-to-work mothers are essential to increasing the available ICT skills base in each country. Multi-stakeholder partnerships have a key role to play in the identification and provision of such education to ensure that the education provided is aligned with industry demand in the short, medium and long-term. Recognising the limitations of vocational training (some research suggests that apprentices will find work quicker, but their skills lack longevity), policies to support the renewal of skills of such workers should be implemented on an on-going basis.

Provide ICT CPD in emerging technological domains (e.g. via MOOCs)	Information and communication technologies continually evolve at a rapid pace. The provision of suitable continuing professional development via different channels (e.g. ICT CPD MOOCs) will support the long-term retention of skilled employees in the active workforce.
Promote informatics education among non-ICT professionals	Research suggests that industry is demanding and expecting workers from all domains to possess strong ICT skills and not simply the ability to use a computer. Promoting the value of informatics education to workers who specialize in other domains is important, particularly given the importance of cross-disciplinary innovation. Policies to identify and develop relevant training inside and outside of the university realm will facilitate a stronger ICT enabled workforce.
Define career paths for ICT professionals	Defined career paths that show professional progression help attract new entrants into the ICT profession, facilitate workforce planning and training requirements within organisations, and provide practitioners with a strong basis on which to plan their careers in ICT.
Develop and promote recognized quality label for ICT training/certification	A recognised Quality Label for ICT training and certification will provides practitioners and employers with a level of reassurance that the education provided will provide increased proficiency in a given competence.
Encourage widespread usage of evidence-based portfolios	Evidence-based portfolios are likely to grow in importance over time, but these initiatives are likely to be led by industry. Policy makers should attempt to identify ways in which such portfolios might interface with/exploit existing initiatives and investments in recording skills e.g. Europass CV. Moreover, policies to facilitate the availability of relevant data/evidence will bolster the usage and validity of such portfolios, e.g. the provision of automated access to university results, on approval from the student.
Promote job matching services to facilitate employment (including via practitioner mobility)	Job matching services based on practitioner competences will help to alleviate the ICT skills gap and help reduce unemployment. Policies to foster job matching services may include civil service and national employment agencies defining ICT roles in terms of competences from a recognised ICT competence framework.
Encourage multi-stakeholder partnerships to facilitate joined up policy making	Policy making for e-skills and the ICT profession demands active engagement from multiple stakeholders in order to jointly conceive and construct innovative joined-up policies that tackle current and emerging challenges from the perspectives of employees and employers, rather than constructing new approaches that "work around" existing institutions and processes to avoid causing disruption. Industry-academia alignment is repeatedly flagged as an area of concern by companies, and initiatives to facilitate the provision of students with industry-relevant skills are important to tackle the skills gap. Within individual industries, encouraging industry wide partnerships to foster the joint delivery of skills, e.g. via apprenticeships, can help to diminish the risks of unfair poaching of newly trained staff.
Facilitate recognition of competence	Policies to facilitate the recognition of the ICT competence of individuals, regardless of the educational path they have chosen, are important.
Facilitate practitioner mobility	The imbalances in supply and demand of ICT skilled workers across countries suggest that measures are taken to foster mobility. For example, travel grants to help unemployed youths find work in other locations and company-led international worker rotation schemes can help to tackle short-term skills gaps as well as develop practitioner

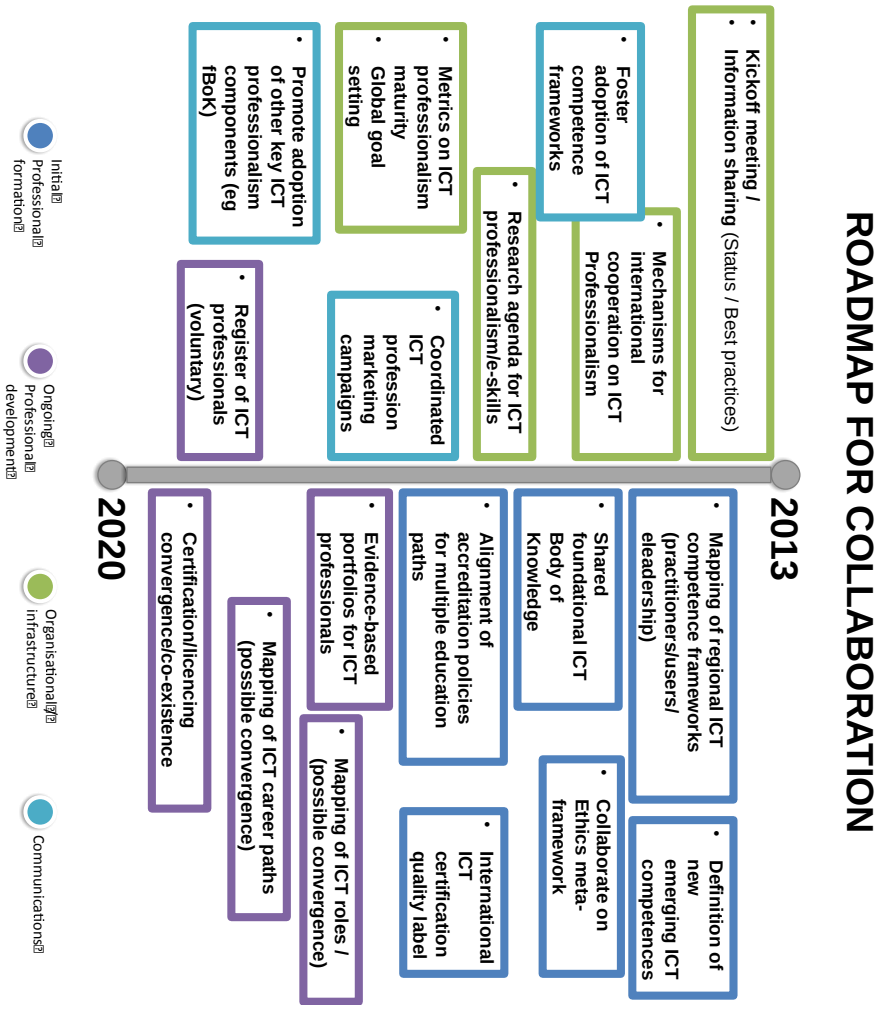
inter-cultural skills.

The breadth of policy actions in place and under development emphasizes the relative importance that economies are placing on e-skills and ICT professionalism. As the pervasiveness of ICT increases further, it is possible that the nature of these policy actions will evolve significantly.

Agenda for international collaboration

ICT facilitates globalization and, in turn, globalization underpins the need for a global ICT profession. Figure 61 below shows a tentative agenda for international collaboration on e-skills and ICT professionalism. The agenda is intentionally high level as it is intended to act as an initial basis for discussion in 'phase 2', rather than as a definitive plan of action. Different countries and stakeholders are at different stages of maturity with respect to the profession, and possess different appetites and attitudes to engagement. As can be seen in virtually every activity, the intention is to build bridges between countries rather than converge on a single solution for each component, as underlined by the term "mapping" in many actions. Further, it is

Figure 61: Roadmap for international collaboration



possible that some countries will not participate in every activity, for example, many countries at this stage are strongly opposed to licensing. However, by engaging in the discussion process, there is a greater chance that common goals can be achieved by understanding the diversity of opinions held. Consensus building and flexibility are essential in this activity.

The sole purpose of this roadmap is to foster collaboration to mature the ICT profession and enhance e-skills. The Commission has no commercial interest resulting from the exploitation of this activity, but is instead acting as a catalyst to help foster economic growth both within Europe and internationally. This comment is stated explicitly to reinforce the fact that the proposals here are not intended to duplicate or replace existing activities, commercial or otherwise, or organisations already active in this domain. Rather, they attempt to connect/amplify the outputs of such existing initiatives to a different audience and in a wider context, towards a common goal. In this respect, it is crucial that progress is entirely demand-driven from the stakeholders involved. Activities are split into four basic categories:

- Organisational/infrastructure – activities related to setup, administration, and operational and informational activities
- Initial professional formation – activities to help develop the next generation of ICT professionals
- On-going professional development – activities related to ICT workers in the workplace environment
- Communication activities – promotional activities to raise awareness and initiate collaboration between countries on e-skills

The following sections provide a description of each activity, as well as identifying the potential shared benefits from collaboration. The list presented is not exhaustive, but intended to present initial ideas for discussion.

Organisational / infrastructure activities

Activity	Description / value
Kick-off meeting / Information sharing meetings (recurring)	An initial kick-off meeting and any subsequent information sharing events are intended to gather relevant stakeholders so that they can share information on the current landscape and trends within their country/organisation, discuss best practices, national policies, challenges, issues, forthcoming events, and planned initiatives. Although shown in the roadmap as the kick-off meeting activity, in practice it is planned that information sharing meetings will happen on a recurring basis. Information sharing sessions are key to facilitating joined-up policy actions on an international basis. **Value:** An opportunity to share lessons learned and identify possible collaborative actions.
Mechanisms for international collaboration on ICT professionalism	Mechanisms to support collaboration and cooperation between the international stakeholders involved need to be fostered. For example, agreement should be reached on a face-to-face meeting every 9 months to shape the vision and roadmap for international collaboration on an ongoing basis, and to identify potential exploratory shared actions. The group may also work to define

	more clearly its scope, objectives and plans. Note there is no intention to create a new formal entity – the proposed approach is an informal initiative with no formal legal structure, membership or employees. **Value:** Establish a clear purpose and structure for the group.
Research agenda for ICT professionalism/e-skills	Many national and regional stakeholders undertake research related to ICT professionalism and e-skill independently of other stakeholders, leading to duplication, conflicting approaches, and inability to consolidate results. **Value:** By sharing plans on tentative research agendas in this domain, there is the potential to identify possible overlap and synergies e.g. survey consolidation and thematic overlaps, thereby reducing redundancy and enhancing the quality of results. Similarly, sharing the results of the research in an appropriate forum is likely to foster improved feedback, and enhance possible future policy decisions and research.
Metrics on ICT professionalism / Global goal setting	Regions should be undertaking strategic workforce planning in order to identify current and future supply/demand imbalances and develop strategies to address them. In this respect, measurement of appropriate metrics is essential to facilitate assessment of progress towards shared goals. This perhaps could lead to possible agreement on an ICT professionalism maturity curve with defined criteria for each level. To this end, this activity will focus on identifying the metrics/KPIs/classification schema that should be recorded in order to mature the ICT profession and enhance the supply of e-skills, as well as facilitating alignment on the approaches for capturing and consolidating this data. For example, the quality of data for supply/demand of skills varies significantly and cannot always be aggregated across borders to form a meaningful picture. This activity will also involve consulting with relevant user-stakeholders (e.g. for employers, what statistics are of most importance to them). Further, this activity involves the setting of national/regional/global goals in order to catalyse change and mature the profession e.g. setting target goals on the percentage of women in ICT employment at specific levels. Suggestions on related initiatives to foster progress towards the agreed targets would be an integral part of the above mentioned recurring information sharing meetings. **Value**: Setting goals on a global basis and reporting on progress will help foster awareness and focus on achieving shared goals.

Communications activities

Activity	Description / value
Foster adoption of ICT competence frameworks	ICT competence frameworks facilitate widespread usage of a common language for ICT competences. Promoting their usage to practitioners, employers and education providers on a consolidated basis will help stakeholders to realize the global benefits that can be accrued from their usage, assuming a mapping exists between the different regional entities. **Value**: ICT competence frameworks act as a common language, hence the more people who use competence frameworks, the greater the potential benefits. If regional frameworks are mapped, as suggested in a preceding activity, the common language of competences will be effective worldwide.
Coordinated ICT profession marketing campaigns	As ICT professionals become vital components in global value chains, the nature of work is changing. Promoting the dynamic changes, the diversity and the value created by ICT on a global scale are important messages to communicate and can be used to promote the ICT profession. It is also important that potential practitioners recognize that demand for ICT is global and the opportunities for career progression are substantial. In this respect, collaboration between stakeholders could range from sharing of key messaging elements in order to help improve consistency and effectiveness, to alignment of communication plans and events in order to help improve timing of messaging to create a consolidated front, to a common logo facilitating the dissemination of messaging under a single umbrella in order to emphasise the global nature of the profession to potential ICT practitioners. Specific campaigns could target relevant global messages e.g. the inclusion of women in ICT. **Value**: Collaborating on promoting a global ICT profession could help to attract new entrants into the ICT profession.
Promote adoption of other key ICT professionalism components	As with the abovementioned action of fostering a common language for ICT competence via usage of mapped competence frameworks, it is important that the other key components of the profession are also promoted and gain traction among stakeholders. For example, more widespread adoption of a foundational ICT Body of Knowledge will facilitate communication between professionals and potentially reduce risk, particularly on projects with staff in more than one country. **Value:** The greater the level of traction nationally and internationally for each component, the greater the potential benefits to employers, practitioners, and other stakeholders.

Core professionalism components

Activity	Description / value
Mapping of regional ICT competence frameworks (practitioner/user/e-leadership)	There are now a number of ICT frameworks gaining traction in different regions including the e-CF, SFIA, and ITSS. Converging on a single framework is unlikely in the short term, but a more pragmatic solution is to map between the frameworks, e.g. from

	e-CF to ITSS, thereby providing a basis for describing practitioner competences on a global basis and facilitating practitioner mobility. **Value**: Improving alignment between competence frameworks via mapping will benefit employers by allowing recruiters to understand the abilities of practitioners regardless of the country where the competences were acquired.
Sharing of information on emerging competences	ICT is evolving rapidly and new competences are continually emerging. Sharing information to facilitate the joint definitions for new competences, e.g. data visualization, ICT intercultural competences, is likely to prove fruitful in the longer term, facilitating stronger compatibility between the different frameworks and alignment between educational outputs. **Value**: Collaborating in the definition of new competence is likely to reduce costs, improve quality and facilitate alignment in the longer term.
Shared foundational ICT Body of Knowledge	At present, many practitioners enter into the ICT profession by accident rather than by design and lack a formal degree in computing. In some instances, such individuals lack a broad understanding of the core knowledge required by ICT professionals and potentially this foundational BoK may include some non-ICT topics rather than being solely technical. This is troublesome, as such individuals often possess deep expertise in a given domain, but the knowledge is siloed and they do not know the limits of their knowledge (i.e. "they do not know what they do not know"), potentially increasing risk. A shared common understanding of the domain would greatly facilitate communication between professionals, and extending this knowledge across the world would introduce a key threshold of ICT knowledge for all ICT professionals. **Value**: The greater the number of practitioners possessing a common understanding of ICT and understanding the limitations of their ICT knowledge, the greater the prospects for professional collaboration across borders.
Collaborate on an ethics meta framework	Codes of ethics/conduct foster consistent behaviours and appropriate conduct are a tenet of every profession. If a global ICT profession is ultimately to emerge, then behavioural norms must be defined and respected. At the same time, different cultures possess different histories, legal systems, political systems and value systems – as such, a single code of ethics is unlikely. However, formulation of a meta-model for ethics is one potential mechanism for facilitating common behaviours. IFIP has already implemented some significant steps in this area. **Value**: Practitioners who adhere to a common code of ethics are respectful of the importance of performing their work in line with accepted norms that potentially differentiate them from others. As such, consistency in ethics is an important step in the path towards a global profession.
Alignment of accreditation policies for multiple education paths	As the ICT profession evolves, as new educational channels emerge e.g. MOOCs, and as lifelong learning grows in importance, it is likely that policies for accreditation will have to evolve to reflect the diverse nature of educational paths open to practitioners, particularly for vocational education/apprenticeships. Interestingly, there appears to be some

	movement in this area, particularly with respect to education reform proposals under the Obama administration advocating a competence based model, rather than the prevailing time-served-in-classroom model. Given the dynamic nature of ICT and its pre-eminent need for practitioners to retain up to date skills, the ICT profession could be a forerunner in identifying and shaping policy thinking in this area. **Value**: Amendments to accreditation policies should be considered from an international perspective in order to facilitate practitioner mobility. Moreover, international recognition of such schemes will potentially facilitate greater interest in such programs e.g. apprenticeships from students, helping to increase the supply of relevant e-skills to industry.
International ICT certification quality label	The development of an international quality label for certification, including formalized and consistent mapping of training and certifications against ICT competence frameworks, would provide additional reassurance to practitioners and employers of the value of investing in a particular educational programme. **Value**: Many training and certification programmes are national in scope, and not recognized outside of their country of origin. Developing an internationally accepted quality label would support improved mobility of practitioners, and facilitate better integration of practitioners from different countries in global value chains.

Workplace components

Activity	Description / value
Mapping of ICT Roles	Different national and regional definitions exist for ICT role profiles. However, given the significance of global organisations, alignment or convergence in these definitions could prove helpful to employers for workforce strategy planning, as well as employees for career planning. **Value**: Aligned ICT role profiles could potentially improve supply of the profiles most in demand. Further, jointly undertaking the definition of new role profiles is likely to be more cost effective and may improve overall quality of the definition.
Mapping of ICT career paths (possible convergence)	The definition of ICT career paths facilitates enhanced career planning, education and workforce planning, and encourages workers to view ICT as a positive career choice. As increasing numbers of ICT practitioners operate within global project teams, the ability to understand the career paths in other regions will be helpful for organisations operating internationally. In the short term, it is unlikely that a single set of global ICT career paths can be forged, but investigation of the respective competences of each ICT role in the defined national ICT career path will help provide a platform for possible convergence in this area. **Value**: Improved alignment between national and regional defined ICT career path models will help organisations that recruit and employ ICT practitioners across national borders.
Evidence based portfolios	The ability of ICT practitioners to demonstrate their competences to employers can be supported through the use of evidence-based portfolios. An initiative to understand different national

	perspectives on evidence-based portfolios could facilitate the development of industry-led solutions that underpin this component of the ICT profession. There is no intention for the group to develop any type of solution, but merely to gather perspectives that could then be exploited by third parties to develop a solution that caters to the ICT profession. **Value**: Gathering international perspectives on evidence-based portfolios could support, in the longer term, the design and development of solutions that support the specific requirements of the ICT profession.
Register of ICT professionals	Over time, it is likely that there will be a growing demand from employers to know the competences of practitioners and if they are certified in this respect. A register of ICT professionals could fulfil such a requirement. However, the landscape is moving rapidly and the form of such a register may be different from current expectations and may resemble something akin to LinkedIn + validated ICT specific Mozilla Badges. It is not proposed that collaboration is undertaken to develop a register but instead to foster discussion on what stakeholder requirements from such a register might be. **Value**: Understanding potential requirements and expectations on a global basis for a register of ICT professionals could help galvanise interest from third parties wishing to develop a relevant global industry solution.
Certification/licensing convergence/co-existence	It is unlikely that a global, regulated licensing scheme for ICT practitioners will emerge in the short or medium term, and the benefits of such a scheme remain unproven. However, pockets of interest in licensing are emerging, and some countries are actively pursuing this path. Instead, it is more likely that certain voluntary professional certification schemes will grow in stature in response to specific industry requirements e.g. cyber security. **Value**: By collaborating in this area, different national perspectives can be shared by participants to facilitate the recognition of different national/international initiatives. In doing so, the potential global "reach" of such initiatives is enhanced, and there is the possibility of formal joint ventures emerging between stakeholders that will enhance their potential application in the marketplace.

Next steps

The scope of the problem space is significant, and the number of stakeholders is large, but the challenges confronting the profession are unlikely to disappear without action. Attempting to forge international collaboration will undoubtedly be challenging. National economic competitiveness is innate and to be encouraged, but sharing best practices and working collaboratively to mature the ICT profession will provide a platform for improved economic productivity, while reducing the many risks posed to society from unskilled ICT workers.

The actions described above provide an initial basis for discussion. In practice, it is likely that some stakeholders will strongly oppose the actions presented. Divisions have evolved over many years - national borders, academic discipline borders, academia versus industry, formal education versus non-formal education, industry

versus public sector, engineering-aligned professional bodies versus information society-based professional bodies and so on. Fostering a common vision on each point will be difficult to achieve. In practice, it is probable that initial activities will only focus on information sharing, and slowly over time some stakeholders may work together to foster agreement on a shared vision, and thereafter agree on possible exploratory actions that could lead to more substantive joint solutions being investigated. However initially, the key objective is solely to get all relevant stakeholders to participate in the discussion, even if only to present their views rather than reach agreement on any single point. This is an essential first step as it provides the necessary platform for a common understanding of the problem space. Moreover, it also helps to reinforce the need for any future work to be entirely demand driven.

ICT is a rapidly changing field. Collaborative initiatives that may previously have been viewed negatively within different stakeholder communities may now be viewed much more positively and new opportunities will continue to emerge over time. Ultimately, it is in the interests of all parties to have an ICT profession that is recognized and valued in our communities, and collaboration is more likely to foster that outcome than trying to develop solutions in isolation.

The alternative is to maintain the status quo, and while this will benefit some individual organisations, it will not begin to address the serious economic and social challenges caused by the current and projected dearth of e-skilled workers and ICT professionals in many countries. As such, all relevant national stakeholders are encouraged to engage in this discussion process. The importance of forging collaborative relationships in order to foster joined up policy and initiatives cannot be overstated. Extracted from a research study for the 2012 European Business Summit, Figure 62 below shows the extent to which European decision makers felt that system-wide collaborative solutions are required: less than 10% stated to "a limited extent". Although not specific to ICT, the chart illustrates the importance of collaborating to address the skills challenge.

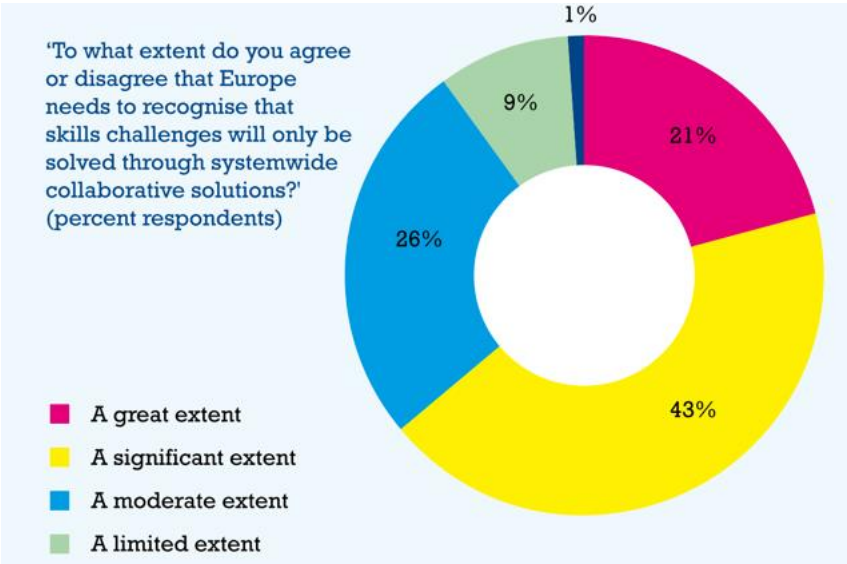


Figure 62: European skills challenges solved through system wide collaborative solutions. Source: Accenture/European Business Summit, 2012.

Concluding remarks

Within Europe, globalization is often vilified in the media as the cause of lost jobs. In practice, the picture is more complicated. Today's economic reality means that we operate in an environment where products and services are delivered as part of global value chains. In such instances, globalization often facilitates the creation and protection of employment opportunities rather than the cause of unemployment.

Reflecting back on the original ACM report into ICT offshoring, Moshe Varde (Varde, 2010) commented "offshoring is just a symptom; the underlying phenomenon is the globalization of computing. Globalization is driven by trade policies, by the evolution of work and business processes, and by IT itself". This view can still be considered valid in 2013, and as the cost of communications declines and communication speeds increase, the potential to provide services remotely continues to grow. However, while some BPO services are provided remotely, relatively few high-level ICT jobs appear to have changed location.

It stands to reason that skills are an essential component of any knowledge-based economy. No matter how sophisticated the ICT infrastructure of a country, if it lacks the skills to exploit the ICT infrastructure to generate value, it is not using its resources efficiently (Kumar and van Welsum, 2013). Certainly within many countries in Europe, the pendulum of focus appears to have shifted from ICT infrastructure to ICT human capital (i.e. competences), emphasizing the need for initiatives to tackle the growing skills gap. As stated previously, young firms and SMEs have a vital role to play in the creation of new jobs, and ICT is likely to be pivotal in both the creation of jobs via new digital enterprises and the destruction of jobs through automation opportunities. Understanding the nature of these changes in depth will enable policymakers to develop appropriate responses to tackle the predicted skills mismatches, and facilitate a continued supply of workers with the right skills in the right locations at the right time. In order to ensure appropriate policies are developed in the longer term, engagement and discussion with many key stakeholders are critical. The tentative roadmap for collaboration on e-skills and ICT professionalism proposed in this chapter serves as a platform for these discussions, and identification of progressive next steps.

CHAPTER 6: THE IMPACT OF GLOBALISATION ON ICT DELIVERY - OFFSHORING AND GLOBAL SOURCING

Introduction

The provision of services from locations in other countries (the core definition of offshoring) is not a new phenomenon. In fact, the importance of offshoring as an element in a global strategy was already mentioned by Stopford and Wells (1972). Essentially, there are two approaches to provision of services from locations in other countries, either through outsourcing the provision of the service to an external service provider or through an organisation setting up its own service operations in other countries and managing these as remote service sites.

The latter approach is typically termed a captive operation and was especially popular in the airlines and financial services sectors during the 1990s. As examples of this, American Express started offshoring various back-office processing tasks to India in 1994 and GE Capital followed suit by opening its GE Capital International Services (GECIS) division in India in 1997 (as an aside, GECIS was sold to private equity in 2005 and is now a third party offshore service provider called Genpact. Many other organisations have followed suit since then and sold off captive operations to external service providers). In the past decade or so, delivery and shared service centres in lower cost European countries, such as Poland, Romania, and the Baltics have also been established as Western European companies, as well as Indian service providers, have realised the benefits of these in terms of cultural affinity, language capabilities and time zone alignments.

As for offshoring via external service providers, this really only took off in the very late 1990s. During the 1990s, an important part of the business of many service providers or service divisions of large ICT vendors was delivering "turnkey" projects, where a large proportion of the work was software development, IT customization and integration work. This work was typically undertaken by locally based consultants and specialists and delivered under fixed price/fixed time agreements. Another important part of the business of many vendors was to provide lower-level support functions, such as hardware break-fix and different levels of software support - again typically quite "people heavy" processes. Outsourcing at the start of the 1990s was still at its infancy with low adoption levels across many European countries but with the UK leading the trend. These outsourcing engagements were also typically fulfilled using locally based staff, frequently transferred from the outsourcing organisation to the service provider. Towards the end of the decade, many large international companies began experimenting with getting some of all this work, mostly programming work, undertaken in India (as a continuation of the captive wave described above).

However, at the start of the twenty-first century, several factors came together to create the perfect storm that set the foundation for ICT and business process offshoring, which today is part of the global sourcing value chain. Against a backdrop of a busted economic bubble, a "discredited" IT sector following the dot.com era and the Y2K debacle, and anaemic US and European economies, customers were looking to find ways to lower IT services and processing services costs. In addition, improved communication technologies and price points enabled the offshoring trend.

While service providers responded by expanding the types of services they would undertake, some also started to establish or acquire, in particular, Indian operations to enable them to offer lower cost services through labour arbitrage. In addition, these extra geographical footprints also enabled them to offer "follow the sun" development and support processes, whereby employees would work on a project in Europe or the United States during the local daytime, and at night, work would pass to offshore-based colleagues, mostly in India but increasingly also in the Philippines, Malaysia and Latin America. Due to language capabilities, this trend benefited especially English and Spanish speaking economies. These changes opened new opportunities for offshore headquartered – again spearheaded by India – companies to address Western customers directly. What was later called the offshore industry was born.

Offshoring in the past decade

While initially the key driver for offshoring was to reduce cost, this has quickly developed to include other objectives. Consequently, the types and scope of work that is offshored is becoming more complex, but with cost savings as an expected outcome. Figure 63 below, adapted from IDC research (Gere, 2003) illustrates these customer needs and the skills and expertise that are required to fulfil these needs at a high level.

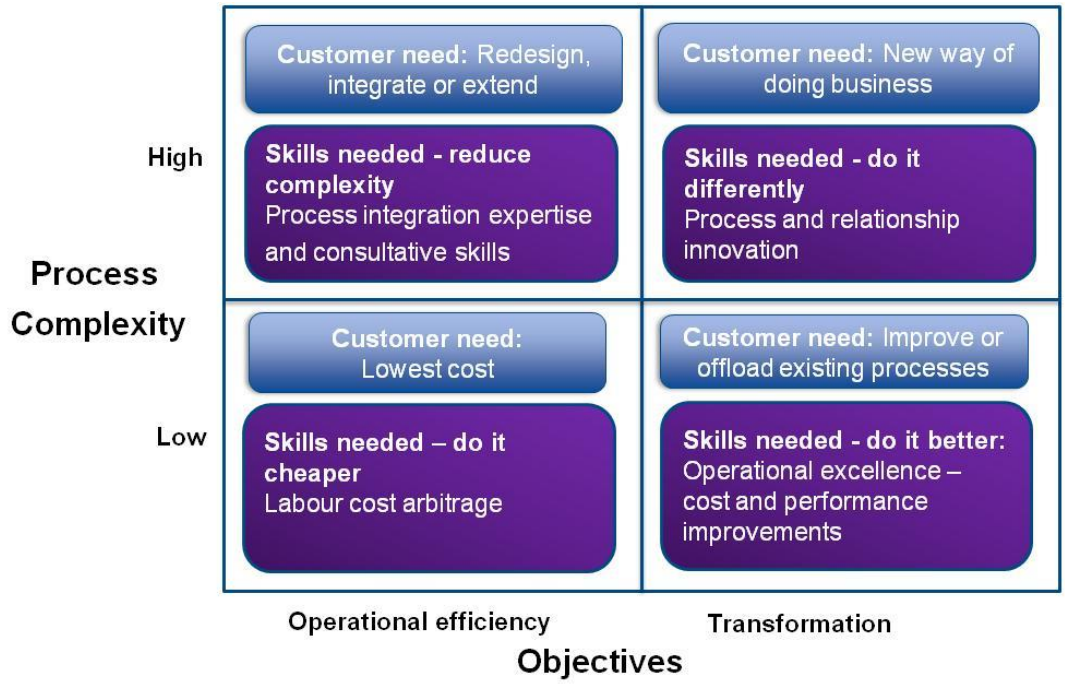


Figure 63: Enterprise objectives and offshore skills needed (Source: Adapted from IDC, 2003).

Figure 63 shows that there are two main types of objectives that are driving the use of offshore resources: operational efficiency (i.e. the ability to operate some status quo aspect of the business at lower cost to improve business efficiency) and transformation (i.e. changing aspects of how the business is executed to gain both cost and performance advantages). Another determinant factor for the work, and hence the skills that are needed offshore, is the complexity of the processes that are offshored. The simplest form of offshoring is a low complexity process where the objective is purely to gain operational efficiency. This is labour arbitrage and is where most offshoring activities were aimed at the outset.

However, as service providers have become more experienced in running offshore operations, have developed better tools, improved delivery processes (e.g. through CMMI certification), 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 of the work that has been done in offshore locations over the years has been "under the radar". Reasons for this are typically that the customer has been worried about the 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 (see *Skills in the Offshore Value Chain* section below). Grossman and Rossi-Hansberg (2006) also describe the difficulty in documenting the extent of offshoring but with a focus on how official statistics on imported inputs and outputs, for example, do not disclose the levels of detail needed to understand the extent of offshoring.

This leads to the question of how to assess the extent of offshoring, the types of activities that are most affected and, hence, the types of skills that are impacted. It is important to underline that this study considers full-time, part-time and free-lance employees - the starting point for the study is the demand for offshore ICT skills - no matter (at the outset) how these are sourced. Since the data on offshoring cannot be obtained directly, two possible approaches to assessing this are suggested – both with their limitations – but they will at least provide indications of the type of activities that are being offshored:

- Analysing publicly available services contracts in the past decade to establish when services are delivered from offshore and the type of services that are affected. The limitations of this analysis are that it pertains to external engagements (i.e. not captive services delivered offshore) and only to contracts that are in the public domain. However, the source for this analysis (IDC's BuyerPulse Deals Database) contains more than 27,000 contracts signed in the years 2002-2012 in Europe and North America – the most important regions for analysing the offshore phenomenon.
- Analysing the revenues of the major India-based offshore providers to understand how these are segmented by different types of services and how they have developed over several years in order to establish a trend and set a basis for discussion of how this may develop in the next decade. The limitation here is that the analysis is focused only on the India-based offshore providers and does not include a view of the services delivered from offshore by major, Western-based companies, such as Accenture, IBM, HP, Capgemini and CSC – all of which have extensive global delivery networks. However, since these companies do not report a segmentation of their revenues into offshore versus onshore delivery, including these players in the analysis is not possible. There are, nevertheless, other data points that show the extent of the major Western-based companies' offshore resources and how quickly these are growing. As an example, Accenture has approximately 80,000 employees in India (nearly a third of its workforce) and 35,000 in the Philippines and the company is expanding these numbers (Tejaswi, 2012). Another example is IBM, which reportedly has more employees in India (125,000) than in its US home base (100,000), (Mishra, 2012). However, even with the abovementioned limitation, the analysis still provides supporting evidence of the trend.

Offshoring – analysis of contracts

When isolating the publicly available contracts signed in Europe and North America in the ten-year period from 2002 to 2012 and where offshore delivery was ***a reported part*** of the engagement, out of the 27,000 contracts only 684 contracts at a total contract value (TCV) of approximately €76 billion explicitly mentioned an offshoring component. This indicates that the extent of offshoring in external service engagements relative to all service engagements has been quite low. However, it is likely that there are more contracts with offshore delivery but the customer has not been interested in this information reaching the public domain due to possible backlash (Mankiw and Swagel. 2006). Nevertheless, it is still possible to see trend developments from this number of contracts.

IDC captures and classifies contracts based on the main reason for the engagement in what is termed foundation markets (there are 14 foundation markets, such as IT consulting, systems integration, and IT outsourcing), as well as several sub-markets. However, an analysis at this level would be too detailed to show trends. Consequently, for this analysis the contracts have been grouped into five categories, which are also relatively aligned with categories used by others studying the offshore market, such as The Conference Board (Lewin et al, 2009):

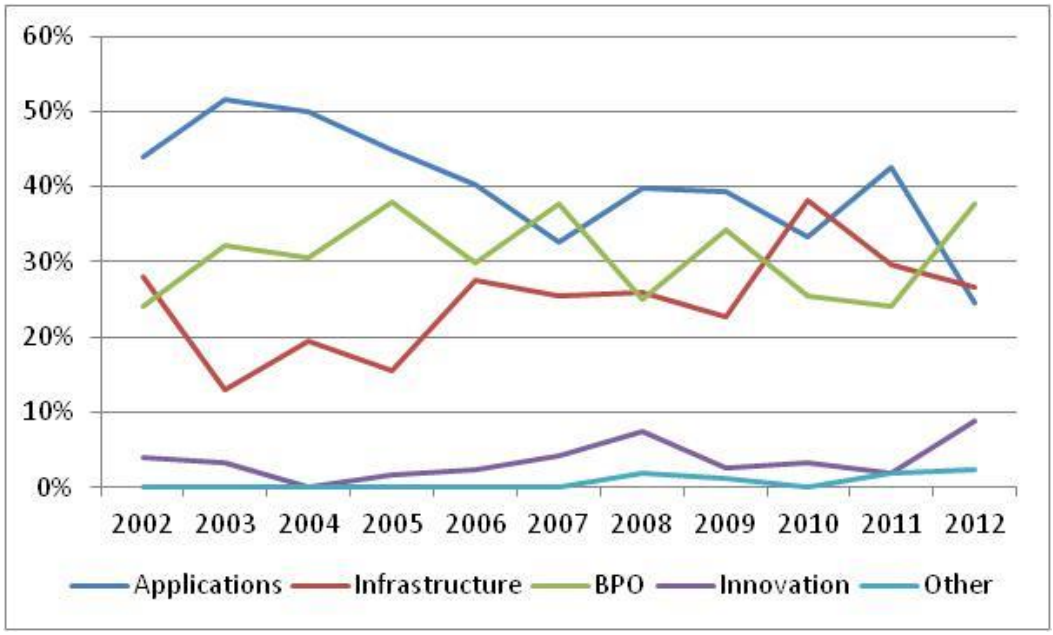
- **Applications:** includes Custom Application Development, Application Management, Hosted Application Management, Software Deploy and Support, and IT Consulting and System Integration contracts where the main purpose is design and implementation of application solutions
- **Infrastructure:** includes Information Systems Outsourcing, Network and Desktop Outsourcing, Network Consulting and Integration Services, Hosted Infrastructure Services, Hardware Deploy and Support, and IT Consulting and System Integration contracts where the main purpose is design and implementation of hardware or network solutions
- **BPO:** includes HR, Finance and Accounting, Procurement, Customer Care and Industry-specific Business Process Outsourcing
- **Innovation:** includes R&D, and Product Engineering
- **Other:** includes pure IT and business consulting engagements and IT education and training services

It is important to note the following:

- Contracts for growth areas, such as Big Data, mobility, social, cloud (the four pillars of what IDC calls the 3rd Platform) and security will typically be captured in either Infrastructure or Applications, depending on the nature of the undertaking. For example, if a customer wants to build a private cloud infrastructure in the company's data centre, then this could be done either on a project basis (IT consulting and/or system integration) or during the course of an outsourcing engagement. On the other hand, if the customer wants to prepare and move the company's application environment over to the existing cloud infrastructure, then this could be done either on a project basis (IT consulting and/or system integration) or during the course of an outsourcing engagement.

- A contract is captured only once in one of the categories so that there is no overlap between the five groups. If a contract is complex in nature and spans several categories, the contract has been placed in the "bucket" where the biggest part (from a value perspective) of the contract belongs.
- A contract is only counted or valued in the year in which it is signed. Hence, a four-year contract, for example, is counted only in year one.
- The analysis below is based on number of contracts rather than value of contracts. The reason for this is that it is difficult to establish from a value perspective the proportion of a contract that is offshore delivered. In some contracts, this would be only a fraction of the contract value (such as in a data centre outsourcing contract) whereas in others it could be most of the contract (such as in a custom application development contract). Hence, a value-based analysis would show a more skewed picture than analysis based on the number of contracts that have offshore delivery elements.
    - To illustrate this, in value terms, the TCV of Infrastructure contracts represents the largest proportion of the €76 billion of total TCV for analysis (€33 billion), followed by BPO (€27 billion), Applications (€14 billion), Innovation (€1 billion) and Other (€26 million).
    - In terms of number of contracts, the largest portion of the 684 contracts is Applications (267), followed by BPO (212), Infrastructure (174), Innovation (26) and Other (5).

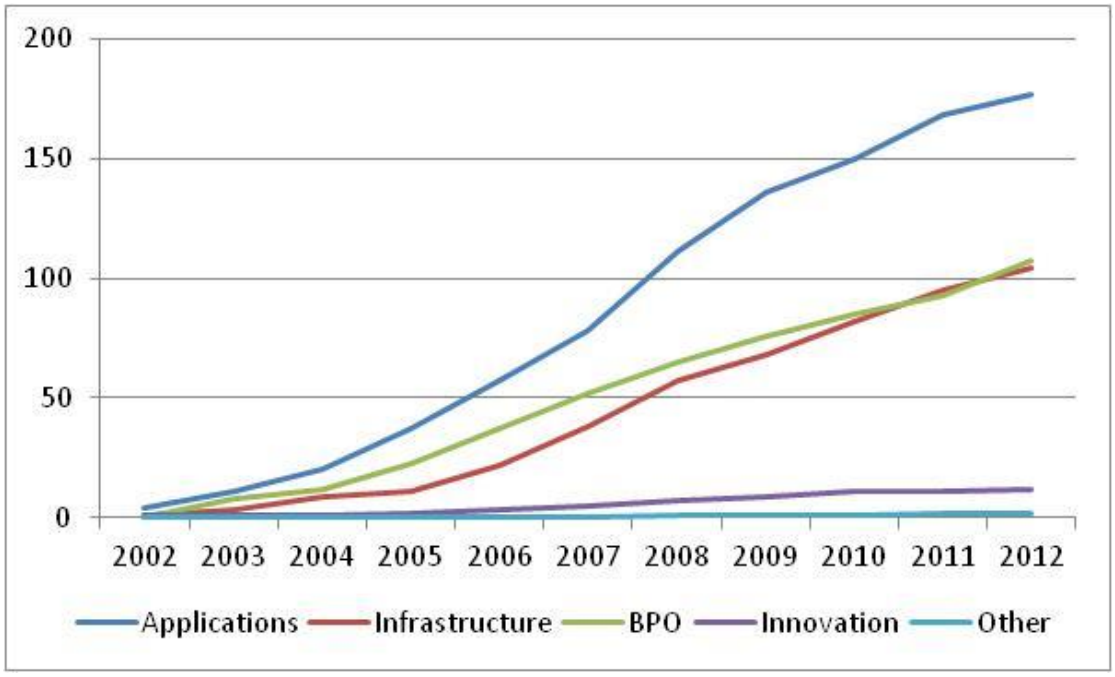
In order to see the pattern of the type of work that is most often offshored over the period, the proportions that these five segments constitute of the total number of contracts in a given year have been calculated. The result of this analysis is shown in Figure 64 outlining contracts signed in North America and Europe. As can be seen, application-related work is the most common for offshore work. This harmonises with where the offshore trend started (see above). However, over the years, there has been an increased tendency towards infrastructure-related work and business process outsourcing so that, relatively speaking, there was little difference in the proportion of contracts for these three segments in 2012. Innovation and "other" consistently account for the smallest proportion of contracts over the period.



N=684 contracts signed in North America and Europe. Source: Analysis of publicly available contracts in IDC's BuyerPulse Deals Database, 2013

Figure 64: 2002-2012 North American and European contracts with offshore elements by type of work

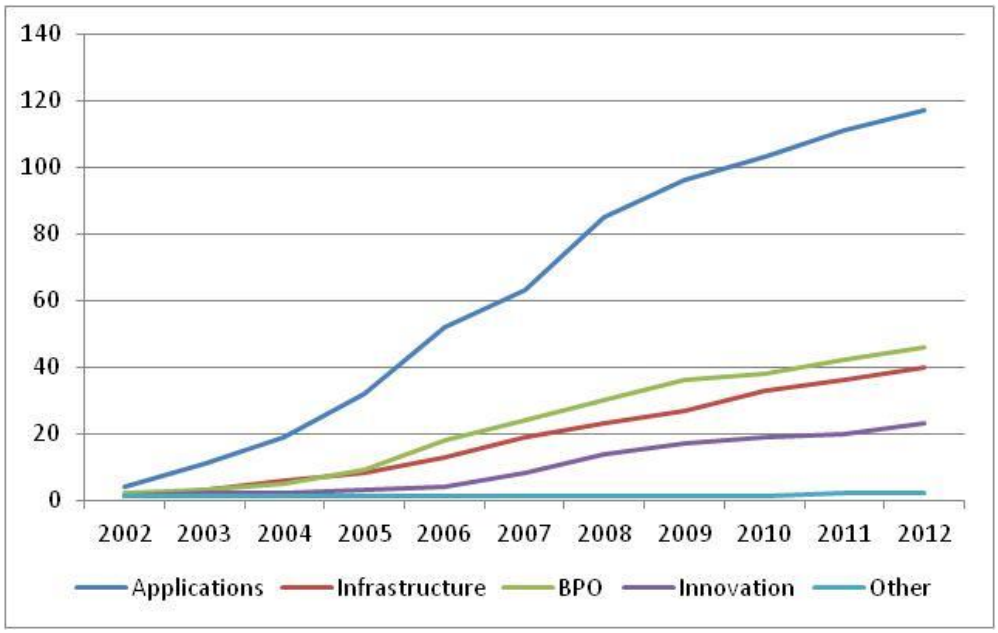
Figure 65 is focused on contracts signed in EU countries only and presents the cumulative percentage of contracts by type of work over the period. It is also clear here that applications-based engagements represent the majority of contracts with offshore elements and that both infrastructure and BPO contracts have been increasing their share (even if the share of BPO contracts has tapered off towards the end of the period). This picture is in line with findings from other sources (Lewin et al, 2009), hence validating the approach.



N=402 contracts signed in European Union countries. Source: Analysis of publicly available contracts in IDC's BuyerPulse Deals Database, 2013

Figure 65: 2002-2012 Contracts signed in EU countries with offshore elements by type of work

As discussed above, when considering contracts signed with Western-based service providers, the offshore elements can be a small proportion of the overall engagements, or they can be the main delivery approach. However, if looking specifically at contracts with the India-based offshore providers (where typically minimum 80-90% of the delivery is offshore), some interesting variations emerge as shown in Figure 65. Firstly, applications-based contracts represent a higher proportion of the overall contracts, which fits well with the heritage of the majority of the Indian offshore providers. Secondly, it is clear that infrastructure and BPO are becoming a higher proportion of the overall number of contracts for these vendors, which is also in line with the strategies that the vendors are pursuing. Many of them are boosting their skills and increasing the offerings they are taking to market in these areas as they are trying to be perceived as more full-scale service providers competing head-to-head with the major Western-based service providers. In particular, capabilities in the Infrastructure space have been seen as a weakness in their service portfolios. Finally, innovation represents an area targeted for growth for the Indian vendors. For many of the vendors, R&D has been a business line from the start, pulling heavily on the large number of master degree level (or above) skills available in the Indian ICT labour market. This is also reflected in Figure 66 below, where it can be seen that Innovation is a larger proportion of contracts for the Indian vendors than for vendors overall.

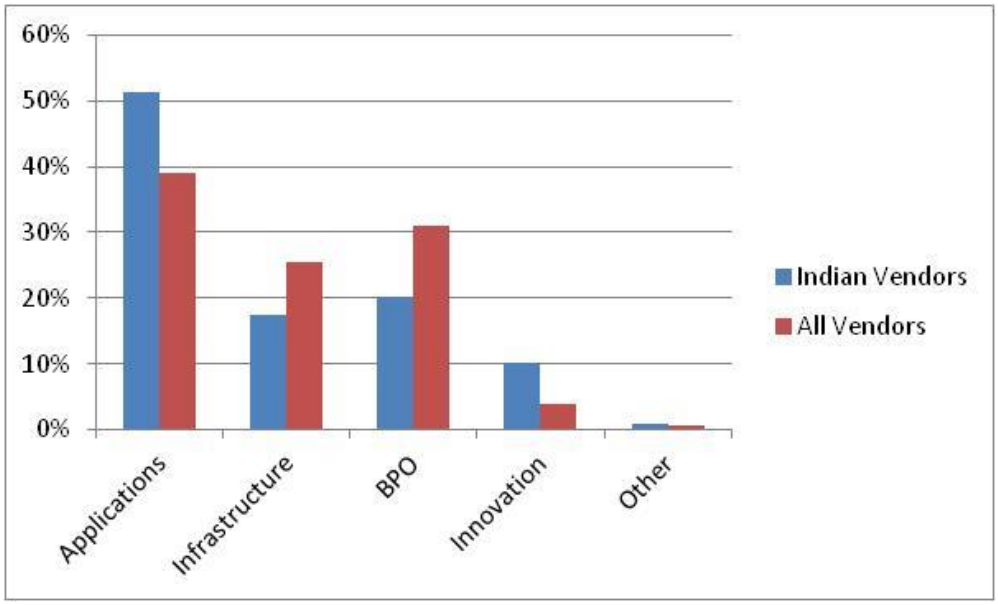


N=228 contracts signed in North America and Europe. Source: Analysis of publicly available contracts in IDC's BuyerPulse Deals Database, 2013

Figure 65: 2002-2012 Contracts with Indian vendors by type of work

Figure 66 shows the comparison between the types of work undertaken by India-based providers compared to all vendors in the analysis, underlining the dominance of application-

based work in offshoring.



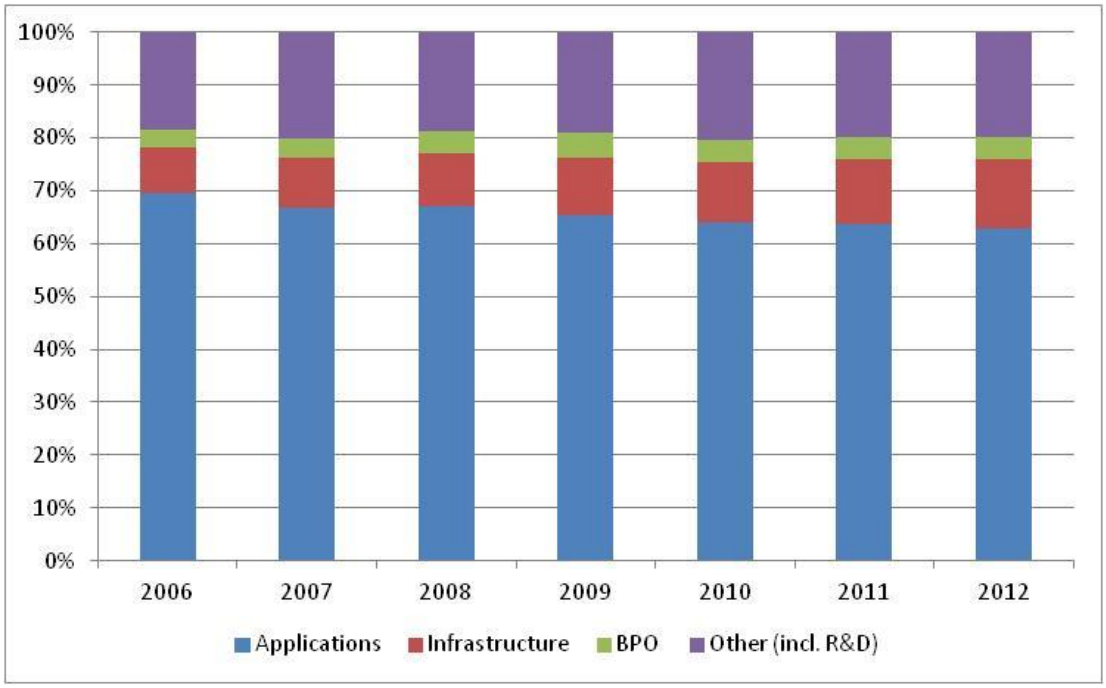
N=684 contracts signed in North America and Europe during 2002-2012. Source: Analysis of publicly available contracts in IDC's BuyerPulse Deals Database, 2013

Figure 66: Comparison of type of offshore work in contracts with Indian vendors and all providers, 2002-2012

Revenue analysis – top India-based offshore providers

While the above analysis has been focused on number of contracts, it is also useful to look at the relative amount of money spent on offshoring of the different segments. As part of its on-going research into the global IT and business services markets, IDC tracks and estimates the revenues of hundreds of services companies worldwide, among which are the major India-based offshore providers. So, when looking at the aggregate revenues of these vendors, does the picture and the trend change? This could be the case if, for example, the application-based contracts were all of smaller sizes than, for example, the BPO contracts.

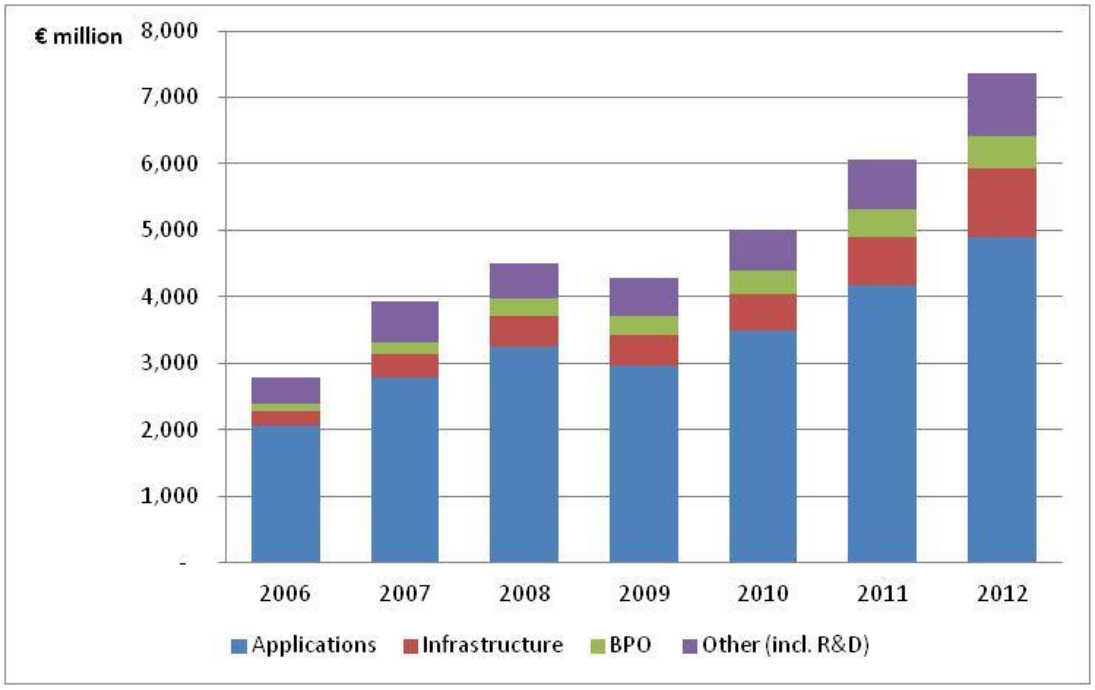
Figure 67 shows the proportion of the aggregate worldwide revenues of the top Indian offshore companies generated from application, infrastructure, BPO and "other" engagements (innovation is included in the "other" category as no further splits are available). It is clear that application-based engagements represent the lion's share of the vendors' revenues, albeit declining slightly over the period to represent just over 60% in 2012. The proportion of revenues from BPO and "other" is stable over the period, while infrastructure is increasing slightly.



Source: IDC analysis of reported revenues by leading offshore providers: Cognizant, HCL, Infosys, Patni, Tech Mahindra (incl. Satyam), TCS, and Wipro. Aggregate revenues of $40.6 billion in 2012

Figure 67: Worldwide revenue distribution of main offshore providers by type of work, 2006-2012

This representation shows the relative value of the types of work. A look at the absolute values and the development in these provides an indication of the uptake of offshoring over the period. Figure 67 shows this analysis but for European revenues only. As can be seen, the aggregate revenues of the India-based providers has increased rapidly in Europe from 2006 to 2012 at an average annual growth rate of 17%, while the overall IT and business services market in the period declined by 1.5% according to IDC data as a consequence of the economic crisis. However, to put it into perspective, in 2012 the aggregate revenues of the India-based providers reached an estimated €7.4 billion, while the total IT and business services market was valued at €212 billion according to IDC estimates, hence they represented only 3.5% of the market. Application-based engagements represent almost 70% of the India-based providers' revenues in Europe, higher than the worldwide proportion, while BPO is slightly more favoured (7% of revenues compared to 4% worldwide in 2012).



Source: IDC analysis of reported revenues by leading offshore providers: Cognizant, HCL, Infosys, Patni, Tech Mahindra (incl. Satyam), TCS, and Wipro. Aggregate revenues of $40.6 billion in 2012

Figure 68: European revenues of main offshore providers by type of work, 2006-2012

Skills in the offshore value chain

The previous sections provide evidence of the type of ICT work that has been offshored in the last ten years. But what are the skills that are being offshored? The skill sets that are needed offshore are as varied as those that are needed onshore. However, in an offshore engagement, the balance in terms of the volume of skills will naturally shift towards skills for activities that can be delivered remotely from the lower cost location and where face-to-face interaction with the end customer of the service or the product is less important. Figure 69 illustrates some typical examples of the skills/activities associated with each of the five segments that were used for the analysis in the previous section.

As can be seen, many of these skills are not only low-level skills but are increasingly high-level skills, as organisations use the possibility of offshoring to gain access to capabilities that may be in short supply locally or onshore, rather than looking for low-cost labour arbitrage.

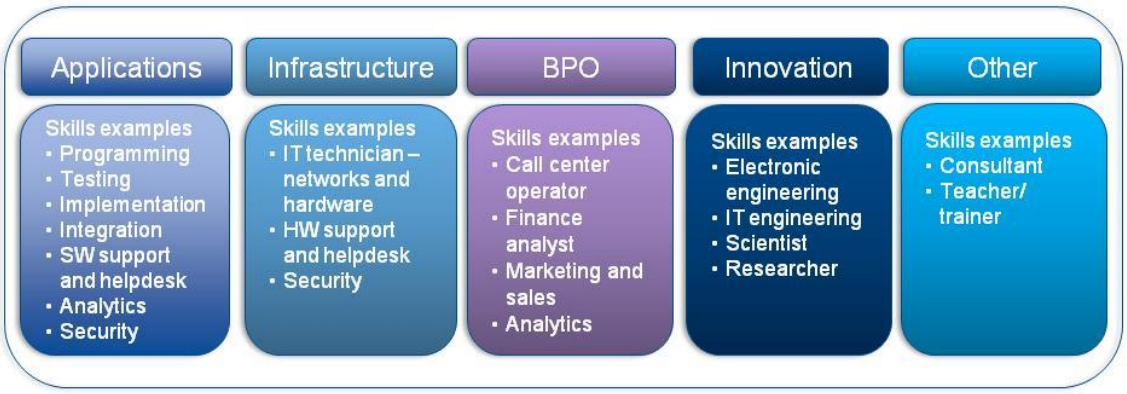
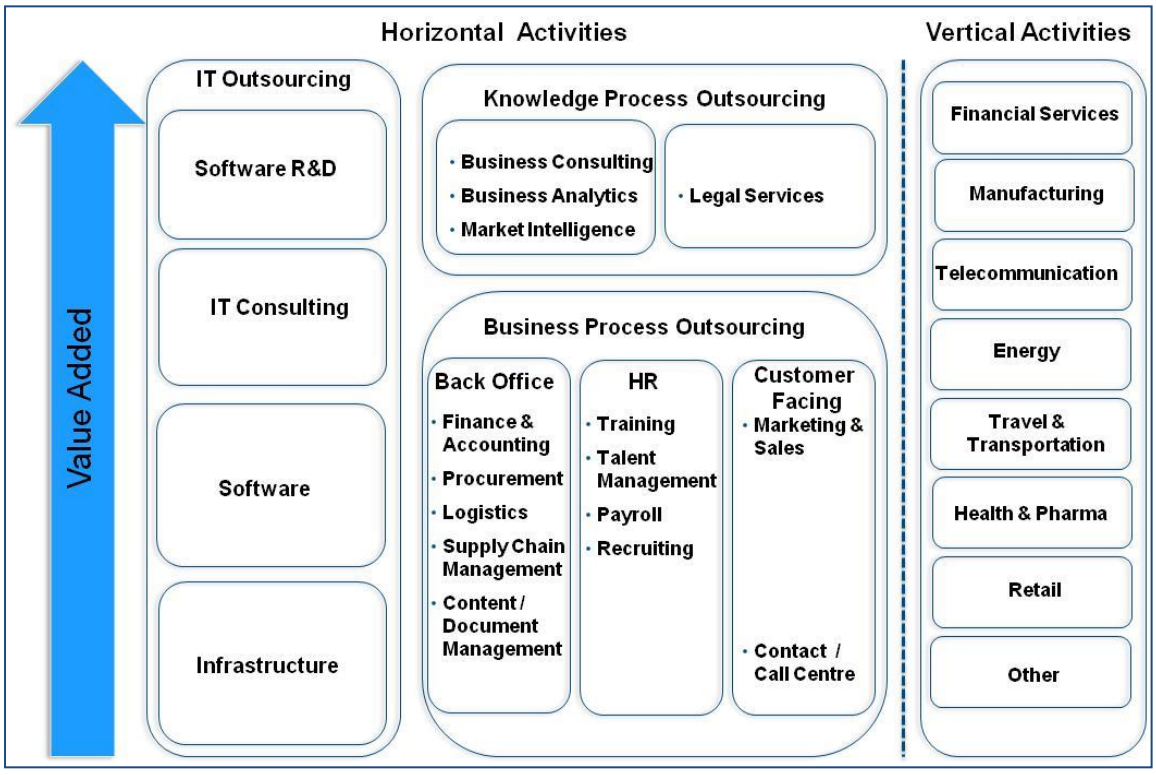


Figure 69: Type of work and examples of types of skills/jobs. (Source: IDC, 2013).

The offshore services global value chain

A detailed investigation of the offshore services global value chain and the related workforce development was undertaken by Duke University's Center on Globalization, Governance and Competitiveness (Fernandez-Stark et al, 2011). A simplified adaptation of the global value chain is presented in Figure 70.



Source: Adapted from Duke CGGC, The Offshore Services Global Value Chain, Fernandez-Stark, Bamber, Gereffi, November 2011

Figure 70: The offshore services global value chain

Compared to product-based value chains, where value is measured on the basis of the price of the input and output added at each stage of production, services value chains are more

complex in the sense that it is much more difficult to measure the value created at each stage due to lack of reliable data and statistics.

In the offshore services global value chain, Duke CGGC has related the value of services to skills levels and work experience, i.e. the human capital input. Consequently, Figure 71 is based on wage levels of employees in the different activities within the value chain, which reflects the associated education and experience levels. While this is a valid simplification in order to create a value chain, it is just that – a simplification. In infrastructure, for example, both lower skills levels, such as IT support, and higher-level skills, such as those needed for data centre consolidation and virtualization, as well as skills for implementing private cloud infrastructures exist. The latter are in high demand due to the uptake of cloud and are also in short supply.

As part of the framework, Duke CGGC has also identified educational profiles and training requirements for each segment of the value chain, based on an analysis of the Chilean offshore services industry (Fernandez-Stark et al, 2010).. These are shown in Table 14. As can be seen, apart from call centre agents, where only low to medium skills levels are required with short on-the-job training, the other positions require a medium skill level as a minimum and a technical diploma or degree.

However, IDC would argue that the positions listed in the table, while relevant, do not represent the broadness of the skill sets that are employed in offshore service delivery. To support this statement a quick scan of open positions for the largest India-based service provider – Tata Consulting Services - in its India operations reveal the following open positions (amongst many others), which would rank high in the value chain:

- Technical architect: bachelor of technology, engineering or science degree and 6-15 years of experience
- Technical lead: bachelor of technology, engineering or science degree and 3-10 years of experience
- Open source architect: bachelor of engineering degree and 6-15 years of experience
- Senior developer: bachelor of engineering, science or law degree and 3-7 years of experience
- Technical systems analyst: bachelor of technology, engineering or science degree and 3-7 years of experience

The offshore value chain is complex, and in all types of work there are low-level 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.

Position	Job Description	Formal Education Requirements	Training/ Experience	Skill Level
ITO				
IT Technician	Maintains equipment and network devices, provides software support for updates.	Technical diploma/degree	Specific technical courses, on-the-job training, and experience	
IT Software Programmer	Programs software applications for general or customized use.	Technical diploma/degree	Software programming courses and certifications	
IT Consultant	Provides advice to help firms align IT strategy with their business objectives (may include information risk management, IT infrastructure, strategy, data management).	Bachelor's degree in IT/ Master's degree in engineering	Consulting/ management experience	
Software R&D Engineer	Designs, develops, and programs innovative software packages and functions.	Bachelor's /Master's/ Doctoral degree in industrial engineering/computer science/informatics	Software programming courses and certifications	
BPO				
Call Center Operator	Answers in-bound calls regarding specific products and provides general customer services.	High school/ Bachelor's degree	Two – three week of training and on-the- job training	
Finance and Accounting Analyst	Provides accounts receivables and accounts payable processing, reconciliations, ledger keeping, and income and cash statement preparations.	High school/ technical institute diploma in accounting	Technical training and on-the-job training	
Marketing and Sales Representative	Supports inbound and outbound sales, sales order processes, and customer monitoring.	Technical/Bachelor's degree	Short training and on-the-job training	
BPO Quality Assurance and Team Managers	Ensure BPO agents meet specified client service standards and monitor agent performance.	Technical and university-level professionals	Technical training and on-the-job training	
KPO				
Finance Analyst	Provide guidance to businesses and individuals making investment decisions; assess the performance of stocks, bonds, commodities, and other types of investments.	Bachelor's degree in business administration	Charted Financial Analyst (CFA) certification	
Business Analyst	Provides business services, such as market research, business opportunity assessment, strategy development, and business optimization.	Bachelor's/Master's degree in business administration	Experience	
Legal Analyst	Reviews and manages contracts, leases/ licenses. May provide litigation support services or intellectual property services.	Law degree	Experience and training in specific country legal systems	
R&D				
Researcher	Undertakes projects to increase the stock of knowledge; develops new products based on research findings.	Master's/doctoral degree	Experience/industry specialization	

Skill Level	Low	Low–Medium	Medium	Medium–High	High
					
	No formal education/ experience	Literacy and numeracy skills; experience	Technical education/ certification	Technical education/ undergraduate degree	University degree and higher

Source: Duke CGGC, based on Fundación Chile, 2009; Fernandez-Stark et al., 2010b; Wadhwa, 2008

Table 13: Job profiles in the offshore services global value chain

How will globalisation affect ICT and delivery in the future?

What of the future for offshoring of skills looking towards 2020? The CIO survey undertaken for this study provides some indicators of the expected development. One question asked was: *For each of the [named] skills, indicate the likelihood that the skill will be offshored at some point in time in the period 2013-2020.* Figure 71 shows the result of this question.

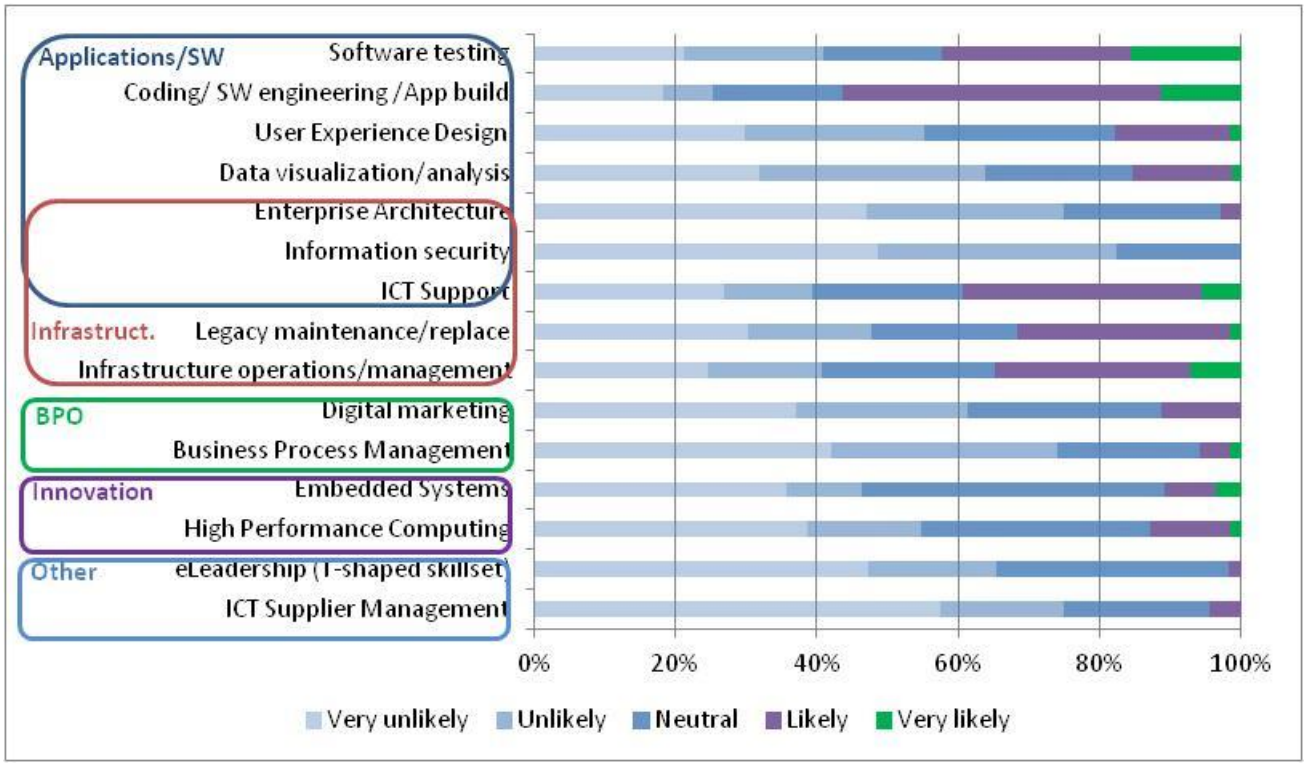


Figure 71: CIO survey: likelihood of offshoring of skills, 2013-2020. (Source: CIO survey for International, 2013).

In Figure 71, the different types of skills evaluated in the CIO survey have been organized to match against the segmentation used in the previous part of this report. The results from the survey show that skills for software testing and programming (the top two in the chart) are the most likely to be offshored in the period out to 2020, followed by infrastructure operations, maintenance and support. The indications of an intention to offshore business processes are low, however this is likely to be a result of the limited number of processes investigated or that many of the easily offshore-able processes have already been moved. An additional concern could also for some processes be related to data privacy. Likewise, skills related to innovation and "other" are also unlikely to be offshored according to the survey. These results indicate a continuation of the trends that have been observed in the past decade with no major "quantum leaps" expected.

This finding is corroborated by a study by PWC looking at the changing global service provider community and the new offerings that they intend to take to market (PWC, 2010). In the study, a survey question explored the new offerings that the providers intended to launch, segmented by the regional/country origin of the provider. The results showed that the vast majority of Chinese and Eastern European providers are targeting application development and maintenance services as a market entry strategy (100% of Chinese companies and 72% of Eastern European companies). IT infrastructure related services were also mentioned as

potential new offerings by 80% of Chinese providers, but overall 90% of providers were focused on offering new software development services. (It should be mentioned that India was not singled out in the study). Although the study is now three years old, the question related to *intended* rather than *existing* offerings. Considering the lead-time in developing, launching, and getting new offerings to the customer, it is reasonable to assume that these intentions signal what may be happening at least in the next two years in the market.

As part of its ongoing tracking of the IT and business services markets, IDC forecasts the spending in these market segments. Through its global sourcing research area, it also estimates the proportion of spending in these markets that is offshore. IDC's current forecast period is five years out to 2017 and thus is providing a reasonable picture of the developments in offshoring for the segments illustrated above. Figure 72 below summarises these forecasts. It should be noted that these forecasts are for the Europe Middle East and Africa (EMEA) region, however, spending in the EU countries will account for approximately 75-80% of total spending and approximately 85-90% of the offshore spending, hence these forecasts are valid approximations.

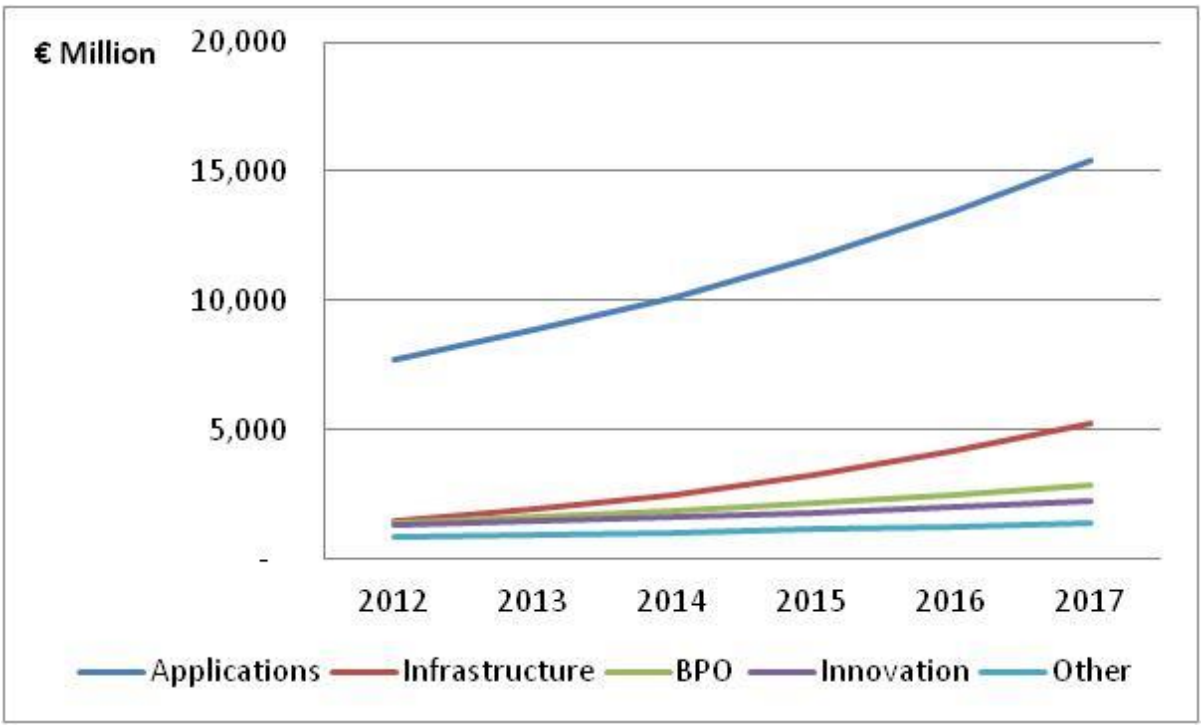


Figure 72: EMEA offshore spending, 2012-2017 (€Million). Source: IDC, 2013 – Adapted from published data (Source: Dialani, 2012; Hayward et al, 2013; Robinson et al, 2013).

The forecast clearly shows that application-related activities will continue to dominate in terms of use of offshore facilities in the near future. Combined with the intentions of the service providers to focus on software-based services, there is little reason to expect a seismic change in the types of skills that are prone to offshoring out to 2020.

From labour arbitrage to standardisation, automation and cloud

An integral part of the increased maturity of offshore service delivery, whether internal or external, is the move away from only considering "throwing people at the problem" to delivering more advanced services and higher productivity by standardising processes and increasing automation where possible.

Standardisation is particularly important in developing "process factories" where:

- The process and its constituent elements are broken down and their parts redistributed logically and physically, or recombined, allowing the supplier (captive or external) to gain economies of scale and of geographic reach. This also allows greater control over the outcome and the quality of the process, and paves the way for greater levels of automation.
- Assets are re-used to service multiple internal or external clients or functions. This drives economies of scale but also enables the use of the same people, technology, and intellectual property to process work.
- 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. "Low-touch" and indeed "no-touch" processing for transactional processes (or at least for the transactional element of processes) is the ultimate goal. This allows the people performing or managing the process to concentrate on higher-value, less repetitive tasks such as exception management and tasks involving professional judgment and advice. It also allows for the process to be performed at the most cost efficient location (Hayward, 2008).

The issue of automation and its impact on knowledge work has been widely described. According to work by the McKinsey Global Institute (Manyika et al, 2013), in the application space, knowledge work automation tools and systems could take on tasks that would be equal to the output of 110 million to 140 million full-time equivalents (FTEs) worldwide. These are massive numbers and massive impacts; however, the key question here is whether the result would be replacement of these FTEs or redeployment? The probable answer is that it will be a mixture of both, quite like what has been observed with offshoring. According to a joint survey-based study by Duke University and Booz Allen Hamilton, as offshoring has matured fewer jobs have been lost onshore as a consequence: only 26% of employees were laid off, while 49% were redeployed either internally or with the external vendor and the remainder left via normal attrition (Couto, 2007). Productivity gains do not always equal job losses. In addition, offshoring brings new skills requirements onshore to manage and/or complement the offshored elements. In the early days, this was an issue that was often not well understood but managing teams of people (even through an offshore partner) many time zones away adds complexity to the relationship and most often require dedicated resources. Consequently, customers are putting pressure on their service providers to have onshore resources that can act as the interface and this has lead to the trend of the offshore providers increasing their locally hired onshore resources to be close to the customers.

However, 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 done solely by computers, the financial benefits of moving this task or process to the other side of the world dissipate. Brynjolfsson and McAfee in 'Race Against the Machine' lists several examples of how the digital revolution is already here and how computers are already capable of taking on many tasks that just a few years ago were considered impossible or things of science fiction (Brynjolfsson and McAfee, 2011). However, 'Race Against the Machine' paints a stark and pessimistic view of the impact of automation on employment. Just as with the calculations from McKinsey, the reality is probably that human beings and employment markets will adapt to take advantage of the new technologies and find other and perhaps higher value-add activities to perform (Worstall, 2011).

Then there is *cloud*. Cloud represents a fundamental change in the way computing power is generated and distributed, transforming the delivery of IT tools and products into elastic, on demand services characterized by flexible "pay as you go" payment models. As shown in previous European Commission projects, more than half of all EU businesses are already using cloud and by 2014, IDC estimates that the public cloud services market will reach €11 billion in revenue (or 3.6% of the total IT market) (European Commission, 2012c). As an example, testing-as-a-service is a cloud-based platform for delivering automated application testing services. It is a self-service solution under which the testing process can be orchestrated end-to-end by automating the provisioning of test labs including applications under test and test tools. Consequently, this cloud service is an alternative to offshore, labour-intensive testing services, which can be provided from anywhere.

Why mention standardisation, automation and cloud in the same breath and when focusing on how offshoring will develop in the period to 2020? The answer is simple: improvements and developments in technologies combined with increased maturity and experience of user organisations means that the way they consume ICT and business process tasks and services is changing quite fundamentally. Offshoring cannot be considered in isolation. Figure 73 illustrates this seamless global use of resources – local, nearshore and offshore, and cloud-based – to deliver an integrated IT or business process.

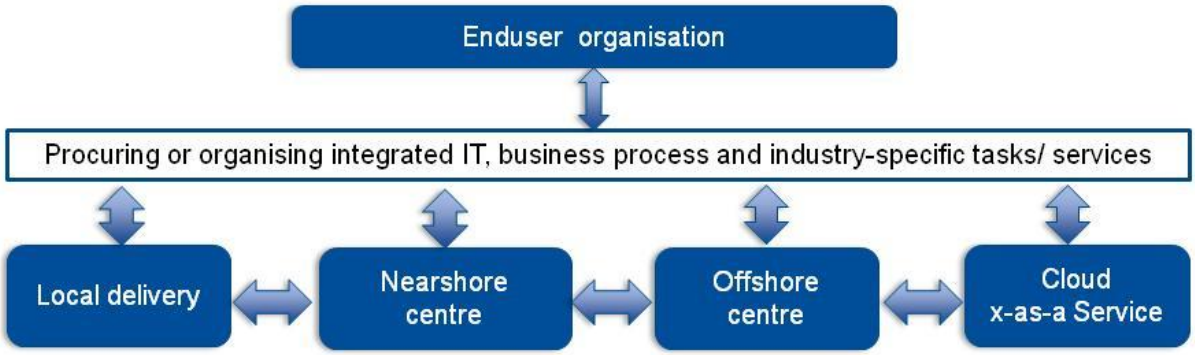


Figure 73: Global sourcing delivery. Source: IDC, 2013

This trend towards global sourcing, where the ability to pull on the appropriate resources to deliver a service wherever they may be based, is also underlined by the changes in the strategies of the Indian offshore providers. The largest of these have established nearshore centres in, for example, Poland, Romania, Czech Republic and even Western Europe, and are hiring local staff in most of the European countries and the US to be able to support

customers. As put recently by the executive chairman of Infosys, Narayana Murthy: “i'm not a great fan of running any company based on visas” at a conference of Indian investors, where he also suggested that the “correct model” for the sector involved more locally hired employees. It is evident from such observations that the face of offshoring is changing.

Concluding remarks

Application-based-services is an area where offshoring has been most strongly used in the past decade and this does not look set to change out to 2020. However, the increasing use of automation tools, standardisation of processes, and re-use of assets combined with cloud, brings extra complexity to the offshore global value chain, which should increasingly more correctly be termed a global sourcing value chain. Many of the skills that are based offshore are lower-level skills, but increasingly include higher-level skills and experience levels as companies no longer only look to offshoring tasks for labour arbitrage, but rather for gaining access to skills that may be in short supply locally.

Consequently, it is important to bear in mind that even if tasks are undertaken in a nearshore or offshore location this does not necessarily mean that all the positions onshore are lost. Studies clearly suggest otherwise. Nevertheless, it is important to understand which skills may be most vulnerable and what is required to up-skill or re-skill these individuals – but the vulnerability will not only be from offshore. Cloud and automation will also play key roles.

Further, it is unlikely that current trends of offshoring will be sustained. An article in the Economist in January 2013, focused on India's offshoring business, quoted analysis from Hackett, which predicted that "the migration of services to India and to other offshore locations such as China and Brazil will slow down after 2014 and stop entirely by 2022” (The Economist, 2013a). A reason for this is that the effects of automation, growing attrition rates, and spiralling wages in the offshore locations make the cost/benefit calculation of offshoring less attractive. Of course, it is possible that other countries or regions will come on the scene but none with the vast amount of skills as China and India. Hence, in the future, even ICT skills that are now considered "typical" offshore skills, such as programming skills, may be in higher demand onshore. Consequently, 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.

CHAPTER 7: THE QUANTITATIVE IMPACT OF GLOBALISATION

Introduction

The increasing reliance on offshoring has an inevitable impact on EU ICT skills, both in terms of employment and demand for ICT graduates. However, the key question is how big is this impact? What are the main drivers of this impact? For example, how is it influenced by the main economic and IT trends, and/or by the main policies studied in this report? To respond to these questions, IDC has built a forecast model drawing from a blend of both proprietary and external sources. The model covers the total EU and details six EU countries (Italy, France, Germany, Poland, Spain, and the UK) for the period 2012-2020, estimating the main impacts of globalisation in terms of jobs moved and jobs lost. The model builds upon a detailed set of assumptions, covering the interaction of main trends including macroeconomic/geopolitics, IT market trends, IT innovation trends, offshoring trends, and the potential impact of main policies clustered in 3 main policy areas with a specific focus on e-skills: education and training policies and initiatives, labour market policies and initiatives, and growth and innovation policies and initiatives for the digital economy.

We have developed a set of assumptions and hypotheses for what we believe to be the most realistic foresight scenario, which we called "Cautious Growth". The estimate of demand of ICT jobs for the period 2014 to 2020 were elaborated by IDC for the Monitor project end of 2013, and have been revised and updated in early 2014 for this project. The estimates of jobs moved and lost due to offshoring were developed specifically for this project. We have also developed two alternative foresight scenarios ("Innovation wins" and "Stagnation") which test the potential variation of the model forecasts in terms of ICT jobs offshored and lost up to 2020. These results are presented in the next sections.

Approach of the model

The approach to the model can be described in three major steps:

- Step 1, aiming to assess the number of jobs moved from EU to offshoring locations
- Step 2, determining the share of jobs lost in the EU
- Step 3, analysing the impact on the number of ICT employees and ICT graduates by country

Considering external services, internal services, and software/ICT R&D services, ***Step 1*** calculates the number of jobs moved, based on the following inputs:

- Estimates and forecasts up to 2020 on the demand for ICT skills, with specific reference to ICT practitioners by area (Applications, Infrastructure, Other), as published in the Monitor project
- Estimates and forecasts of external IT spending, with a focus on software and IT services by area (Applications, Infrastructure and Other), as resulting from IDC forecast research

- Estimates and forecasts of internal IT spending, based on IDC research and existing IDC primary research inputs
- Estimates and forecasts of offshoring services spending in EU countries split by Applications, Infrastructure and Other, based on IDC services research
- Estimates and forecasts of worldwide R&D services spending by region, and the share which is offshored, as published by IDC US
- The percentage of ICT R&D on total R&D, as published by Eurostat

From an *external IT services* perspective, the model calculates the elasticity of ICT practitioners' demand to external IT services spending and applies it to offshoring services spending, considering though different levels of labour cost in EU countries versus offshoring locations and the incidence of intra-EU offshoring on total offshoring. The approach is similar for *internal IT services* spending, but a further correction factor is applied, based on the assumption that internal ICT staff are more often redeployed inside companies' IT organisations compared to external functions. Estimates of external and internal skills moved related to services also include custom application software development, which is a services category rather than a software category in IDC definitions. From a *software/ICT R&D perspective*, the model calculates spending on internal and external R&D offshoring services up to 2020 and applies average employee costs to estimate the number of jobs moved in this area. The share attributable to software and ICT R&D is estimated leveraging Eurostat available data on the share of ICT R&D on total R&D.

Resulting data for step 1 represent the number of jobs moved from EU countries to offshoring locations for:

- **Applications:** including Custom Applications Development, Application Management, Hosted Application Management, Software Deploy and Support, and System Integration contracts where the main purpose is implementation of application solutions
- **Infrastructure:** including Information Systems Outsourcing, Network and Desktop Outsourcing, Network Consulting and Integration Services, Hosted Infrastructure Services, Hardware Deploy and Support, and System Integration contracts where the main purpose is implementation of hardware or network solutions
- **Innovation:** including software R&D, and ICT Product Engineering
- **Other:** including pure IT and business consulting engagements, IT education and training services, and IT management skills that are not specifically attached to applications or infrastructure, including enterprise architects, vendor management skills, data scientists and the emerging role of "chief digital officer"

Jobs *moved* don't necessarily mean jobs *lost* in the EU. Various studies and research have shown that the majority of employees are redeployed rather than let go when activities are offshored (see Chapter Six- The Impact of Globalisation on ICT Delivery: Offshoring and Global Sourcing).

The focus of ***step 2*** is to determine the number of jobs lost in EU countries due to ICT offshoring. A 2007 survey-based study (Lewin and Couto, 2007) shows that only 26% of onshore employees were on average laid off as a consequence of an offshoring project. 41%

were redeployed, 8% moved to the service provider, and 25% left by normal attrition. The study also shows that the more offshoring matures; the lower is the number of jobs lost. Based on this Empirical study and on the maturity level of offshoring in the different EU countries, IDC produced estimates of jobs *lost* over jobs *moved* in IT (Applications, Infrastructure, Other) versus innovation (R&D and Product Engineering).

The last step in the model***, step 3***, calculates the impact jobs lost have on ICT employment, as published in the Monitor project, and on demand for ICT graduates considering jobs lost that would have been available to ICT graduates if they had remained in the EU.

Key assumptions and hypotheses

The cautious growth scenario: brief description

The "Cautious Growth" scenario foresees the European Union following a moderate growth path in the next years up to 2020, confirming the modest economic recovery experienced so far in 2014, picking up some steam in the next years but with annual GDP growth under 2% (about 1.7% on average until 2020). This growth is helped by a healthy combination of technical innovation, driven by the 3d platform technologies - cloud, social technologies, big data and mobile, and business transformation designing and developing new products and services based on IT innovation. Macroeconomic and IT investment trends interact positively and feed into each other. This drives an increase of EU demand for total ICT skills from 7.7 million in 2012 to 8.6 million in 2020, representing a 1.4% CAGR.

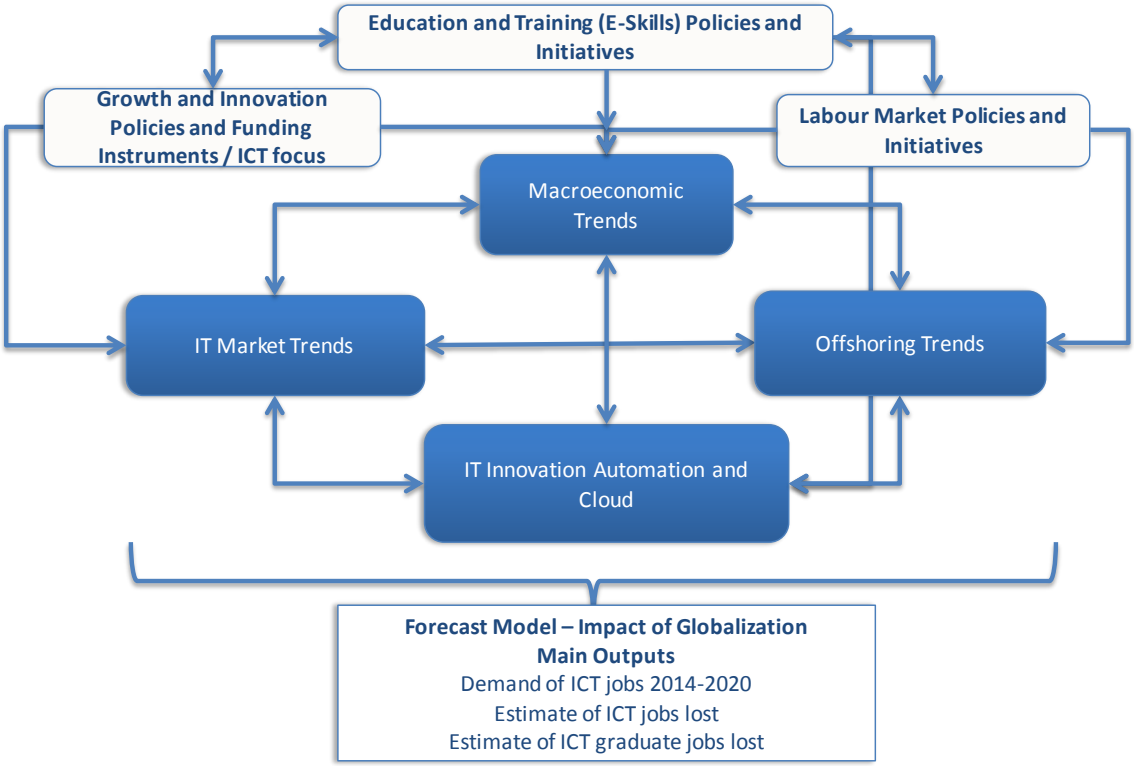


Figure 74: Forecast model assumptions: interaction of main trends (Source: IDC 2014).

The main assumptions behind the model in the Cautious Growth scenario are the following:

In terms of macroeconomic and financial trends:

- No change to the EU market composition will happen and no country will exit the Euro zone
- After a period of weakness, the EU economy will return to moderate growth in the 2014-2020 timeframe, with GDP growth expected to reach 1.4% in 2014 and, on average, 1.7% annually to 2020
- After a difficult 2011 and 2012, unemployment will remain relatively stable starting 2014
- Bank loans will remain the primary source of funds for SMEs. Lending conditions to SMEs will have somewhat improved in 2014-2020
- Venture capital investments will also moderately improve
- There will not be a prolonged stock market plunge, as observed in mid-2011, which deteriorated business confidence driving lower economic expectations across EU countries
- There will be no factors/happenings/external shocks that may cause a big deviation from the long-term average of the EU business and consumer confidence indicators, for a persistently long time-frame
- Political instability in the Middle East will remain fluid but will not have a strongly adverse impact on EU economic growth up to 2020

In terms of IT market trends:

- EU IT spending will grow by 2.7% in 2014 and by 2.9% annually up to 2020. Capital spending on IT equipment has weakened since last year, which has helped create a certain level of pent-up demand for infrastructure hardware. Software spending has rebounded strongly over the past two years and EU businesses seem willing to continue with software investments, even while looking to cut back on other areas of their overall spending. Services markets have been steady but tepid by historical standards. Government austerity programs have included direct reductions in levels of IT services spending, and cannibalisation from the cloud is still a drag on overall growth

In terms of IT innovation, automation and cloud trends:

- The software industry will continue to go through a major transformation, from basic architecture (service-oriented architecture [SOA]) and the way software is written (composite applications), to the way software is delivered (cloud), and even funded (advertising based). The disruption to pricing and delivery models in particular has been significant in 2013, and this will continue for the next few years. This transformation will take a decade to play out but will allow for a much faster and more dynamic delivery of software functionality
- The impact of the new digital marketplace will be increasingly seen in software as a service, the integration of Internet and enterprise search and other functionality, the concept of "cloud computing," and competition for ad revenue among Microsoft,

Google, and other vendors. The digital marketplace will affect content delivery, commerce, datacenter architectures, advertising, marketing, telecommunications, and social interactions

- The shift towards 3rd platform technologies, including cloud, social, Big Data/analytics, mobility and the Internet of Things, will continue steadily. According to IDC, by 2020, when the ICT industry will generate nearly €4 trillion in spending worldwide, approximately 40% of the industry's revenue and almost the totality of its growth will be driven by third platform technologies. Today they represent just 22% of ICT spending

As regards offshoring:

- IDC forecasts a 14.1% CAGR in offshoring spending to 2017. The EU accounts for some 85-90% of the total EMEA market
- The United Kingdom will remain the largest consumer of offshore IT services in the EU for the foreseeable future. However, IDC end-user survey results indicate that acceptance of offshore-based IT services has grown hugely in the recent past, and that offshore-based services are now gaining widespread acceptance among enterprises (if not public bodies) not only in the UK but also in continental Europe. Supporting evidence of this is the strong revenue growth of the leading Indian offshore service providers in continental Europe
- This rise in acceptability is driven by costs savings but also by the investments made by the offshore vendors to "localize" their operations in the EU by hiring (or acquiring) local consultants and opening delivery centres for example in Poland, Hungary, and the Czech Republic
- Application-related activities will continue to dominate in terms of use of offshore facilities in the near future

Main assumptions about policy trends:

- Concerning policy trends and how they factor in our scenarios, our assessment is based on the potential impact of the main policy strategies at the EC and national government level, as well as the potential impact of policy initiatives which provide funding or coordinate stakeholders actions about e-skills (for example public-private initiatives such as the Grand Coalition for Digital Jobs launched in 2013 by EC DG CNECT). Policies are not usually designed and implemented in isolation, but are part of general policy frameworks active at EU, national and regional/local level, with shared general objectives. There is always some overlapping, duplication of efforts, and failure, as well as uneven diffusion and deployment across Europe. What counts for our scenarios is the potential cumulative impact of these policies and initiatives and whether they will succeed in transforming the socio-economic environment and achieving their general objectives. For the sake of this study, we have used our expert assessment as a study team to leverage the evidence collected for this study to select the main policy clusters relevant for our scenarios, identify their shared objectives and estimate their potential impacts under the 3 designed scenarios. Lacking a quantitative assessment of the policy impacts, we have used a qualitative assessment of the level of effectiveness of the examined policies and initiatives, for example, to what extent they will be able to achieve their designed objectives and therefore impact the socio-economic system by removing bottlenecks and promoting desired positive impacts. To

do so we specify for each policy cluster our assumptions about the type of impact they are expected to have and to what extent we expect them to be able to achieve them.

Concerning this "Cautious Growth" scenario we are relying on the following assumptions:

- **Education and Training policies and initiatives**: This cluster includes the e-skills policies analysed in this report (see Chapter 9 of the Final Report e-skills policies in the EU) specifically aimed at reforming and modernising national educational systems (at primary, secondary and tertiary level) to improve ICT education and training and therefore improve the supply of e-skills. These policies address the inclusion of informatics as a core competence and the development of teacher training curricula that provide teachers with the skills to use ICT as a teaching and learning tool as well as the ability to teach informatics. Initiatives include for example the Opening up Education, a funding partnership launched by DG Education and Culture, aimed at increasing the quality of education and facilitating the transnational cooperation by going beyond pilots to have real impacts.
    - **In this scenario**, our assumption is that these policies will have a moderate level of achievement of their objectives, gradually improving the supply of ICT skills in the medium-long term, with impacts starting to be felt at the end of the analysed period (from 2018 onwards). Initiatives aimed at improving enrolment in STEM courses or reforming primary and secondary schools will have an impact in a timeframe beyond the period of our scenarios.
- **Labour market policies and initiatives**. This includes the e-skills policies analysed in this report as "workplace policies" targeting the establishment of programmes for matching jobs to ICT professional competences, the establishment of national sector skills councils for ICT, and the creation and funding of multi-stakeholder partnerships directly benefiting the ICT sector. This includes for example the EC policies addressed to overcome the e-skills demand-supply gap, included in the 2012 Communication "Towards a job-rich recovery". Initiatives include for example the e-skills week annual initiatives run by DG Enterprise to raise awareness; the Grand Coalition for Digital Jobs launched in March 2013 under the framework of the Digital Agenda for Europe to better match demand and supply of e-skills. For practical reasons, we include here also the cluster of policies identified as "transversal" by this report, cutting across a number of domains with an impact on a range of areas such as education, the workplace, and the state of the information society at a national level on a whole, because they share the objective to overcome the shortcomings and mismatches of the e-skills labour market. Examples of transversal policies include the promotion of career opportunities in ICT, measures to achieve a positive gender balance, and encouraging the up-skilling and re-skilling of experienced ICT professionals.
    - **In this scenario,** our assumption is that these policies will partially improve the demand-supply match in the short-medium term, thanks to the increase of internships, upskilling and retraining programs, and the promotion of mobility between national markets with excess demand and those with unemployment. In addition, we expect EC initiatives to fight young unemployment such as the Youth on the Move package and the Youth Employment initiatives to have a marginal impact, because even though they are probably targeted to lower-skilled audiences they may mobilise some of the unemployed youth and start them on ICT-related training paths.

- **Growth and innovation policies and initiatives for the development of the digital economy in Europe.** This cluster of policies has an indirect impact on the e-skills market by driving the demand of ICT jobs and promoting virtuous cycles of growth, through IT-based innovation, contributing to a macroeconomic scenario favourable for employment growth. This includes the innovation and R&D policies aimed at the digital economy (Horizon 2020 ICT priority), as well as the specific digital policies such as the Digital Agenda for Europe, within the EU 2020 Growth strategy framework. This includes also the promotion of regional innovation strategies based on smart specialisation promoting the digital economy, supported by EC Cohesion funds and with the collaboration of DAE.
    - **In this scenario** our assumption is that these policies will have a moderate success by contributing to the development of the digital economy in Europe, particularly promoting digital services, digital growth strategies and digital infrastructures growth, but without being enable to overcome completely the fragmentation of the EU market and with an uneven level of achievement across Europe. In the short term in fact the EU economies most affected by the economic crisis will still suffer from a low level of investments for IT innovation.

According to our model, these are the main estimates of the dynamics of ICT skills demand by country and for the overall EU:

- EU demand for total ICT skills will grow from 7.7 million in 2012 to 8.6 million in 2020, representing a 1.4% CAGR (Table 15).
- The UK is, and will remain, the country with the highest number of ICT skills demanded but will show a moderate annual growth of just 0.3%. Italy and Poland, which show relatively low levels of ICT skills in demand, will have more positive CAGRs (around 2.3%)

	2012	2013	2014	2015	2016	2017	2018	2019	2020
France	915,000	925,000	940,000	959,000	980,000	1,002,000	1,026,000	1,052,000	1,076,000
Germany	1,342,000	1,362,000	1,390,000	1,420,000	1,451,000	1,488,000	1,520,000	1,550,000	1,581,000
Italy	676,000	682,000	690,000	702,000	721,000	741,000	763,000	787,000	809,000
Poland	414,000	419,000	429,000	441,000	453,000	465,000	477,000	488,000	498,000
Spain	489,000	489,000	492,000	498,000	510,000	524,000	539,000	552,000	565,000
UK	1,709,000	1,777,000	1,765,000	1,816,000	1,864,000	1,932,000	1,912,000	1,869,000	1,880,000
EU21	2,132,000	2,157,000	2,196,000	2,246,000	2,298,000	2,253,000	2,233,000	2,204,000	2,180,000
Total EU	7,677,000	7,811,000	7,902,000	8,082,000	8,277,000	8,405,000	8,470,000	8,502,000	8,589,000

Table 14: Total ICT skills demanded (Source: IDC, 2013 for Monitor).

- Demand for ICT skills is currently higher in the infrastructure area, which accounts for more than 36% of total demand. By 2020, following a CAGR of 2.6%, other skills will represent the majority of demand (34.4%). Demand for R&D-related skills will remain small relative to the other segments, but will show a significant CAGR of over 9%
- The strong development in the "Other" skills category is driven by demand for the 3rd Platform technologies and the fact that a larger proportion of IT investments will come from outside the IT department from the line of business. While many of the skills needed for implementing and managing these technologies would fall under

Applications and Infrastructure skills, the technologies, due to their promise of changing the way that organisations work internally (employees and processes) and externally (customers and partners), require new skill sets that go across traditional IT environments and straddle across business and IT. These skills include e-leaders, enterprise architects, business and IT transformation and innovation skills, data scientists and customer experience IT skills

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Applications	2,374,919	2,399,500	2,404,900	2,446,700	2,491,100	2,527,300	2,537,700	2,536,000	2,557,800
Infrastructure	2,810,072	2,834,100	2,842,300	2,876,600	2,918,400	2,932,200	2,931,100	2,917,300	2,920,400
Other	2,250,195	2,330,100	2,401,900	2,498,100	2,598,600	2,670,200	2,720,300	2,762,800	2,819,000
R&D	241,815	247,300	252,900	260,600	268,900	275,300	280,900	285,900	291,800
Total EU	7,677,000	7,811,000	7,902,000	8,082,000	8,277,000	8,405,000	8,470,000	8,502,000	8,589,000

Table 15: Total ICT jobs demanded by segment – total EU. Source: IDC, 2014

Model results on ICT jobs moved and lost

The scale of ICT jobs moved from an EU country to offshoring locations is strictly connected to the level of acceptance offshoring has in the country. The UK, which dominates EU offshoring spending, represented more than 44% of all EU jobs moved to offshoring locations in 2012. As offshoring spending grows also in other EU countries, more ICT jobs will be moved. By 2020, the UK will represent some 31% of total ICT jobs moved, while France and Germany will have grown from 10.7% and 17.2% to 13.9% and 21.3% respectively (Table 17). ICT jobs moved in Italy will grow the fastest (17.9% CAGR), but will continue to account for a relatively small share at the end of the forecast period (3.4%).

		2012	2013	2014	2015	2016	2017	2018	2019	2020
Total EU	Jobs Demanded	7,677,000	7,811,000	7,902,000	8,082,000	8,277,000	8,405,000	8,470,000	8,502,000	8,589,000
	Jobs Moved/Impacted	268,600	307,200	349,700	397,500	452,400	514,300	585,000	664,100	752,200
	Jobs Lost	60,400	67,400	74,400	82,100	90,700	99,900	110,100	121,100	132,900
	Jobs Lost as % of Demand	0.8%	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%
France	Jobs Demanded	915,000	925,000	940,000	959,000	980,000	1,002,000	1,026,000	1,052,000	1,076,000
	Jobs Moved/Impacted	28,800	34,200	40,400	47,400	55,600	65,300	76,600	89,600	104,800
	Jobs Lost	6,400	7,400	8,400	9,500	10,800	12,200	13,800	15,500	17,500
	Jobs Lost as % of Demand	0.7%	0.8%	0.9%	1.0%	1.1%	1.2%	1.3%	1.5%	1.6%
Germany	Jobs Demanded	1,342,000	1,362,000	1,390,000	1,420,000	1,451,000	1,488,000	1,520,000	1,550,000	1,581,000
	Jobs Moved/Impacted	46,200	54,200	63,600	74,400	87,200	101,700	118,800	138,700	160,600
	Jobs Lost	10,200	11,700	13,200	15,000	16,900	19,100	21,500	24,300	27,100
	Jobs Lost as % of Demand	0.8%	0.9%	0.9%	1.1%	1.2%	1.3%	1.4%	1.6%	1.7%
Italy	Jobs Demanded	676,000	682,000	690,000	702,000	721,000	741,000	763,000	787,000	809,000
	Jobs Moved/Impacted	6,900	8,200	9,800	11,600	13,700	16,000	18,800	22,100	25,800
	Jobs Lost	1,500	1,700	1,900	2,200	2,500	2,800	3,200	3,600	4,100
	Jobs Lost as % of Demand	0.2%	0.2%	0.3%	0.3%	0.3%	0.4%	0.4%	0.5%	0.5%
Poland	Jobs Demanded	414,000	419,000	429,000	441,000	453,000	465,000	477,000	488,000	498,000
	Jobs Moved/Impacted	7,800	8,400	9,000	9,700	10,500	11,300	12,200	13,200	14,300
	Jobs Lost	1,800	1,900	2,000	2,100	2,300	2,400	2,500	2,700	2,800
	Jobs Lost as % of Demand	0.4%	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%
Spain	Jobs Demanded	489,000	489,000	492,000	498,000	510,000	524,000	539,000	552,000	565,000
	Jobs Moved/Impacted	12,700	14,100	15,800	17,500	19,400	21,500	23,800	26,500	29,300
	Jobs Lost	3,000	3,200	3,500	3,800	4,100	4,400	4,800	5,200	5,600
	Jobs Lost as % of Demand	0.6%	0.7%	0.7%	0.8%	0.8%	0.8%	0.9%	0.9%	1.0%
UK	Jobs Demanded	1,709,000	1,777,000	1,765,000	1,816,000	1,864,000	1,932,000	1,912,000	1,869,000	1,880,000
	Jobs Moved/Impacted	119,100	131,900	143,900	156,700	170,400	184,800	200,200	216,500	233,900
	Jobs Lost	26,700	29,000	31,000	33,100	35,300	37,500	39,900	42,300	44,900
	Jobs Lost as % of Demand	1.6%	1.6%	1.8%	1.8%	1.9%	1.9%	2.1%	2.3%	2.4%
EU21	Jobs Demanded	2,132,000	2,157,000	2,196,000	2,246,000	2,298,000	2,253,000	2,233,000	2,204,000	2,180,000
	Jobs Moved/Impacted	47,100	56,200	67,200	80,200	95,600	113,700	134,600	157,500	183,500
	Jobs Lost	10,800	12,500	14,400	16,400	18,800	21,500	24,400	27,500	30,900
	Jobs Lost as % of Demand	0.5%	0.6%	0.7%	0.7%	0.8%	1.0%	1.1%	1.2%	1.4%

Table 16: Total ICT jobs demanded, moved and lost by country – AGGREGATE. (Source: IDC, 2014).

ICT jobs moved to offshoring locations are not necessarily lost onshore. 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 moved are lost. Moreover, Empirical studies show that as offshoring matures, the number of jobs lost onshore on 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 jobs were lost up to 2012 in the EU and that some 132,900 jobs will be lost in total up to 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.

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.

The overall impact of offshoring on ICT jobs is relatively limited. 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.

Model results by segment

The applications segment, which is the prominent focus area for many offshoring projects, shows the highest number of ICT jobs lost. As shown in the chapter on offshoring and global sourcing, these skills are likely to be software coding and testing rather than user experience design, for example. More than 64% of losses up to 2012 occurred in this segment (Table 18). 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).

		2012	2013	2014	2015	2016	2017	2018	2019	2020
Total EU	Jobs Demanded	7,677,000	7,811,000	7,902,000	8,082,000	8,277,000	8,405,000	8,470,000	8,502,000	8,589,000
	Jobs Moved/Impacted	268,600	307,200	349,700	397,500	452,400	514,300	585,000	664,100	752,200
	Jobs Lost	60,400	67,400	74,400	82,100	90,700	99,900	110,100	121,100	132,900
	Jobs Lost as % of Demand	0.8%	0.9%	0.9%	1.0%	1.1%	1.2%	1.3%	1.4%	1.5%
Applications	Jobs Demanded	2,374,919	2,399,500	2,404,900	2,446,700	2,491,100	2,527,300	2,537,700	2,536,000	2,557,800
	Jobs Moved/Impacted	165,800	186,800	210,000	236,900	267,200	301,000	339,700	381,700	427,500
	Jobs Lost	38,800	42,700	46,700	51,100	56,000	61,300	67,000	73,200	79,600
	Jobs Lost as % of Demand	1.6%	1.8%	1.9%	2.1%	2.2%	2.4%	2.6%	2.9%	3.1%
Infrastructure	Jobs Demanded	2,810,072	2,834,100	2,842,300	2,876,600	2,918,400	2,932,200	2,931,100	2,917,300	2,920,400
	Jobs Moved/Impacted	36,700	45,200	54,500	64,700	76,500	92,100	110,700	132,400	157,800
	Jobs Lost	8,400	10,000	11,500	13,100	15,000	17,200	19,800	22,700	25,900
	Jobs Lost as % of Demand	0.3%	0.4%	0.4%	0.5%	0.5%	0.6%	0.7%	0.8%	0.9%
Other	Jobs Demanded	2,250,195	2,330,100	2,401,900	2,498,100	2,598,600	2,670,200	2,720,300	2,762,800	2,819,000
	Jobs Moved/Impacted	50,800	58,400	66,800	76,200	87,100	97,800	108,800	121,400	135,400
	Jobs Lost	10,900	12,300	13,600	15,100	16,700	18,300	19,900	21,600	23,500
	Jobs Lost as % of Demand	0.5%	0.5%	0.6%	0.6%	0.6%	0.7%	0.7%	0.8%	0.8%
R&D	Jobs Demanded	241,815	247,300	252,900	260,600	268,900	275,300	280,900	285,900	291,800
	Jobs Moved/Impacted	15,300	16,800	18,400	19,700	21,600	23,400	25,800	28,600	31,500
	Jobs Lost	2,300	2,400	2,600	2,800	3,000	3,100	3,400	3,600	3,900
	Jobs Lost as % of Demand	1.0%	1.0%	1.0%	1.1%	1.1%	1.1%	1.2%	1.3%	1.3%

Table 17: Total ICT jobs demanded, moved and lost by segment – total EU – AGGREGATE (Source: IDC, 2014).

In relative terms, R&D accounted for a higher share of jobs lost on total ICT skills demanded in 2012, as ICT players moved research centres and labs to lower cost countries. This is already a consolidated trend. By 2020, IDC expects only 2.5% of R&D ICT skills will be lost to offshoring, while losses will strengthen in the applications area to represent some 3.1% of total ICT skills demanded.

Impact on demand for ICT graduates

IDC calculated the impact on demand for ICT graduate-level skills. The estimate is based on:

- A calculation of the replacement rate of total skills demanded, based on the CEDEFOP replacement rate of 2.5% and the proportion of these that may be graduates
- The proportion of net new jobs each year that may be for graduates
- An assumption of the proportion of jobs lost that if they had remained would have been replaced – and replaced with graduates
- An assumption of the net new jobs that – if they had not been lost – would have been available to graduates

The estimate shows that some 2,300 ICT graduate jobs were lost in the EU in 2013, representing some 4.9% of the jobs that would have gone to graduates if offshoring hadn't impacted demand. By 2020, the number would increase to 4,000 or 9.1% of ICT graduate employment (Table 19). Hence, while the annual impact on ICT skills demand is relatively limited, the impact on ICT graduate employment is stronger and deserves attention.

	2012	2013	2014	2015	2016	2017	2018	2019	2020
ICT Graduate Jobs	39,400	46,300	40,400	56,200	59,700	55,600	42,200	42,100	43,700
ICT Graduate Jobs Lost	2,300	2,300	2,300	2,500	2,800	3,100	3,400	3,700	4,000
Annual impact on ICT Graduate employment	5.8%	5.0%	5.7%	4.4%	4.7%	5.6%	8.1%	8.8%	9.2%

Table 18: ICT graduates – new hires per annum – total EU (Source: IDC, 2014).

Alternative scenarios of ICT jobs demand and offshoring

A "cautious growth" scenario is by definition also cautious in its assumptions. The consequences of the economic crisis are such that a cautious perspective feels realistic. However it is a well-known mistake to predict the future merely extrapolating the present. For this reason, we have elaborated two alternative foresight scenarios ("Innovation wins" and "Stagnation") based on a variation of the main assumptions presented above, assuming different growth paths and therefore different landing places or outcomes. These scenarios help us to test the range of potential variation of the model forecasts in terms of ICT jobs offshored and lost up to 2020: they should be considered as a way to measure the potential gains – if a more virtuous growth cycle could be launched in the next years – and the potential risks if a negative scenario would prevail. The reality in the next years is likely to be a mix of the trajectories designed here.

Innovation wins scenario: brief description

In this scenario, faster growth is triggered by a dramatic increase in the speed of digital transformation by businesses and organizations, thanks to a new breed of products and services based on the convergence of 3d platform technologies (mobility, social technologies,

big data, cloud computing) and a few "killer apps". As Accenture's "Technology Vision (Accenture, 2014) foresees, this can create revolutionary changes as traditional companies reinvent themselves. Some of the major global corporations are leading the way. For example, in the manufacturing arena, GE is betting on the industrial Internet, building cloud-based services with intelligent analytics so that it can collect and combine vast amounts of industrial-machine data and equipment data, extracting unique insights that it can use to set new performance standards in major industries such as energy and aviation. In the business-to-consumer realm, Disney is introducing a collection of tools including a wireless tracking wristband to create an entirely new personalized and enriched experience for visitors to its amusement parks. The wireless Magic band allows Disney park-goers to simply "touch to pay" for food and merchandise and to make and share plans with family and friends in a travel group. Now imagine if this evolution becomes a competitive run by innovative companies across all sectors, revitalizing demand growth and consumption across Europe. What's emerging is more than just an "Internet of Things"; it's a new layer of connected intelligence that augments the actions of individuals, automates processes, and incorporates digitally empowered machines into our lives, increasing our insight into and control over the tangible world. This virtuous cycle contributes to increase investments, and to drive up GDP growth above current forecasts in the medium term, from 2017 onwards. Macroeconomic growth in turn feeds the expansion and demand for innovative products and services. The demand for ICT skills grows to 9.2 million jobs in 2020, with an 18% net growth over 2013 levels (almost twice as much as in the Cautious Growth scenario).

The main assumptions behind the model in the Innovation Wins scenario are the following:

Macroeconomic trends:

- GDP growth will reach on average 2.3% annually in the period 2014-2020, a full half-point higher than the 1.7% indicated for the Cautious Growth scenario
- The other main assumptions remain the same as in the Cautious Growth scenario, without disruptive changes in the EU and/or the Euro area.

IT spending trends:

- EU IT spending will grow by 2.7% in 2014 and by 5% on average annually up to 2020, driven by investments in software and services, but also in hardware (as the Internet of Things links innumerable devices and corporations invest to harness hyperscale, that is deploy the mega-datacentres with the computing power to deal with vast volumes, variety, and velocity of data)

IT innovation, automation and cloud trends:

- The IT industry evolves faster than foreseen in the Cautious Growth scenario, with software in the forefront, as described above.

Offshoring trends:

- In this scenario, the dynamism of the IT industry is reflected in the growth of offshoring at a similar pace as in the Cautious Growth scenario, around 14% CAGR. However enterprises do not cut back on their European investments, rather they add offshoring investments to the mix.

Main assumptions about Policy trends How do policies contribute to this scenario?

- **Education and Training policies and initiatives**: I**n this scenario**, our assumption is that these policies will have a good to moderate level of achievement of their objectives, gradually improving the supply of ICT skills in the medium-long term, with impacts starting to be felt at the end of the analysed period (from 2018 onwards).
- **Labour market policies and initiatives**. **In this scenario,** our assumption is that these policies will strongly improve the demand-supply match in the short-medium term, thanks to the increase of internships, upskilling and retraining programs, and the promotion of mobility between national markets with excess demand and those with unemployment. In addition, we expect EC initiatives to fight young unemployment such as the Youth on the Move package and the Youth Employment initiatives to have a positive impact, mobilising some of the unemployed youth, starting them on ICT-related training paths and contributing to the positive climate.
- **Growth and innovation policies and initiatives for the development of the digital economy in Europe.** These policies play a very important role in this scenario, by achieving their objectives to remove obstacles to innovation and the digital economy, accelerating substantially the diffusion and take-up of digital innovation. Specifically, the investment in deploying an upgrade of high speed networks provides finally the necessary infrastructures for a European connected society.

Stagnation: brief description

This scenario is driven by the inability of Europe to leave behind the economic crisis. Economic recovery could stall in Southern European countries, hindered by high taxes and austerity policies restraining public spending. Weak demand will be depressed by deflation trends. This is not helped by the slow-down of growth in China and other Asian and Latin American countries, reducing their demand for exports from EU countries. This hits even the powerful German economy. As a consequence of the continued economic mire, IT budgets and investments are once again under pressure - new projects once again put on hold. Enterprises are forced to focus only on maintenance, with lack of investments reducing innovation. Lack of protection 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% annual growth mark, much lower than in the innovation scenario. The overall demand of ICT skills in this scenario is expected to grow to 8.1 million jobs, with an average growth rate around 5% which half as much as in the Cautious Growth scenario.

The main assumptions behind the model in the Stagnation scenario are the following:

Macroeconomic trends:

- GDP growth will reach on average only 1.1% annually in the period 2014-2020, much lower than the 1.7% indicated for the Cautious Growth scenario
- The other main assumptions remain the same as in the Cautious Growth scenario, without disruptive changes in the EU and/or the Euro area

IT spending trends:

- EU IT spending will grow by 2.3% in 2014 and by only 2% on average annually up to 2020, driven by investments in software and services

IT innovation, automation and cloud trends:

- The IT industry evolves faster than foreseen in the Cautious Growth scenario, with software in the forefront, as described above.

Offshoring trends

- In this scenario, offshoring grows rapidly, driven by companies' needs to cut costs rather than to invest strategically.

Main assumptions about Policy trends. How do polices contribute to this scenario?

- **Education and Training policies and initiatives**: I**n this scenario**, our assumption is that these policies will have a moderate level of achievement of their objectives, gradually improving the supply of ICT skills in the medium-long term, with impacts starting to be felt at the end of the analysed period (from 2018 onwards).
- **Labour market policies and initiatives**. **In this scenario,** our assumption is that these policies will fail to improve the demand-supply match in the short-medium term. Lack of investments will lead to a reduced number of internships and upskilling efforts, even if unemployment is likely to grow. The supply-demand mismatches remain and increase due to scarce mobility. Therefore some enterprises, including SMEs, have difficulty to source the right skills.
- **Growth and innovation policies and initiatives for the development of the digital economy in Europe.** In this scenario policies fail to remove the constraints limiting the diffusion and take-up of digital innovation. Public funds are rerouted to welfare and unemployment benefits and as a result, strategic investments in digital infrastructures as well as digital innovation are reduced or insufficient.

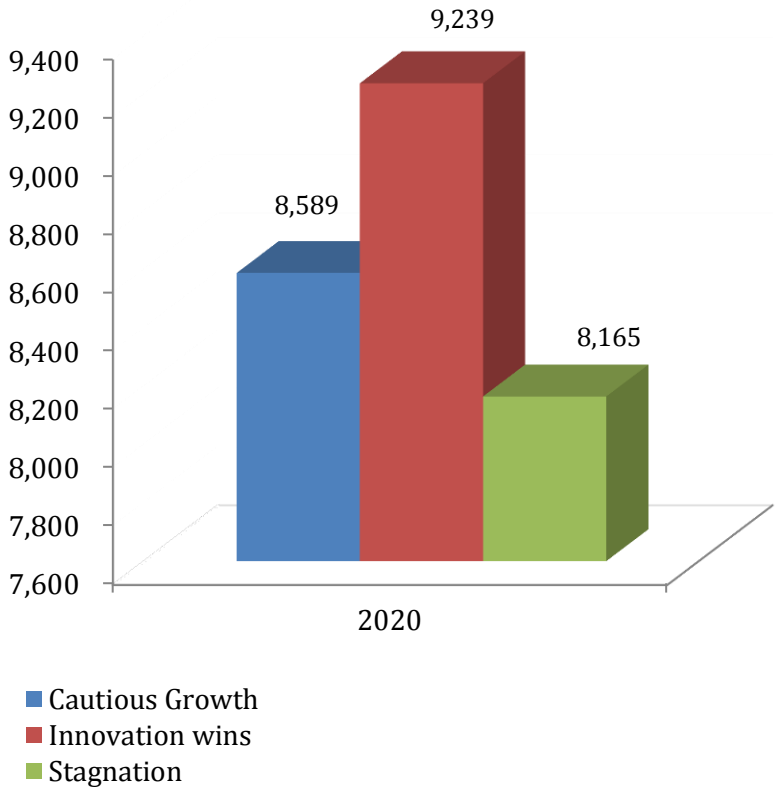


Figure 75: Forecast of total ICT Jobs demand by scenario (Thousands of Jobs, total EU) (Source: IDC 2014).

	2013	2020		
	Baseline	**Cautious Growth**	**Innovation Wins**	**Stagnation**
France	925,000	1,076,000	1,115,456	1,030,583
Germany	1,362,000	1,581,000	1,684,381	1,517,963
Italy	682,000	809,000	861,781	727,007
Poland	419,000	498,000	534,306	472,311
Spain	489,000	565,000	582,157	532,842
UK	1,777,000	1,880,000	2,095,599	1,717,989
EU21	2,157,000	2,180,000	2,365,465	2,166,318
Total EU	7,811,000	8,589,000	9,239,144	8,165,012
EU: % ICT skills demand growth 2020/2013		10.0%	18.3%	4.5%

Table 19: Total ICT skills demanded by scenario (Source: IDC, 2014).

Forecast of impacts on jobs moved and lost by scenario

Finally, we can estimate what could be the impacts of offshoring on jobs moved and lost for the two alternative scenarios presented above, compared to the baseline "Cautious Growth". Overall, the scale of jobs moved is estimated at approximately 587 thousand jobs in the

Innovation wins scenario by 2020, corresponding to 6% of the overall jobs demanded in the same year. In the Stagnation scenario, jobs moved are over 845 thousand, corresponding to 10% of the jobs demanded in the same year. The risk of the Stagnation scenario is that because of the lower growth of demand for ICT skills, the percentage of jobs moved is only slightly higher than the same incidence in the Cautious Growth scenario, but in absolute terms is much more relevant. The relative incidence of jobs moved by country is broadly similar to that in the Cautious Growth scenario, but in the case of Italy and Spain offshoring (currently very low) grows faster than in other countries (reflecting a growing maturity of the user industries).

The jobs lost by scenario are not very many in absolute terms, but they increase substantially in the Stagnation scenario compared to the other two. The estimate is of 289 thousand jobs lost in 2020, corresponding to 33% of the jobs moved, while in the case of the Innovation wins scenario, only 12% of jobs moved are lost, and in the case of the Cautious scenario only 18%. The incidence of jobs lost over the total of jobs demanded is marginal, but qualitatively important. It varies from 1.5% in the Cautious scenario to 0.7% in the innovation wins scenario and a peak of 3.4% in the Stagnation scenario.

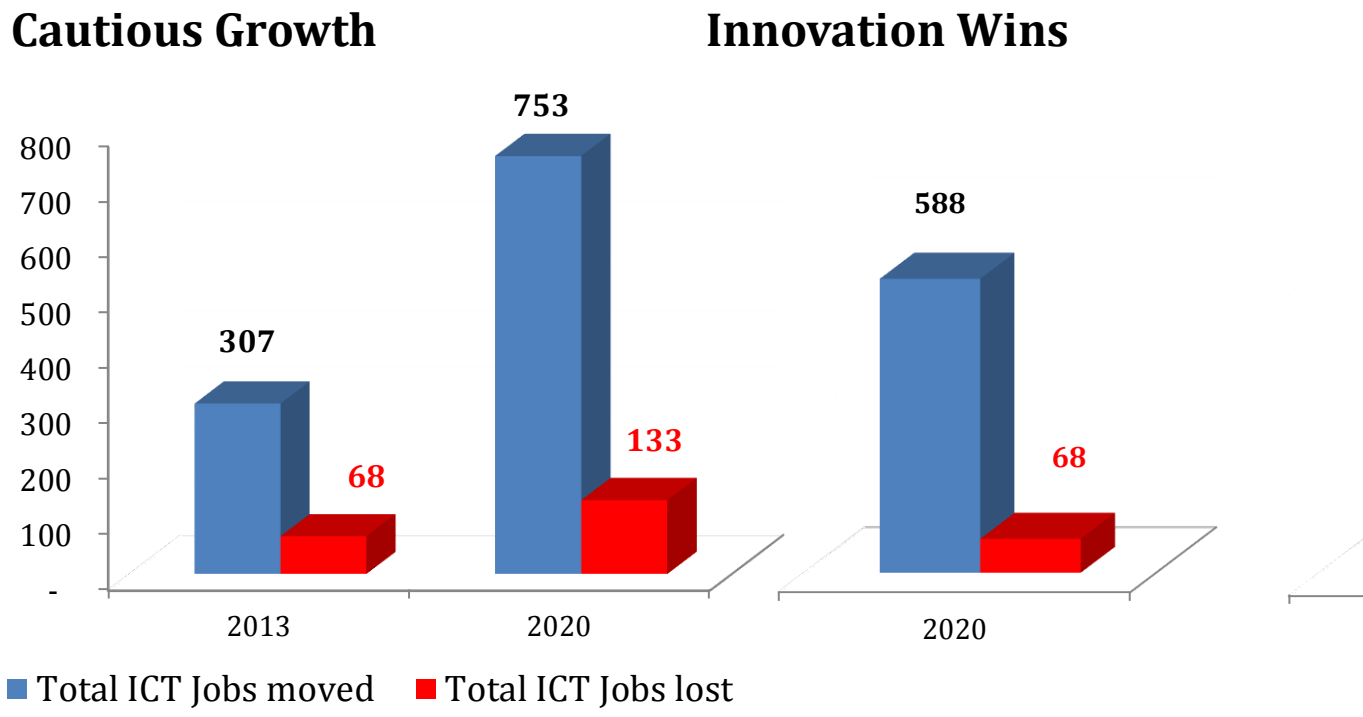


Figure 76: Comparison of Jobs Moved Offshore and Jobs Lost by scenario (thousands of jobs, total EU) (Source: IDC 2014).

	2013	2020		
	Baseline	**Cautious Growth**	**Innovation Wins**	**Stagnation**
France	34,151	104,836	79,786	118,371
Germany	54,184	160,613	122,256	202,579
Italy	8,219	25,841	12,370	26,141
Poland	8,395	14,347	10,657	16,136
Spain	14,142	29,346	19,241	29,911
UK	131,929	233,915	180,527	250,958
EU21	56,229	183,490	162,685	201,410
Total EU	307,250	752,388	587,521	845,506
EU - ICT jobs moved as % of jobs demanded per scenario		9%	6%	10%

Table 20: Total ICT jobs moved by scenario (cumulative) (Source: IDC, 2014).

	2013	2020		
	Baseline	**Cautious Growth**	**Innovation Wins**	**Stagnation**
France	7,371	17,510	8,835	37,357
Germany	11,668	27,145	13,028	63,283
Italy	1,701	4,066	1,350	8,075
Poland	1,929	2,841	1,338	5,756
Spain	3,235	5,589	2,588	10,592
UK	29,036	44,884	22,631	91,095
EU21	12,519	30,908	17,881	64,475
Total EU	67,460	132,944	67,652	280,632
ICT jobs lost as % of ICT jobs moved by scenario		18%	12%	33%
ICT Jobs lost as % of total ICT jobs demanded by scenario		1.5%	0.7%	3.4%

Table 21: Total ICT Jobs Lost by scenario (cumulative) (Source: IDC 2014).

Forecast impacts by segment and by scenario

The assessment of impacts in terms of skills demanded, moved and lost is also presented here by market segment, based on the four main groups identified by IDC: applications, infrastructure, R&D and other (including general IT management and security). The dynamics by scenario do not change much. The applications segment remains the one showing the highest number of jobs lost by scenario. The percentage of ICT jobs lost in the applications segment over the total is 3.1% in the Cautious Growth scenario, 1.4% in the Innovation wins scenario and goes up to 6.6% in the Stagnation scenario.

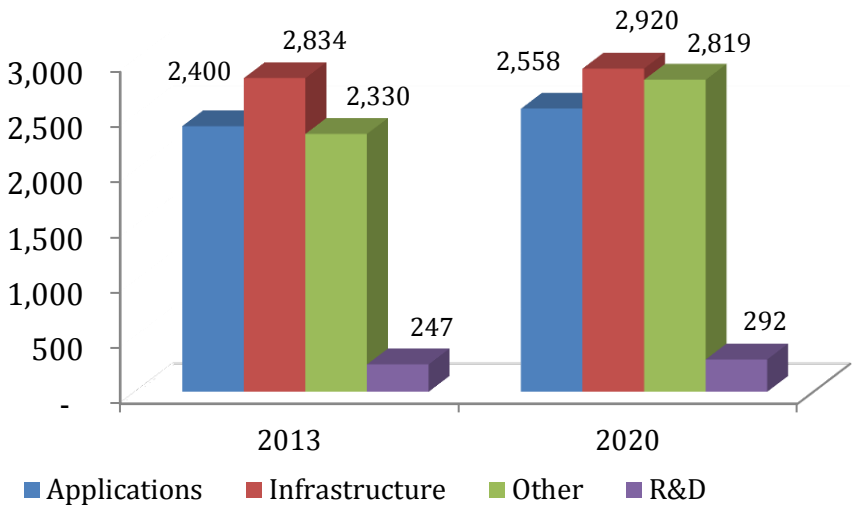


Figure 77: Total ICT Jobs demand by segment – Cautious Growth scenario (thousands of job, total EU) (Source: IDC 2014).

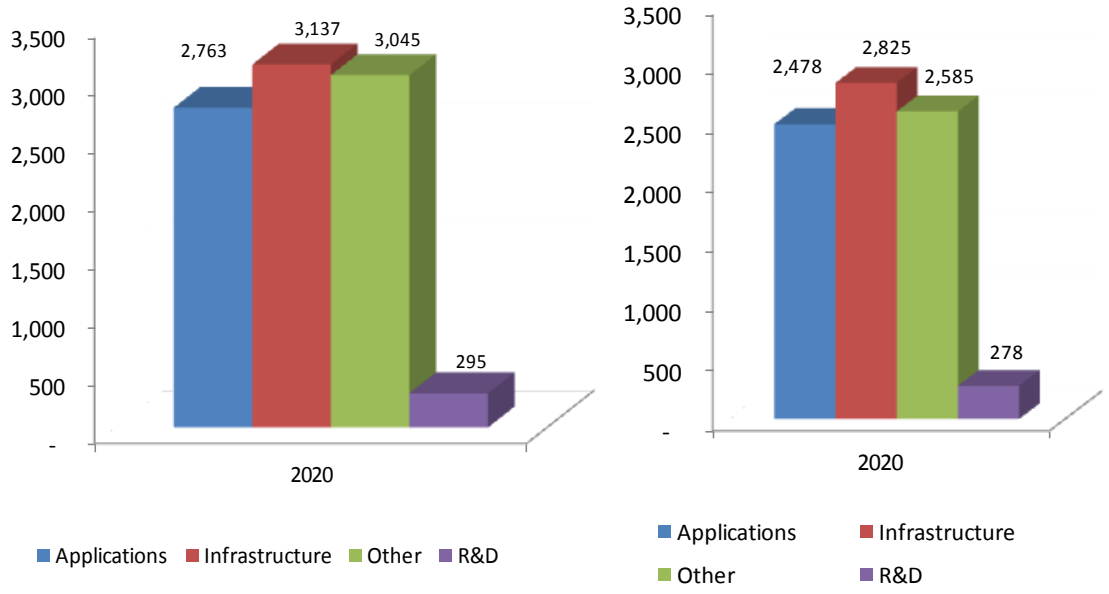


Figure 78: Total ICT jobs demand by segment – Innovation Wins (left) and Stagnation scenario (right) (thousands of job, total EU) (Source: IDC 2014).

	2013	2020		
	Baseline	**Cautious Growth**	**Innovation Wins**	**Stagnation**
Applications	2,399,542	2,557,855	2,762,646	2,477,614
Infrastructure	2,834,102	2,920,379	3,136,728	2,824,900
Other	2,330,078	2,818,965	3,044,540	2,584,748
R&D	247,277	291,801	295,230	277,750
Total EU	7,811,000	8,589,000	9,239,144	8,165,012

Table 22: Total ICT jobs demanded by segment - Total EU – cumulative. (Source: IDC 2014).

	2013	2020		
	Baseline	**Cautious Growth**	**Innovation Wins**	**Stagnation**
Applications	42,725	79,598	38,101	163,797
Infrastructure	10,018	25,941	16,248	55,054
Other	12,272	23,492	11,011	54,073
R&D	2,444	3,913	2,291	7,708
TOTAL ICT JOBS LOST	67,460	132,944	67,652	280,632
ICT Jobs Lost as % of total Jobs demanded by Applications segment by scenario		*3.1%*	*1.4%*	*6.6%*

Table 23: ICT jobs lost by segment - Total EU – cumulative (Source: IDC 2014).

Forecast impacts on new ICT hires by scenario

	2013	2020		
	Baseline	**Cautious Growth**	**Innovation Wins**	**Stagnation**
ICT Graduate Jobs	46,328	43,673	65,140	34,585
ICT Graduate Jobs Lost	2,264	3,956	1,020	8,990
Annual impact on ICT Graduate employment	4.9%	9.1%	1.6%	26.0%

Table 24: ICT graduates - new hires per annum by scenario - Total EU (Source: IDC 2014).

Finally, Table 25 presents the impact by scenarios on new ICT graduate hires per annum. As anticipated, this impact is relevant and growing; from 4.9% of jobs lost in 2013, the indicator grows to 9.1% in the Cautious Growth scenario, while in the Innovation wins scenario the share of jobs lost is substantially reduced to 1.6%. However, in the stagnation scenario the percentage increases to 26%, almost a third of annual graduate employment. This confirms that the impact of globalization is stronger on young graduates at entry job level.

Concluding remarks

The IT world is profoundly changing. 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, where the demand for highly specialised ICT skills grows both onshore and offshore. The speed of digital transformation by businesses and organizations, 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 affect directly the patterns of socio-economic growth in the next years. But digital transformation requires a new mix of e-leaderships 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 on 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% 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 affect more than proportionally ICT graduates, since according to our estimate, up to 4,000 jobs or 9% of ICT graduate employment could be lost to offshoring in 2020.

We have tested two potential alternative scenarios, "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, globalization 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 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 globalization 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 positively the market. 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.

CHAPTER 8: REQUIREMENTS FOR NEW CURRICULA FOR FUTURE SKILLS AND JOBS

Background and objectives

Newly emerging ICT trends have always created new skill requirements and jobs on the one hand, but on the other hand, through efficiency gains and restructuring have also contributed to the vanishing of old jobs no longer meeting the requirements of industry and the markets.

"Technology impacts the types of occupations in demand, as well as their skills content. Demand for new types of skills comes with new waves of technologies. The new wave of ICT currently arriving is creating new skills demands (such as for big data analytics and its virtualisation, e-leadership and dual thinkers on the business and technical side, and including for Chief Information/Technology Officers – CIOs and CTOs)" (European Commission, 2013g).

A recent study for the European Commission revealed that the main training/education barriers to the impact of newly emerging ICT trends (e.g. cloud computing, social media technologies, big data, internet of things) that – in particular in combination – drive economic transformation and growth include the lack of training/education in skills or the wrong skills and outdated education systems and educators (European Commission, 2013g).

It is against this background that the present study was undertaken to

- identify and specify the requirements of industry as to the skills required as a result of the emerging new ICT mega-trends
- discuss these with experts from academia responsible for the development and teaching of higher and executive education programmes at European business schools and universities
- gather their views on the availability of educational offerings which may already partly meet these requirements and
- take advice as to whether there may be gaps in existing programmes in respect of new skills, and how these might be met

This chapter summarises the results from a research exercise and expert consultation undertaken to describe emerging skills requirements and job descriptions of professionals resulting from different mega-trends in the IT industry, termed as 3rd platform skills and jobs. The results from this intensive stakeholder dialogue with e-skills demand side representatives from industry and supply side experts from academia have been incorporated and first conclusions are drawn.

The 3rd platform is IDC's term for the convergence of disruptive mega-trends in the IT industry which is built on

- mobile devices and apps (mobility & consumerization)
- cloud services (cloud computing)

- big data analytics (Big Data)
- social technologies (Social Media Technologies)
- IT Security
- Internet of things and
- Microelectronics and Parallel Systems

Each of these '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, skills requirements were identified in both the IT industry and user industries.

The adopted definition of future skills and jobs largely builds on IDC work carried out in relation to the *'Curricula for e-Leadership skills'* service contract for the European Commission DG Enterprise and Industry Unit ENTR-E4 - Key Enabling Technologies and Digital Economy, entitled *'New ICT Technology Trends for Europe 2020 and the Impact on the Demand for e-Skills'*.

The next section describes the approach and methodology adopted. This is followed by the presentation of results from previous research undertaken and the stakeholder dialogue with e-skills demand side representatives from industry and supply side experts from academia. Appendix C includes a selective overview of programmes in 'Cloud Computing' and 'Big data' in the United Kingdom, Germany and the USA, while Appendix D outlines the European ICT professional jobs profiles developed for CEN.

Approach and Methodology

General

During December 2013 and January 2014 Empirica Senior Research Consultants and Project Directors conducted scoping interviews with several CIOs, heads of HR and those responsible for education and training of ICT and business related issues personnel. These were followed by interviews with professors and higher and executive programme development experts with the objective of:

- further defining skills and competences needed by industry to accomplish 3rd Platform jobs in the future
- communicating the identified requirements to higher and executive education institutions in order for them to
    - further develop the education systems to better respond to employer needs and
    - more clearly shape third platform skills, as a first step towards the development of curricula and learning outcomes for programmes delivering these skills.

Demand side: interviews for capturing industry requirements

The initial round of interviews was carried out with industry experts of the type described above. Experts who participated in these interviews and focus group meetings and who were helpful in scoping skills demands were:

- Jan Muehlfeit, Chairman Europe, Microsoft (CZ)
- Peter Hagedoorn, Secretary General, Euro-CIO (NL)
- Wilfried Berlin, Education Manager, ICT Academy - IGRA Airbus (DE)
- Paul Costelloe, CIO, CIPROS International (UK)
- Gary J Kildare, Head of HR, IBM USA (USA)
- Martin Frick, General Manager BPO, Avaloq (CH)
- Christian Pagel, CIO, SGL Carbon (DE).

Prior to conducting the interviews, Empirica developed a document to guide this discussion. This included a description and overview describing, for each trend, the

- e-skills domain / tasks
- relevant competences and skills needed for accomplishing these tasks using the European e-Competence Framework (e-CF) and the competences specified therein, but also and where necessary, other additional skills.

Finally roles and functions involved as per the existing ICT Professional Profiles, which build on the e-CF, were allocated to each skill set for each task / domain under each trend.

The result was a first attempt to translate relevant newly emerging tasks and skills into e-CF coded competences (e-CF: European e-Competence Framework (http://www.ecompetences.eu/site/objects/download/5983_EUeCF2.0framework.pdf), complemented with other competences not yet covered by the e-CF. These initial skills / competence mappings were sent to the experts, soliciting comment and suggestions for any changes, such as additions or deletions of skills, and addition or deletion of e-skills domains.

For each of the trends, the following questions were included into the information material sent:

1. Regarding the **e-*competences*** *(for more information see: European e-Competence Framework: http://www.ecompetences.eu/site/objects/download/5983_EUeCF2.0framework.pdf)* do you think these are the most important ones, in terms of their necessary presence in someone charged with this (set of) task(s)?
2. Is this set of **tasks** sufficiently complete? If not, please add.
3. What emerging *job roles* would you attribute, and to which existing *(ICT) job profiles (for more information see ICT job profiles: ftp://ftp.cen.eu/CEN/Sectors/List/ICT/CWAs/CWA%2016458.pdf)* could they be docking / are they most similar with?
4. Do you see a need for more or new academic/educational programmes which deliver these skills?

5. Do you know of academic/educational programmes which deliver these skills for the domains described?

Due to the breadth of topics, single interview partners were only able to review up to two or three topics or 'mega-trends'.

The research team refrained from aggregating skills sets into any draft job profile, as job descriptions are still evolving. Rather, the team resorted to defining "e-Skills domains" which define (sets of) tasks and map these to e-CF (European e-Competence Framework) coded competences, or other competences not covered by the e-CF.

Supply side: interviews with higher and executive education professionals

After involving the above experts in this process, academics from universities and business schools offering or starting to offer relevant courses and programmes, and representing the 'supply' side, were contacted to

- Present the results from previous research and interviews and discuss the requirements identified by industry
- Gather their views on the availability of educational offerings which may already partly meet these requirements and
- Take their advice as to whether there may be minor or major gaps in existing programmes in respect of new skills, and how these might be met.

The following professors and HE programme development experts participated in the interviews and focus group meetings:

- Robert D. Austin, Professor, Copenhagen Business School (DK)
- Lachlan Mackinnon, Professor, University of Greenwich (UK)
- Liz Bacon, Professor, University of Greenwich (UK)
- Volker Markl, Professor, Technical University Berlin (DE)
- Juan Soto, Senior Project Manager, Database Systems and Information Management, Technical University Berlin (DE)
- Brian Donnellan, Professor, National University of Ireland Maynooth (IE)
- Eduardo Vendrell Vidal, Professor, University Valencia (ES)
- Theodoros Evgeniou, Professor, INSEAD eLab (FR)
- Martti Raevaara, Professor and Vice President, Aalto University (FI)
- Denise Leahy, Professor, Trinity College Dublin (IE)
- Giovanni Vaia, Professor, Università Ca'Foscari Venezia (IT)
- Silvia Leal, IE Business School, Madrid (ES).

The results of this exercise are presented in the following section.

Results

The following descriptions of skills requirements for each of the mega-trends represent the results of the stakeholder dialogue described above. They include all changes made to the initial proposal during the consultations and textual descriptions as to the scope of the tasks at stake for each domain. Views of experts are reflected regarding the availability of educational offerings which may already partly meet these requirements, their opinions as to whether there may be minor or major gaps in existing programmes in respect of new skills, and their advice on how these might be met.

Trend: Mobility and consumerization

Mobility

The growing mobility of people and goods has challenged European organisations to meet the requirements of employees and customers while on the move. An effective mobility strategy calls for the development of a new set of ICT and managerial skills.

From the point of view of both 3rd party service providers and end-user IT departments there will be stronger demand for:

- Mobile applications development skills, including customization to companies' processes

User industries will be particularly interested in e-leadership skills to:

- Integrate mobile solutions into companies' existing processes and workflows
- Design new services/ products based on mobility
- Leverage mobility as a new channel to reach customers (particularly in the sectors telecom/media, finance, government and healthcare).

IT industry actors will increase demand for the following skills (as well as those indicated above):

- Ability to integrate mobile applications with traditional ones
- Enhanced security skills.

Consumerization

Consumerization is the blurring of boundaries between business and personal time, driven by employees bringing personal devices into the work environment. Operationally, consumerization introduces a range of skill and management issues. The increasing variety of different hardware, OS and configurations requires both strong skills to apply new approaches to enterprise architecture as well as the skills to organize the effective integration of user devices. *Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.*

e-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'Mobility & Consumerisation' as specified in expert consultations are depicted in the following overview. A necessary differentiation is drawn between those required for professionals at IT industry / ICT vendors and those of the other (end-user) industry.

Mobility & Consumerization	IT Industry / Vendors		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Mobile Apps development skills incl. customization to companies' processes	A.4. Product or Project Planning A.6. Application Design B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment B.5. Documentation Production C.4. Problem Management	- Developer - Systems analyst - Project manager - Digital media specialist
	Integration of mobile Applications with traditional ones	A.5. Architecture Design B.2. Systems Integration B.3. Testing E.7. Business Change Management	- Systems architect - Systems analyst - Developer
	Enhanced Security skills	D.1. Information Security strategy Development D.3. Education and Training Provision D.9. Personnel Development E.8. Information Security Management	- ICT Security Manager - ICT Operations Manager - ICT security specialist

Mobility & Consumerization	Other industries / demand side		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Mobile Apps development skills incl. customization to companies' processes	A.4. Product or Project Planning A.6. Application Design B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment B.5. Documentation Production C.4. Problem Management	- Developer - Systems analyst - Project manager - Digital media specialist - ICT security manager
	Redesign of business and marketing strategies	A.1. IS and Business Strategy Alignment A.3 Business Plan Development A.7. Technology Watching E.1. Forecast Development E.5. Process Improvement E.7. Business Change Management	- Business analyst - Business information manager - Enterprise architect - ICT consultant - CIO

	Design of new products and services based on mobility	A.4. Product or Project Planning A.5. Architecture Design A.6. Application Design B.1. Design and Development	- Project manager - Developer - Systems analyst - Systems architect - Project manager - Digital media specialist - ICT security manager
	Complexity of internal IT support, broader technical skill set required (Management of BYOD environments)	C.1. User Support C.2. Change Support C.3. Service Delivery C.4. Problem Management D.3. Education and Training Provision	- Systems administrator - ICT security specialist - Service Manager - Service Desk Agent
	Asset Management challenge + Governance issues	E.9. IT Governance E.3. Risk Management E.8. Information and Security Management	- Systems administrator - ICT security manager - CIO
	Security between corporate and consumer environments	D.1. Information Security Strategy Development D.9. Personnel Development E.3. Risk Management E.8. Information and Security Management	- ICT Security Manager - ICT Security Specialist - ICT Operations Manager - Service Manager
	Security between corporate environment and staff devices / training of staff and awareness raising for security issues	D.1. Information Security Strategy Development D.3. Education and Training Provision E.3. Risk Management C.1. User Support C.2. Change Support C.3. Service Delivery	- ICT Security Manager - ICT Security Specialist - Service Desk Agent

Scope of tasks

The dialogue with stakeholders elicited the topic as being prominent on the agenda of CIOs and security officers. There is a strong need for mobile device management and acceptable use policies as security issues are eminent, and there is a serious threat of security breaches in mobile devices brought in by staff or enterprise data made available to private devices. Training and raising awareness among staff have been reported a key issue and hence been included as a task here.

Trend: Cloud computing

In perspective, cloud diffusion will lead to increased demand for high level ICT skills including e-leadership skills, but lower demand for traditional technical infrastructure skills. It is still difficult to predict if this will lead to an overall neutral or net-loss/net-gain of skilled people. There are differences in terms of the mix of skills required, depending on the type of organization. The demand for skills is expected to change as follows:

Demand from ICT vendors:

- Increased demand for skills to design, build, optimize, and manage their clouds and all the users of these clouds (even though maintenance skills are less required because of clouds automation levels)
- High demand for IT security skills, a very complex task in public clouds

In the case of IT users, there is quite a difference in skills demand, depending on the type of cloud adopted.

Demand from IT users of public clouds:

- Reduction of demand for the technical skills and resources to build and maintain companies' infrastructures and applications
- Demand for new skills of managing external cloud services, defining strategies, managing security and SLA requirements, and supporting cloud users

Demand from IT users of private clouds:

- High-level complex IT skills (usually bought externally) to design clouds
- Skills for managing and maintaining private clouds (easier than traditional IT)
- Skills for customization of private clouds services

The demand for specialized resources tends to move from the IT users to the IT vendors. Generally, the profiles required by IT users in this field become more business and project-oriented. E-leadership skills in user organisations must keep pace with this change.

Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.

e-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'Cloud Computing' as specified in expert consultations are depicted in the following overview. A necessary differentiation is drawn between those required for professionals at IT industry / ICT vendors and those of the other (end-user) industry. For the latter a further differentiation has been undertaken with respect to public and private clouds.

Cloud Computing	IT Industry / Vendors		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Cloud Design	A.4. Product or Project Planning A.5. Architecture Design A.6. Application Design B.1. Design and Development E.3. Risk Management E.6. ICT Quality Management E.8. Information and Security Management E.9. IT Governance	- Enterprise Architect - Systems Architect - Developer - Network Specialist - ICT Security Manager - Quality Assurance Manager - Test Specialist - Database Administrator - Systems Analyst
	Cloud Building	B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- Systems Architect - Developer - Test Specialist
	Cloud Optimization	B.3.Testing B.4. Solution Deployment C.2. Change Support E.5. Process Improvement	- Business Analyst - Developer - Test Specialist
	Cloud Management	A.2. Service Level Management C.4. Problem Management D.2. ICT Quality Strategy Development E.6. ICT Quality Management E.9. IT Governance	- Service Manager - ICT Operations Manager - Quality Assurance Manager - Database Administrator
	Aligning the Cloud with national law / IT Governance?		

Cloud Computing	Other industries / demand side		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Public Clouds		
	Manage external Cloud services	D.4. Purchasing D.8. Contract Management E.3. Risk Management E.6. ICT Quality Management E.8. Information and Security Management E.9. IT Governance	- CIO - ICT Security Manager - Service Manager
	Define Strategies	A.1. IS and Business Strategy Alignment D.2. ICT Quality Strategy Development E.3. Risk Management E.7. Business Change Management	- CIO - ICT Security Manager - Business analyst - Business Information Manager - Enterprise Architect

	Security Management	D.1. Information Security Strategy Development D.3. Education and Training Provision D.9. Personnel Development E.3. Risk Management E.8. Information and Security Management	- ICT Security Manager - Quality Assurance Manager - ICT Operations Manager
	Manage Service Level Agreement requirements	A.2. Service Level Management D.7. Sales Management	- Service Manager
	Private Clouds-		
	Cloud Design (high level skills)	A.4. Product or Project Planning A.5. Architecture Design A.6. Application Design B.1. Design and Development B.3. Testing E.7. Business Change Management	- Enterprise Architect - Systems Architect - ICT Security Manager - Developer - Business Information Manager
	Cloud Management	E.3. Risk Management E.6. ICT Quality Management E.8. Information and Security Management E.9. IT Governance	- Project Manager - Quality Assurance Manager - Systems Administrator - Database Administrator
	Cloud Maintenance	C.1. User Support C.2. Change Support C.3. Service Delivery C.4. Problem Management	- Technical Specialist - Service Manager - ICT Security Specialist - Service Desk Agent - Systems Administrator - Database Administrator
	Cloud Customization	B.2. Systems Integration	- Systems Architect - Systems Administrator - Database Administrator

Scope of tasks

The challenge in cloud computing today is not so much technical, as the technology has begun to mature and stable solutions exist. Rather, the main challenge is of a legal nature – in an international sense. Due to the very nature of cloud computing, many different judicial systems can apply to both user and provider industries. A CIO or other type of professional charged with responsibility in this area in an organisation has to cope with different laws of the countries involved, including at least the home country of the organisation, the country of the supplier organisation and those countries where data might be stored. This includes, but is not limited to, the very diverse regulations concerning data protection.

Knowing that security breaches would jeopardise the entire business model, cloud providers usually work to very high security standards, but at the same time they are also the target of professional hackers who try to steal their data. Risk strategies thus need to be made.

On the demand side, Quality Assurance as well as security management roles are reported essential since there is strong need to be confident in the level of protection offered by a cloud provider. Other experts stress the importance of the 'organisational perspective', arguing that

one should not lose sight of processes, rules and service management (including contract management) as key issues to be considered within cloud computing.

Academic / educational programmes

'Cloud computing' is currently taught at higher education institutions in Europe and the USA, where there are different ways of teaching and learning as described elsewhere in this document. Further, developments in Europe of relevance to cloud computing (discussed with the experts) include, for instance, the programmes offered by the EIT ICT Labs Masters School including the Master of ICT Innovation (http://www.masterschool.eitictlabs.eu/programme/), which offers seven Technical Majors:

- Digital Media Technology (DMT)
- Distributed Systems and Services (DSS)
- Embedded Systems (ES)
- Human Computer Interaction and Design (HCID)
- Internet Technology and Architecture (ITA)
- Security and Privacy (SaP)
- Service Design and Engineering (SDE)

The idea is to combine Technical Majors with an Innovation and Entrepreneurship Minor. The EIT ICT Labs Master School offers a two year programme in which individuals can choose two universities in two different European countries to build a curriculum of their choice based on their skills and interests. It offers double degrees which combine technical competence with a set of skills in Innovation and Entrepreneurship. Almost 20 universities around Europe are committed to the programme that offers a great variety of majors. However, some experts argue that the EIT ICT Labs Master School programmes are still too light on the business aspects.

A further, national programme from the United Kingdom discussed with experts is the Information Technology Management for Business (ITMB) degree (http://www.e-skills.com/ITMB; http://www.itmb.co.uk/). An ITMB degree is aimed to enable students to secure a job in:

- IT management
- business strategy and planning
- system design
- IT consultancy

Some experts believe the ITMB to be more a generalist education programme including some specific topics but poor on necessary technical and computing skills (therefore it is suggested as not being suitable for SMEs who make up 90% of the market and thereby addresses a niche market). It cannot achieve the numbers of students needed ("only a drop in the ocean").

An overview of some programmes in 'Cloud Computing' in the United Kingdom, Germany and the USA can be found in Appendix C.

Trend: Big data

The role of the statistician has been reborn with the rise of Big Data, combining analytical and statistical skills with some level of business understanding to create the "data scientist". More specifically, IDC foresees increasing demand for business analytics and particularly Hadoop (Hadoop = Apache™ Hadoop® is an open source software framework that enables the distributed processing of large data sets across clusters of commodity servers) related skills, not only by IT companies but also by end-user companies. Demand for ICT-based business analytics is expected to grow most strongly in finance, large retail companies and telecom providers, and the leaders initiating innovation must have the skills to guide holders of these new qualifications.

Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.

E-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'Big Data' as specified in expert consultations are depicted in the following overview. It includes a special section on 'data scientists' mainly demanding non-ICT specific skills and competences.

Big Data	**Both ICT industry / vendors and user industries**		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Business analytic skills (specific to vertical sectors)	*Not just ICT specific* A.1. IS and Business Strategy Alignment A.3. Business Plan Development A.7. Technology Watching E.1 Forecast development E.5. Process Improvement	- CIO - Business Information Manager - Business Analyst - Account Manager
	Building sw/hw environments for Big Data (e.g. Hadoop or MapReduce)	A.4. Product or Project Planning A.6. Application Design B.1. Design and Development	- ICT Operations Manager - Business Analyst - Project Manager - Database administrator - Developer - ICT Consultant
	SW/HW implementation (e.g. Hadoop or MapReduce)	B.2. Systems Integration B.3. Testing E.7. Business Change Management	- Project Manager - Systems Architect - Database Administrator - Developer
	Environment management (e.g. Hadoop or MapReduce)	C.1. User Support C.3. Service Management C.4. Problem Management E.6. ICT Quality Management E.9. IT Governance	- Database administrator - Systems Administrator
	Demand for 'Data Scientists' (DS):		
	DS: Statistical & Analytical skills	*Mainly non- ICT specific*	

	DS: E-business skills to assess the meaning of data (specific to vertical sectors)	*Mainly non- ICT specific*	
	Note: sensor data and stream data handling are to be seen as an integral part of the above domains / tasks		

Scope of tasks

Big data builds on at least three pillars:

- the business or vertical knowledge
- the analytical methods and
- the IS enabling the analysis

These skills need to be brought together, to some degree in persons understanding all three, and to some degree in interdisciplinary teams.

Recruitment of data scientists has been reported to happen especially among mathematicians and people with strong mathematical skills, such as natural scientists and engineers. The ICT skills needed relate to understanding the IS requirements, as well as being able to code algorithms in programming languages such as Python.

Experts believe that the 'big data' challenge makes it clear that education still happens too much in "silos". It resembles the situation of software engineering 30 years ago, when good software engineers came from Mathematics/sciences, technical and engineering fields, as well as economics.

One of the experts expressed the opinion that the Hadoop Map/Reduce engine is dying (expecting YARN and HDFS as successors to remain). Therefore, he proposes that the skill set to be taught should be more generic (scalable data analytics), as opposed to specifically map/reduce. He quotes Mike Olson, CSO of CLoudera, the major Hadoop vendor: "What the Hadoop ecosystem needs is a successor system that is more powerful, more flexible and more real-time than MapReduce. While not every current (or maybe even future) application will abandon the MapReduce framework of today, new applications could use such a general-purpose engine to be faster and to do more than is possible with MapReduce".

Academic / educational programmes

Topics like 'Big data' but also other new topics like 'cloud computing' are currently taught at higher education institutions in Europe and the USA where there are different ways of teaching and learning. 'Big data' for instance is either taught as

1. Integral part of already existing 'Informatics' or 'computer science' study programmes in which undergraduates obtain the necessary informatics skill sets and get offered the possibility to chose and follow a dedicated 'track' on data analytics for different master's programmes (advised and certified lists of modules within an ECTS Masters,

in the hands of individual professors and not otherwise managed); or as dedicated 'big data' Masters programmes during the Masters studies (or in the last year of the Bachelor study) as in universities in Germany, Finland and the United Kingdom. At the Technical University Berlin, a master's programme track is offered for different programmes as further described in the 'box' below

2. Non official degree programmes (titulo propio) in cooperation with industry next to the strongly regulated official Bachelor and Masters degree studies in countries like Spain. These are non-official degrees not formally approved by the national ministry of education and taught as one year programmes in cooperation with industry at costs of more than EUR 3,000. Students achieve a university degree (not an official one). These degrees are well recognised by industry. Depending on the length and intensity of the studies, different degrees can be obtained: Experto Universitario ('expert') (open also for non-academics with several years of job experience) (250 hours), Especialista Universitario ('specialist') or Diploma Universitario de Postgrado ('post graduate diploma) (300 hours), Máster or Magíster Universitario, also Maestría (500 hours)
3. Executive 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 at INSEAD with the INSEAD Executive Education Course 'Data Analytics for Business'. This course is about running data analytics projects and interpreting the results where students also learn practical tools to implement the analytics projects discussed. The emphasis of the course is not on the technical/mathematical aspects of data analytics, but rather on its practical use in organizations. Applications of data analytics in a wide range of business cases, from Marketing, to Finance, to Operations are discussed. Techniques such as factor analysis and positioning methods, discriminant analysis and targeting methods, as well as cluster analysis and segmentation methods are addressed since these are deemed useful for example in market segmentation and targeting or mapping market structure and product design. Students analyse datasets using cloud based and open source data analytics software tools which they should be enabled to directly use in their jobs (see below outlining an example of an executive education programme on 'data analytics for business' at INSEAD).
4. Specific and dedicated 'big data' or 'data science' higher education programmes, branded as such for commercial reasons and to make these attractive and appealing to prospective students and employers, as in the USA. This is described by some universities in Europe as a 'marketing' approach, probably sustainable only for a limited period of time when re-branding becomes necessary after the 'big data' hype has come to an end.

Several experts argue that the challenge today is that university professors are not used to the ways of properly teaching topics which cut across traditional borders (e.g. ICT-related subjects and business-related ones), allow for different types of combinations of subjects, and which require teaching in an academic way on the one hand, but also needs to be business driven on the other, and highly case study based.

An example – although not related to 'big data' - where these combinations are being practiced is the 'International Design Business Management (IDBM)' programme at Aalto University in Helsinki (http://www.idbm.fi/). The International Design Business Management (IDBM) Program is a joint teaching and research platform of the Aalto University's schools of business, design and technology. The aim of the IDBM Program is to develop world-class

expertise in global design business management through multidisciplinary research and learning. The programme has arisen from the needs of industry, and gives future marketers, engineers and designers an opportunity to develop systemic skills through cooperative industry projects and specialized courses.

Technical University Berlin: Data Analytics Laboratory

Master's Programme Track on Data Analytics (with university certificate)

- Volker Markl, Professor and Chair of the Database Systems and Information Management (DIMA) group, Technical University Berlin
- Juan Soto, Senior Project Manager, Database Systems and Information Management, Technical University Berlin

The Data Analytics Laboratory

As a leading academic institution, the Technische Universität Berlin (TUB) is spearheading numerous initiatives to deliver impactful/groundbreaking research in the big data arena. One of these initiatives was the establishment of the Data Analytics Laboratory in 2011, to serve as a focal point for innovative research and curriculum development.

Its aim is to coordinate efforts, bring about synergies, and leverage collective expertise to address the growing big data challenges.

The Data Analytics Lab will build upon the extensive expertise of TUB investigators in scalable and high-velocity data processing, information integration, statistics, visualization, machine learning, signal processing, compression, security, and networking.

Through the Data Analytics Lab TUB will educate data scientists that master the challenges of big data with respect to volume, velocity, variety, veracity and visualization. The Data Analytics Laboratory at TUB is conducting research to explore the online (i.e. low latency) analysis of large data sets (i.e. the processing of complex data and control flows on large data sets, within guaranteed time-constraints), with a particular focus on integrating data of complex media types and reporting the veracity of the derived information.

The primary mission of the Data Analytics Laboratory includes:

- meeting the needs of data scientists, by devising solutions that can simultaneously cope with the volume, velocity, variety, and veracity aspects of data analytics,
- developing novel statistical & mathematical algorithms, prediction techniques, modelling methods, compression schemes, as well as new approaches for data collection, integration, and data/information sharing technologies,
- opening up new ways of extracting useful, reliable, and verifiable information from monstrous data sets, swiftly using advances in information processing, integration, signal processing, machine learning, data mining, compression, and visualization,
- establishing a pipeline to prepare the data science leaders of tomorrow and narrow the gap in the expected shortfalls for qualified data scientists,
- focusing on holistic data science research and education addressing the challenges of large data sets, high ingestion rates, short analysis time windows, different content and media types, and contradicting, incorrect, and missing information,
- educating data scientists who will be well prepared to develop innovative data analysis tools, develop scalable data processing systems, and showcase their solutions to challenging real-world use cases of relevance to science, industry, and society,
- leveraging the EIT (European Institute of Technology) located at TU Berlin and its established partnerships with large enterprises and SMEs, closing the loop between research, education, and innovation, including the larger big data ecosystem in Berlin with research institutes (e.g., Fraunhofer HHI, Fraunhofer FOKUS, DFKI), Charité, SMEs and the Berlin startup scene.

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.

The intended job profiles include Data Scientist / Data Analyst / Data Engineer

The track is running for a four semester (two years) masters study with lectures, seminars and internships (cooperation with partners from industry) during the first three, and the masters thesis in the fourth semester. It is structured into three pillars:

1. **Data Anaysis:** machine-based learning, statistics, text mining
2. **Scalable Data Management:** Dealing with large, heterogeneous structures and data, map/reduce concepts, new hardware architectures
3. **Applications:** specific to studies: health, material science, energy, logistics

Upon satisfying the course requirements 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.

INSEAD Executive Education Course 'Data Analytics for Business'

January 23 - February 20, 2014

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

Programme:

1. **State-of-the-art Open Source Tools:** to bring students "up to date" with the latest analytics tools (methods, "math", software, processes) considering the increasingly dominating open source analytics tools, such as libraries in languages like R (or python)
2. **Flexible tools for efficient and effective analytics research:** using "script" type tools (not "click and drag" type) so that students (and data scientists in general) can more efficiently and effectively analyse data and reach insights (use of R and Rstudio with all related libraries).
3. **Replicable and Reusable analytics:** to ensure that analyses and processes developed for a project can be (a) replicated by others (e.g. to confirm the analytics research was done properly, and also for different datasets or applications), (b) reused easily (e.g. as data change) (use of state-of-the-art tools in R that allow to replicate and reuse analytics research documents and slides, with the analytics "code" embedded in the text for easy reuse and sharing).
4. **Easy to share and hassle-free tools:** to ensure no technical issues with students' IT (especially as the tools used are open source and state-of-the-art, hence fast changing). All students are provided with an individual data server where they run all their analysis and post their documents/projects. All servers are exact replica of a "prototype" server the faculty designs (e.g. with all software, data, course material, etc on it). Moreover, students can share their projects through their individual servers, also using online collaborative platforms such as github.
5. **Balance IT, statistical methods, and business insights:** While the course readings include "statistical readings" (e.g. about cluster analysis, classification, etc) as well as "IT resources" (e.g. about tools), the time during the course, as well as for the student projects, is spent to a large extend on balanced discussions and analyses of business case studies and issues at the interface of data analytics and organisational change/innovation/strategy.

Examining a country such as Ireland, one can find a few new Masters programmes addressing 3rd platform skills issues, for example:

- http://www.dcu.ie/prospective/deginfo.php?classname=MCM
- http://www.smurfitschool.ie/ourcourses/masters/technology/mscinbusinessanalytics/
- http://www.dit.ie/news/archive2010/dataanalysis/
- https://www.dcu.ie/news/2013/jul/s0713s.shtml
- http://www.imi.ie/imi-diplomas/imi-diploma-in-data-business/

While the above are dedicated Big Data programmes, some with the support and involvement of IBM, and one offered by a Business School, these subjects are covered as part of other courses in other universities, for instance Trinity College. An overview of some programmes in the United Kingdom, Germany and the USA can be found in Appendix C.

Trend: Social media technologies

The first area of new demand for skills is in digital marketing and PR, as organizations evaluate how to extend marketing campaigns from traditional media across to social media. However, other demand trends are emerging:

- New demand for cloud service management, orchestration, and supplier relations skills, since social data is by nature in the cloud
- Demand for skills to lead innovation processes using understanding and experience of new modes of internal collaboration and the use of ESN (Enterprise Social Networks) space

Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.

e-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'Social Media Technologies' as specified in expert consultations are depicted in the following overview. A necessary differentiation is drawn between those required for professionals at IT industry / ICT vendors and those of the other (end-user) industry.

Social Media Technologies	IT Industry / Vendors		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Enterprise Social Network (ESN) Software Vendors:		
	Customer service skills (CS): Project management	A.1. IS and Business Strategy Alignment A.4. Product or Project Planning B.2. Systems Integration B.3. Testing B.4. Solution Deployment E.2. Project and Portfolio Management	- Systems Architect - Service Manager - ICT Consultant
	CS: Change management	E.5. Process Improvement E.7. Business Change Management	- ICT Consultant - Business Analyst - Business Information Manager
	CS: consultancy, to help users adopt ESN	D.3. Education and Training Provision D.10. Information and Knowledge Management	- ICT Consultant - ICT Trainer - Business Information Manager
	Digital Marketing, CRM	D.7. Sales Management E.4. Relationship Management	- Account Manager - Digital Media Specialist
	Customer oriented services and applications	A.4. Product or Project Planning A.5. Architecture Design A.6. Application Design	- Systems Architect - ICT Consultant - System Analyst
	Aligning services with national law?		

Social Media Technologies	Other industries / demand side		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	Digital Marketing and PR to deal with social media	*Not mainly e-competences* E.4. Relationship Management E.7. Business Change Management	Domain skills Business skills Regularly does not require ICT above what is in house already - Digital Media Specialist
	Cloud Service Management (Social Media Data is in the Cloud)	E.3. Risk Management E.6. ICT Quality Management E.9. IT Governance E.8. Information and Security Management	- ICT Security Manager - ICT Security Specialist - Quality Assurance Manager
	Supplier management/relations	*Not mainly e-competences* E.4. Relationship Management	- Account Manager

	ESN project management	A.1. IS and Business Strategy Alignment A.4. Product or Project Planning B.2. Systems Integration B.3. Testing B.4. Solution Deployment E.7. Business Change Management	- Business Information Manager - ICT Operations Manager - Business Analyst - Project Manager - Developer - System Analyst - System Architect - ICT Consultant
	Demand by vertical markets:		
	Social Customer Service skills	*Not mainly e-competences* E.4. Relationship Management	**Soft skills, IT to support** - Digital Media Specialist
	Social marketing skills in retail, media and professional services	*Not mainly e-competences* E.4. Relationship Management D.6. Channel Management D.7. Sales Management	- Digital Media Specialist
	Open Innovation integrating social tools with R&D	A.1. IS and Business Strategy Alignment A.4. Product or Project Planning B.2. Systems Integration B.3. Testing B.4. Solution Deployment D.10. Information and Knowledge Management E.7. Business Change Management	- Business Information Manager - CIO - ICT Operations Manager - Business Analyst - Systems Analyst - Enterprise Architect - Systems Architect

Scope of tasks

Similar to cloud services, social media services need to be aligned to different, national legal situations. IT security and data protection are important topics to guarantee that users trust the service.

Experts mention the current gap between business and IT people on this subject, with marketing and sales people in organisations currently being managed some distance away from the IT function, and IT people not properly understanding the business problems and needs. They argue for a proper strategy and portfolio management which needs to be business driven but also addressed to IT people. They suggest the need for more 'change managers' or 'business relationship' managers with the necessary skills employed in organisations as a separate role next to the CIO.

As an example of how to proceed in order to create the necessary skills, the Università Ca'Foscari Venezia has in late January started a dialogue with industry representatives in Italy to make further progress.

Trend: IT security

Given increasing demand for IT security, requests for specialists with the right skills are growing. These include the knowledge and skills of designing, implementing and operating security solutions, as well as knowledge of how to design, formulate and implement security policies and procedures. More specifically, the main trends include:

- Increased demand for advanced security management skills driven by all innovation trends (often connected with the market leader security solutions)
- Increased demand for skills to design and implement sophisticated identity and access management solutions to protect against authentication hacking
- Specific demand for a larger set of security skills driven by the use of social media, dealing with privacy, data protection, compliance with regulation, and control and protection of company data residing in social media platforms. This includes the development of appropriate company and sector security policies, procedures and solutions
- New demand for security skills to ensure end-to-end protection of emerging smart networks, such as smart grids, smart cities, and smart e-health networks. The precise nature of these skills is still evolving and will require constant updating and learning.
- Increased demand for security skills connected to SCADA (Supervisory Control and Data Acquisition) or Process Control Systems (PCS), driven by increased automation of manufacturing processes

The profile of e-leadership in this area is clearly required.

Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.

e-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'IT Security' as specified in expert consultations are depicted in the following overview. A necessary differentiation is drawn between those required for professionals in the IT industry / ICT vendors and those of the other (end-user) industry.

	IT Industry / Vendors		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
IT Security	**Design sophisticated identity and access management solutions**	A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.3. Testing D.1. Information Security Strategy Development	- Developer - Enterprise Architect - ICT Security Manager - Systems Architect - Test Specialist
	Implement sophisticated identity and access management solutions	B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- ICT Security Manager - ICT Consultant - Network Specialist - Systems Administrator -Systems Analyst -Systems Architect

	IT security for SCADA (Supervisory Control and Data Acquisition) or PCS (Process Control Systems) systems in manufacturing processes	Same as above: A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment D.1. Information Security Strategy Development	- ICT Security Manager - Systems Architect - Test Specialist - Developer -Systems Architect
	Advanced security management skills	E.3. Risk Management	- ICT Security Manager
	Design of IT security for social media	A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.3. Testing D.1. Information Security Strategy Development	- Developer - Enterprise Architect - ICT Security Manager - Systems Architect - Test Specialist
	Implementation of IT security for social media	B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- ICT Security Manager - ICT Consultant - Network Specialist - Systems Administrator -Systems Analyst -Systems Architect
	Design of end-to-end protection of emerging smart networks and cyber infrastructures	A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment D.1. Information Security Strategy Development	- Developer - Enterprise Architect - ICT Security Manager - Systems Architect - Test Specialist
	Management of end-to-end protection of emerging smart networks and cyber infrastructures	E.3. Risk Management	- ICT Security Manager

	Other industries / demand side		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
IT Security	**Management of IT security for social media**	E.3. Risk Management C.1. User Support C.3. Service Delivery C.4. Problem Management	- Digital Media Specialist - Enterprise Architect - ICT Security Management - ICT Security Specialist - Technical Specialist
	Advanced security management skills	E.3. Risk Management	- Quality Assurance Manager
	Design of IT security for social media	A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.3. Testing D.1. Information Security Strategy Development	- Digital Media Specialist - Developer - Enterprise Architect - ICT Security Manager - Systems Architect - Test Specialist

	Implementation of IT security for social media	B.2. Systems Integration B.4. Solution Deployment A.7. Technology Watching	- Digital Media Specialist - ICT Security Manager - ICT Consultant - ICT Trainer - Network Specialist - Systems Administrator -Systems Analyst -Systems Architect
	Design of end-to-end protection of emerging smart networks and cyber infrastructures	A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment D.1. Information Security Strategy Development	- Developer - Enterprise Architect - ICT Security Manager - Systems Architect - Test Specialist
	Management of end-to-end protection of emerging smart networks and cyber infrastructures	E.3. Risk Management	- ICT Security Manager - ICT Trainer
	Physical devices management, Software management	E.3. Risk Management C.1. User Support C.3. Service Delivery C.4. Problem Management B.2 System integration B.3 Testing B.4 Solution Deployment	- ICT Security Manager - ICT Operations Manager - Network Specialist - Systems Administrator - ICT Security Specialist
	Third party relationship	E.3 Risk management E.4 Relationship Management E.8 Information Security Management	- ICT Security Manager - Project Manager
	Staff training	D.3 Education and Training Provision	- ICT Trainer

Scope of tasks

Social media is perceived a serious threat and challenge from the security point of view, and at the same time, huge benefits are expected from marketing and other lines of business. Staff training and raising awareness are seen essential from security officers.

IT Security is overarching other trends as data protection becomes essential in the distributed networking 3rd Platform trend (Internet of Things, Social Media Services and Cloud Computing), where data is stored and generated in external systems.

Trend: Internet of things

Currently, IoT solutions are mostly deployed to address issues around the supply chain, and product/asset tracking and location in such industries as utilities/oil&gas, manufacturing, retail, healthcare, and logistics. Going forward, IoT solutions have the potential to create smart environments spanning across different industries (smart cities, smart energy, smart transport, smart buildings, smart health, smart manufacturing, smart retail, etc). This still evolving environment is driving demand for new R&D and management skills and well as for IoT governance, with particular reference to the governance of "Things". Demand for both

specialists and those able to lead them, is growing, particularly to enable enterprises to guarantee trust, identity and liability.

Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.

e-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'Internet of things' as specified in expert consultations are depicted in the following overview. A necessary differentiation is drawn between those required for professionals in the IT industry / ICT vendors and those of the other (end-user) industry.

Internet of things	IT Industry / Vendors		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	R&D and High level IT skills		
	Architecture design (object identification virtualization and decentralization)	A.5. Architecture Design A.7. Technology Watching B.1. Design and Development B.2. Systems Integration B.3. Testing	- Developer - ICT Consultant - Systems Analyst - Systems Architect
	IT security for the information life cycle	D.1. Information Security Strategy Development E.3. Risk Management	- ICT Security Manager
	Software and Middleware development supporting data flows from sensing devices	A.6. Application Design B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- Database Administrator - Developer
	Multi-model interface design	A.6. Application Design B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- Developer - ICT Consultant - Systems Analyst - Systems Architect
	Design and development of smart sensors	A.4. Product and Project Planning B.1. Design and Development	- Developer - ICT Consultant - Systems Analyst - Systems Architect
	Standardisation and interoperability	D.2. ICT Quality Strategy Development E.6. ICT Quality Management	- Quality Assurance Manager

Internet of things	Other industries / demand side		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**

	IT management skills of IoT networks	D.1. Information Security Strategy Development E.1. Forecast Development E.2. Project and Portfolio Management E.3 Risk management E.5. Process Improvement E.7. Business Change Management E.8 Information Security Management	- Chief Information Officer (CIO) - Business Information Manager - ICT Security Manager
	Development of new business models, products and services enabled by IoT	A.1. IS and Business Strategy Alignment A.4. Product and Project Planning A.7. Technology Watching E.1. Forecast Development	- Business Analyst - Chief Information Officer (CIO) - Enterprise Architect - Systems Analyst
	IoT governance of Things to guarantee trust, security, and identity and liability management	E.3 Risk management E.8 Information Security Management E.9. IT Governance	- ICT Security Manager

Scope of tasks

Standards are emerging, such as RFID Near Field Communication standards. The impact on organisations includes security challenges but also innovation potential. Naturally, incentives exist for vendors to offer secure products. For the time being, tasks include risk management and strategic skills requirements.

Trend: Microelectronics and parallel systems

There will be stronger demand by the ICT industry for the following skills:

- R&D skills for the design and development of cost-effective, advanced software tools and systems suited for parallelism and new applications, enabling the development of new software or reengineering legacy codes
- R&D skills for the development of heterogeneous hardware and software architectures, harnessing existing competencies in both hardware and software to develop architectures that are aligned with requirements in key industries such as automotive, healthcare, and energy.

Source: IDC 2013: Guide Synthesis Report. Annex ICT Technology Trends. Not yet published.

e-skills tasks, relevant competence requirements and associated professional profiles

The e-skills tasks, relevant competence requirements and associated professional profiles for 'Microelectronics and Parallel Systems' as specified in expert consultations are depicted in the following overview. A necessary differentiation is drawn between those required for professionals in the IT industry / ICT vendors and those of the other (end-user) industry.

Microelectronics and Parallel Systems	IT Industry / Vendors		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	R&D skills for design and development of parallel software tools and systems	A.5. Architecture Design A.6. Application Design	- Developer - Systems Analyst - Systems Architect
	R&D skills for design and development of heterogeneous HW and SW architecture aligned with requirements of key user industries	A. 1. IS and Business Strategy Alignment A.5. Architecture Design A.6. Application Design B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- Business Analyst - Developer - Enterprise Architect - Network Specialist - Systems Analyst - Systems Architect
	High-level ICT skills for Hardware virtualization, modelling/design/ optimization of mixed criticalities SW systems	A.5. Architecture Design A.6. Application Design B.1. Design and Development B.2. Systems Integration B.3. Testing B.4. Solution Deployment	- Developer - Network Specialist - Systems Analyst - Systems Architect
	Semiconductor industries		
	R&D skills to design and develop new components		

Microelectronics and Parallel Systems	Other industries / demand side		
	e-Skills domain / tasks	**Relevant e-competences (e-CF) and other / additional skills**	**Roles involved as per the existing ICT Professional Profiles built on the e-CF:**
	E-business skills to develop applications and services based on new multicore/manycore systems specific by vertical market	A.1. IS and Business Strategy Alignment A.4. Product and Project Planning A.5. Architecture Design A.6. Application Design A.7. Technology Watching E.1. Forecast Development	- Business Analyst - Chief Information Officer (CIO) - Enterprise Architect
	ICT technical skills to manage complex IT environments and systems	C.1. User Support C.2. Change Support C.3. Service Delivery C.4. Problem Management E.2. Project and Portfolio Management E.6. ICT Quality Management E.7. Business Change Management E.9. IT Governance	- ICT Operations Manager - Project Manager - Service Desk Agent - Systems Administrator - Technical Specialist
	IT security skills to manage security in complex IT environments	D.1. Information Security Strategy Development E.3. Risk Management	- ICT Security Manager - ICT Security Specialist

Concluding remarks

The activities described in this chapter have resulted in a solid overview of e-skills domains / tasks and skills requirements needed for professionals in the future and resulting from different mega-trends in ICT development. These have been mapped onto the competences as specified in the European e-Competence Framework (e-CF), also describing the roles involved as per the existing ICT professional job profiles which build on the e-CF and were developed for CEN (the main focus of the present study was on 'Cloud Computing' and 'Big data' and less on the other mega-trends and emerging requirements for skills development, although descriptions and specifications have been developed for all mega-trends).

These have been developed with representatives from industry, communicated to and discussed with representatives from higher and executive education institutions responsible for teaching and programme development in the Informatics, Computer Science, Information Systems (IS) and business domains, and subsequently further developed and refined.

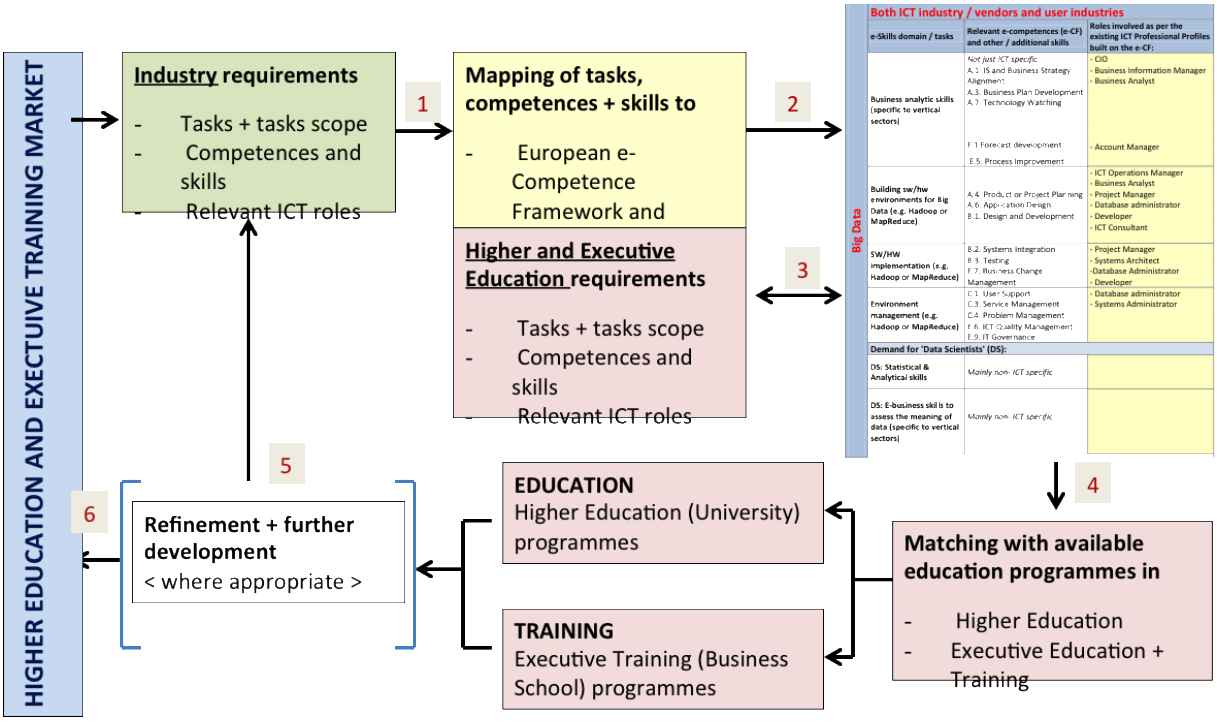


Figure 79: Adaptation and development of higher and executive education offerings for the provision of skills and competences for 3rd Platform jobs meeting industry demands

The results will now enable higher and executive education institutions to identify how well their current offerings already meet industry requirements and/or further develop and adapt existing programmes 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.

It is worthwhile mentioning that different approaches and ways of teaching these and related skills could be identified and will most likely continue to be followed in the different countries when adapting existing or developing new programmes to best fit industry skills demands. These approaches follow different teaching traditions in different countries and range from developing and teaching these as:

- Integral part of already existing ‘Informatics’ or ‘computer science’ study programmes in which undergraduates obtain the necessary general informatics skill sets and get offered the possibility to chose and then specialise in these newly emerging topics and skills (e.g. data analytics, cloud computing) in different master’s programmes during the Master studies (or in the last year of the Bachelors study) as in universities in Germany, Finland and the United Kingdom
- Non official degree programmes (titulo propio) in cooperation with industry next to the strongly regulated official Bachelor and Masters degree studies 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 taught 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 as in the USA, but also to some extent in the United Kingdom.

Each university and business school will follow its own procedures in curriculum revision.

Some experts interviewed strongly argue for a competence-based approach to higher education programme development when moving towards the next generation of Graduate degree programmes in Information Systems. Such an approach is outlined in more detail in a forthcoming publication: Hopi, H., Conboy, K., Donnellan, B., Ramesh, V., Wright, R.T. ‘Moving Toward the Next Generation of Graduate Degree Programmes in Information Systems’ in Communications of the Association for Information Systems (forthcoming).

In an ongoing service contract for the European Commission DG ENTR on ‘New Curricula for e-Leadership’ (www.eskills-guide.eu), the partners are currently developing European guidelines and quality labels for new curricula fostering e-leadership skills. To this end, e-leadership curriculum profiles are being developed in cooperation with stakeholders in demand of e-leaders and higher education institutions to define rationale, learning experience and learning outcomes of educational programmes that would meet the demand for e-leaders in Europe. New and existing higher education programmes can be matched against these profiles, either by the institutions (self-assessment) or by an accrediting body. Whichever assessment approach is utilised, it requires a set of quality criteria together with assessment procedures. The curriculum profile approach makes heavy use of the European e-Competence Framework (e-CF) (Hendriks et al, 2014).

The approach can also be used for, and applied to, subject areas such as the ones in the present report, for instance ‘Big Data’.

The knowledge gained to date and as presented above could, in a next step, be compiled in a concise form into guides to curricular development. These guides are referred to as curriculum profiles. In the case of the selected example of ‘Big Data’, a curriculum profile is to help curriculum designers meet identified ‘Big Data’ related requirements.

The profiles are to encapsulate the learning outcomes, and are intended as a key vehicle for improving communication. This proposed communication tool is to capture the key learning

outcomes for (a set of) 'Big Data' related skills, as well as specifying necessary attributes of the learning experience needed to achieve these.

The new curriculum profiles are to meet a number of further requirements to play their intended role. Key requirements are related to stakeholder positions, given that the new tool is to function in communication between stakeholders. As discussed, a curriculum profile has to offer a concise overview of the curriculum, with a focus on the benefits for the attendees in the case of successful completion. The key content of a curriculum profile is a set of learning outcomes.

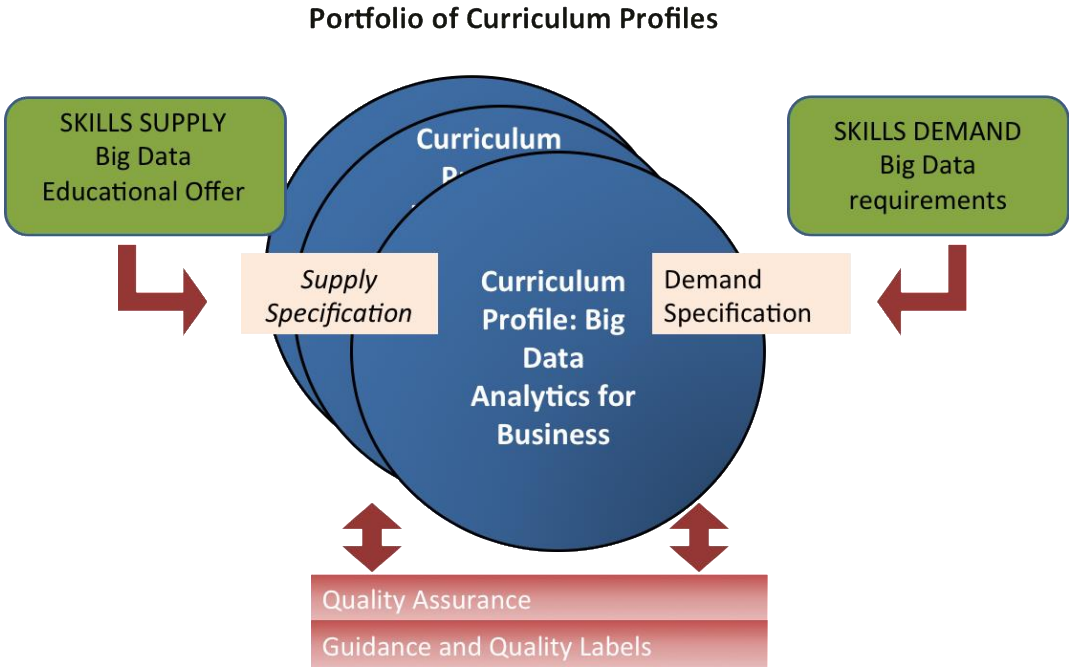


Figure 80: Curriculum profile approach: example Big Data

The approach is to respect the autonomy of educational institutions, and also to encourage them to apply their specialist knowledge in offering learning experiences they consider appropriate to their mission.

A curriculum profile should:

- be informative for stakeholder organizations in their selection of executive training and in their hiring decisions and for this, contain essential learning outcomes for important e-leadership roles
- be inspiring to educational institutions with new ideas and research in the field, minimize the level of prescription (while remaining informative to stakeholder organizations), and in particular, not contain all the information which an institution would publish on a programme in a brochure or on the web
- show clear benefits for students / alumni
- be free of intellectual property rights so every educational institution is able to use it as a reference for the learning outcomes their particular e-leadership curriculum will provide

- In line with the autonomy argument, the idea of an e-leadership curriculum profile is not to replace the documentation provided for real educational offerings by educational institutes e.g. in brochures or on their web sites

The curriculum profiles are to function as a tool for communicating complex skills requirements from decision-making situations in enterprises and the wider economy into the design of curricula in institutions of higher and executive education. To be most effective, such communication must use clearly understood concepts and terminology. The solution adopted was to use the systematic view of task-oriented competencies defined in the European e-Competence Framework (e-CF) (CEN 2008). An additional source of standard categories used are the example job roles and competencies also defined in the international domain by CEN (CEN 2012), and formulated in a terminology understood by practitioners and employers.

As a bottom line it can be said that a curriculum profile can be seen as a bundle of learning outcomes and teaching specifications, which has to have certain stability, but is not regarded as having an indefinite shelf-life. Given the dynamic nature of technological development, its impact on a wide range of economic enterprises, and on decision-making knowledge and skills requirements in particular, curriculum profiles in areas such as 'Big Data' are seen, now and in the future, not as a fixed quantity. Rather, they are seen as the emergent product of a live process of consultation and information exchange between organizations looking to employ decision-makers with up-to-date skills for this domain, i.e. the demand side of the market, and the supply side of this market, i.e. institutions of higher and executive education. This process is to be fully informed by the latest research, not only research into ICT techniques, products and services.

The curriculum profile approach is currently undergoing a validation phase in real-life settings using existing programmes offered by universities and business schools. It should also be applicable for higher education and executive education programmes validation and development in areas summarised under 3rd platform skills and jobs and further described in this report.

CHAPTER 9: E-SKILLS POLICIES IN THE EU

Introduction and context

In this chapter, the report examines the extent to which existing EU Member State policies in the field of e-skills operate to the benefit of European professionals in the ICT labour market, including new graduates. There is an urgent and critical need to generate a larger pool of European ICT professionals, equipped with the competences to match evolving labour market demands. Some EU Member States, alongside industry and pan-European stakeholders such as the European institutions, are already playing an active role in this area. Member States' governments can and are directly influencing the national policy environment impacting European ICT professionals including new graduates, and the profession as a whole, through a range of different policies and initiatives. It is the extent to which these existing policies operate to the benefit of European ICT professionals that is examined in this chapter.

Taking into account previous initiatives such as the research on Monitoring and benchmarking e-skills policies and partnerships (2013 and Development of European guidelines and quality labels for new curricula for e-leadership skills, 2013-2014) that have been noted as relevant, this chapter focuses on policies that stem directly from national governments, as opposed to initiatives that are undertaken by multi-stakeholder partnerships (MSPs). Furthermore, the scope of this policy examination precludes considering the benefits that user skills have on the profession pipeline, and focuses on higher levels of skills such as computing, coding and practitioner skills and the impact they have. Education, i.e. primary and secondary education and tertiary teacher training, as a policy area has nevertheless been included, since research has shown that this is an area where a clear majority of Member States are focusing their efforts to broadly promote e-skills and foster tomorrow's European ICT professionals.

Existing EU Member State policies

This research on existing EU Member States e-skills policies found that across the EU-28 today there are some 100+ policies dealing broadly with e-skills (including policies that address issues and areas falling outside the scope of this examination such as digital literacy/user skills, e-inclusion, e-government, the promotion of green ICT etc. Innovation policy was deliberately not included as it was deemed as falling outside the scope of this e-skills policy), the European e-skills landscape is extremely diverse and complex given that Member States are at different stages of maturity and have varying issues considered of national importance. This results in a level of e-skills policy activity that fluctuates substantially across the various Member States, and a plethora of policies addressing a wide range of policy areas.

Categories of e-skills policies in Europe

This research examines e-skills policies stemming from EU Member State governments that are intended to benefit European professionals in the ICT labour market including new graduates. This includes policies dealing with broader issues such as reducing the overall gender gap within the ICT sector, policies aiming to promote STEM (Science, Technology, Engineering and Mathematics) studies and career paths, as well as policies intended to promote the uptake of ICT competence frameworks. Existing relevant e-skills policies show that although the EU e-skills landscape is complex, existing policies can be grouped into three general categories:

- **Transversal policies** cutting across a number of domains with an impact on a range of areas such as education, the workplace, and the state of the information society at a national level on the whole. Examples of transversal policies include the promotion of career opportunities in ICT, measures to achieve a positive gender balance, and encouraging the up-skilling and re-skilling of experienced ICT professionals.

- **Education policies** aimed at reforming and modernising national educational systems (at primary, secondary and tertiary level). These policies address the inclusion of informatics as a core competence and the development of teacher training curricula that provide teachers with the skills to use ICT as a teaching and learning tool as well as the ability to teach informatics.

- **Workplace policies** targeting the establishment of programmes for matching jobs to ICT professional competences, the establishment of national sector skills councils for ICT, and the creation and funding of multi-stakeholder partnerships directly benefiting the ICT sector.

Approach and methodology

This section details the approach and methodology used to assess the extent to which existing EU Member State policies in the field of e-skills are operating to the benefit of European professionals in the ICT labour market, including new graduates. Commencing with desktop research to determine what e-skills policies currently exist in Europe, each identified policy was subsequently assessed for its relevance to European professionals in the ICT labour market, including new graduates. Those policies dealing with e-inclusion, and e-accessibility for example, were not included for further analysis.

Following the assessment of the identified policies, a shortlist of key policies was created. These were devised in the form of 12 generalized policies deemed to be of high and direct relevance for ICT professionals across Europe. These policies were selected for further analysis. Each of the key policies was assigned one or more key performance indicators (KPIs) based on the possible datasets against which the policies could be measured to assess their impact/benefit to European ICT professionals. The key policies, where they have been implemented in Member States, were then evaluated against their KPIs to come to a quantitative assessment of their impact.

In parallel, a survey was created to enable e-skills experts from across Europe, in particular those involved in the national bodies representing ICT professionals, to provide their input. Experts from the professional bodies are uniquely placed to provide insight on the impact of various policies on ICT professionals. This evaluation was shared with experts across greater Europe with a conscious focus on gaining insight from a broad geographic spread of countries. The survey examined the benefit of each policy going back 5 years, as well as looking ahead 10 years, and how each benefitted ICT professionals. Based on the analyses, conclusions regarding the benefits of each generalized policy were drawn. The process is visually illustrated below:

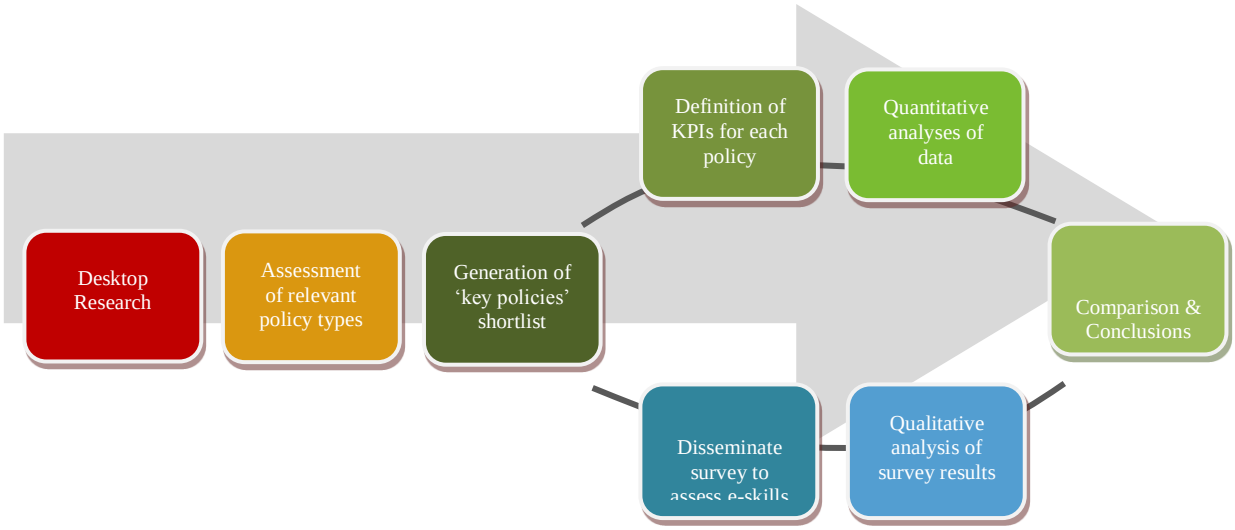


Figure 81: Overview of research approach and methodology

Scope

During the initial stages of the research, the assessment of Member State policies was identified as partly intersecting with the then on-going Monitor project (European Commission, 2013h). As a result it was decided that the scope of this examination would be refined uniquely to policies stemming from national governments, as opposed to MSPs, which are covered in detail in Monitor. It was also agreed that this assessment would cross-reference the results of Monitor, acting as an additional validation while adding value in term of the timing, since the data collection phase of this extends to a more recent period.

Data gathering and sources

Existing e-skills policies at national level across all EU-28 Member States were identified and recorded.

This research drew on the following data sources:

- National websites of relevant national ministries/departments, government agencies and bodies at national level including statistical bodies
- National websites of relevant regional ministries/departments, government agencies and bodies at a regional level
- National policy papers, publications and reports
- National academic research, industry publications and trade press articles

Assessment of existing policies

The data capture on Member State e-skills policies generated 100+ policies and in some cases proposals for policy actions. In order to identify the most relevant policies to European ICT professionals in the labour market including new graduates, an initial assessment of the identified policies was necessary. Each identified policy was assessed in terms of its relevance and fit with the scope. For instance, policies relating to e-inclusion, such as investing in public Wi-Fi hotspots, or policies dealing with ICT skills for public servants, were excluded from

this examination. This assessment led to the identification of a sample of "key" policies of direct relevance to European professionals in the ICT labour market. Some of these policies were found to exist in a number of Member States, while others were present in only one or two countries. In some cases where key policies were identified in only one or a small number of Member States, the relevance of the policy decided whether they were to be included or not.

Generation of genericised key policies shortlist

Given that similar e-skills polices can vary slightly in terms of their wording, format, definition and implementation, depending on the country in which they were developed, it was necessary to define a list of genericised key policies as a starting point for further analysis. This exercise was undertaken in order to strip individual policies of their national context which in turn facilitated cross-border analyses of the policies as well as the final formulation of recommended e-skills policies for duplication in Europe and further beyond. The process of genericising a large number of e-skills policies resulted in a list of 12 key policies. These 12 key policies were further refined and validated through input from the project research team.

Quantitative analysis

To allow for a quantitative analysis to be undertaken in order to establish the impact or benefit of each policy, a number of objective criteria for assessment needed to be established. By examining each key policy identified in Table 26 below, key performance indicators (KPIs) were assigned to each policy. The intrinsic nature of government policies means KPIs are by definition difficult to establish – if even clearly defined – and thus the impact of the policy is difficult to measure. Research into the various types of policies in existence across Europe confirmed this lack of defined performance indicators. A clear majority of the identified polices are defined at a high level. Therefore, the chosen KPIs were based on our assessment of what was considered to be measurable in terms of available data and meaningful in measuring impact given the lack of performance indicators being defined in the Member State policies. The 12 genericised key policies are categorised and listed below, along with their KPI(s) and the countries in which the policies exist.

Primary, secondary and tertiary education policies and their KPIs		
Policy	**Country of origin**	**KPIs**
Reform primary and secondary education systems to include informatics as a core competence.	AT, CY, DK, EE, SE, UK	*Number of national primary education curricula that have been reformed.* *Number of national secondary education curricula that have been reformed.* *Number of students having gone through the reformed curricula.*
Reform teacher training curricula to include training in informatics.	FI, IE	*Number of teacher training curricula that have been reformed.* *Number of teachers having gone through the reformed curricula.*
Workplace policies and their KPIs		
Policy	**Country of origin**	**KPIs**
Reform national Immigration policy to tackle shortages in supply of skilled ICT Practitioners (for non-EU residents).	AT, EE, FR	*Number of practitioners having benefitted from reformed immigration policies.*
Encourage up-skilling and re-skilling of experienced ICT professionals.	DE, NL	*Number of up-skill/re-skill programmes/initiatives.* *Number of up-skilled/re-skilled ICT professionals having gone through programmes.*
Match jobs and ICT professional competences for worker and workplace mobility.	BE, IT, NL, FR	*Evidence of jobs/competence matching programmes/initiatives.* *Number of people having gone through these programmes/initiatives.*
Promote the uptake of ICT competence frameworks with relevant stakeholders.	FR, NL, UK	*Number of stakeholders having implemented ICT competence frameworks.*
Establish multi-stakeholder partnerships benefitting the ICT profession (e-Skills Alliances, apprenticeship programmes).	MT, UK	*Evidence of MSPs with direct relevance to ICT Professionals.* *Evidence of results of initiated MSPs (projects, council established, results of initiatives).*
Establish national Sector Skills Councils for ICT.	UK	*Evidence of ICT Sector Skills Councils.* *Evidence of results of existing ICT Sector Skills Councils (projects, council established, results of initiatives).*
Match training/educational curricula and labour market demand.	BE, IE	*Number of programmes aimed at matching ICT training/education with labour market demand.* *Number of people having gone through such programmes.*
Transversal policies and their KPIs		
Policy	**Country of origin**	**KPIs**
Encourage positive gender balance within Europe's ICT profession.	ES, SE	*Number of women/girls reached/impacted (expressed in projects, events and initiatives.*
Promote career opportunities in ICT and related career paths.	DE, FR	*Number of people reached/impacted (expressed in projects, events and initiatives).*
Establish granular labour market monitoring programmes/mechanisms which include the ICT sector.	DE, UK	*Establish granular labour market monitoring programmes/mechanisms which include the ICT sector.* *Evidence of results from monitoring programmes.*

Table 25: Key policies and KPIs

Survey analysis

Against the backdrop of limited KPI data, the quantitative analysis is complemented by survey analysis. This analysis also serves to validate the quantitative elements. The survey analysis is based on a brief two-question survey asking experts to rank the above-mentioned 12 key policies in terms of their benefit for European professionals in the ICT labour market. The scale used was high benefit, medium benefit, and low benefit.

The first question was asked retroactively, asking experts how they perceived the policy benefit looking back over the past five years. The second question asked experts which policies they believe will be most beneficial to European professionals in the ICT labour market in the next ten years.

The survey was sent to a select sample of e-skills policy experts in EU Member States, targeting only those who are deeply involved in the profession and the national bodies who represent the ICT profession and individual professionals. Particular attention was paid to the geographic spread of responses to ensure that good coverage was provided and no regional/geographic imbalances would bias the results.

Results: quantitative evaluation of policies

This section examines the 12 key e-skills policies and quantitatively analyses them based on available data and identified KPIs, their impact and potential benefit for European professionals in the ICT labour market, including new graduates. The available data on the impact and results of these e-skills polices was found to be limited in many cases. This has influenced the depth of the quantitative analysis. However, the analysis in this section is reinforced and further validated by the survey research in the next section.

1. Reform primary and secondary education systems to include informatics as a core competence

In recent years, a number of European Member States have reformed or are in the process of reforming their primary and/or secondary education systems to include informatics (informatics is for the purposes of this examination defined as a broad academic field encompassing computer science, human-computer interaction, information science, information technology, algorithms, and certain areas of mathematics, especially mathematical logic and category theory). The extent of the reforms varies from country to country, ranging from the inclusion of basic ICT skills to the inclusion of programming and/or coding and computational thinking. The overall aim of these reforms seems to be twofold: to provide children and teenagers with basic digital skills; and to encourage them to pursue computing-oriented studies later on in their education. This section examines education reforms in Austria, Cyprus, Denmark, Estonia, Sweden and the United Kingdom and how they fare when assessed against the established KPIs:

- *Number of national primary education curricula that have been reformed.*
- *Number of national secondary education curricula that have been reformed.*
- *Number of students having gone through the reformed curricula.*

Austria, Estonia and Sweden

Austria, Estonia and Sweden can be grouped together as their reforms focus primarily on further integrating informatics and the use of ICT into education in general. These reforms are not aimed at teaching students traditional computer science. In Austria, recent education reforms have focused on secondary education with the introduction of the Neue Mittelschule (Neu Mittelschule, 2014), or new middle school. The new system was launched as a pilot in 2008/2009 and is, since autumn 2012, the 'regular' school system. The new Austrian curriculum places emphasis on e-learning. The Swedish primary and secondary educational systems underwent a series of reforms in 2010/2011 when the government called for a review of the documents governing schools. This took the form of a new Schools Act (Regeringen, 2014) including new syllabi and new curricula for primary and secondary schools. The first pupils entered the reformed system in autumn 2011. The new system is considered to provide what the Ministry of Education deems necessary in terms of digital skills for teachers, pupils and students. Meanwhile, the Estonian national curricula for both primary and secondary schools were updated in early 2011(Estonian Ministry of Education and Research, 2011) to include Informatics as an optional subject at primary school and Technology and Innovation as an optional cross-curricular subject at secondary school. Informatics at primary school is split across two courses called Information Society Technologies, and Computers as a professional tool, both of which focus on digital literacy. Technology and Innovation at secondary level is a cross-curricular topic which includes learning how to use ICT to solve problems and make learning and working more efficient.

Cyprus, Denmark and the United Kingdom

Cyprus, Denmark and the United Kingdom (UK) have taken a different approach to reforming their educational systems, focusing more on the inclusion of traditional computer science skills and competences as a generic stand-alone subject. Following a long process of reforms in the area of education begun in 2005, today's secondary education system in Cyprus includes three informatics courses as elective subjects. The three courses, taught at upper-secondary level are Computer Science, Applications, and Networks. Educational statistics in Cyprus do not currently include statistics regarding the popularity of these three courses (Republic of Cyprus, 2014). In Denmark a new subject has recently been developed - Computational Thinking and Practice - which is currently being tested with volunteering secondary schools for a three-year period (2011-2014). The subject includes knowledge areas such as application architecture, programming and programmability, abstraction and modelling, and digitisation. The UK is taking a similar approach in terms of updating its national curriculum framework to include computing as a standalone subject as of September 2014 (Department for Education (2013). The subject covers the fundamentals of computer science including elements such as coding and creating basic computer programmes.

Impact

Among the examined policies in the six above-mentioned countries, we can observe that a total of 3 primary (Estonia, Sweden and the UK) and 5 secondary (Austria, Cyprus, Denmark, Estonia and Sweden) education systems have been reformed or are in the process of being reformed to include, or to further focus on, informatics. In only two cases, Sweden and Estonia, has both the primary and secondary education system been reformed.

The identified primary and secondary education system reforms have been fully completed and implemented in certain countries (Estonia, Sweden, Austria and Cyprus), while in some

countries the new curricula are yet to be introduced, such as in the UK, or in Denmark where the new computational thinking and practice subject remains in a testing stage. This makes an evaluation of the benefits and impact of these types of education reforms difficult to perform at the current time. A follow-up examination of these policies and the success of each curriculum in the future is worth considering.

The Danish and UK reforms are notable as they focus on traditional computer science skills including coding and programming, with the Danish subject of Computational Thinking and Practice standing out as a cutting edge initiative in Europe. The Danish initiative appears to be the most ambitious and cutting edge. Yet, there is little data on the impact it has had to date, or on its uptake levels. Research from Aarhus University in Denmark suggests that the new subject was taken up by and taught at 18% of Danish high schools in its first year (2011-2012) and at least 26% in its second year (2012-2013) (Caspersen and Nowack, 2013). To date there has been no formal quantitative evaluation of the subject; however it is being praised as an excellent initiative by teachers, examiners and pupils alike.

In terms of estimating the number of students that have gone through the reformed systems in the various countries, a lack of recent statistical data and data looking at individual subjects and their popularity has proved to be an obstacle. In Austria, the new curriculum is only in place since autumn 2012 for the 2012-2013 academic year, and no recent data on numbers is readily available. The most recent available educational statistics for Austria is for the year 2011/2012 (Statistik Austria, 2013). In Cyprus, the three available informatics related courses are electives. As such, and as far as available data is concerned, no clear indications of the number of students choosing to study these courses is readily available as the educational statistics do not drill down into individual subjects. As stated above with regard to Denmark, the only readily available statistics information is that "at least" 26% of the high schools (note: this percentage represents the share of volunteering schools participating in the pilot programme) were teaching the subject in the 2012-2013 academic year. The Estonian primary level course of Informatics is an optional subject, meaning data on the number of pupils choosing this course is not detailed in national statistics (Eesti Statistiken, 2012). No readily available data was found with regard to secondary education in Estonia, looking in particular at the number of students taking Technology and Innovation as an optional cross-curricular subject (Eesti Statistiken, 2012). The reformed Swedish primary and secondary education system welcomed its first pupils in the autumn of 2011. Since the adoption of the new Schools Act in Sweden a total of 2,701,243 students have entered the reformed primary education system and a total of 1,050,920 (Skolverket, 2014) students have entered the reformed secondary education system. While in the UK, as stated above, the subject of Computing will only be introduced in the autumn of 2014, meaning no pupils have taken the new curricula to date.

The potential positive impact of curricula including various informatics elements, whether they are broad as in Austria and Sweden, or highly specialised as in Denmark and the UK, will become increasingly clear only in the years to come. It is positive to note that education reform increasingly incorporates informatics, computer science, and computational thinking. This is a necessary and welcome trend. It is safe to assume that a steadily increasing proportion of European primary and secondary pupils are benefitting from access to progressively more sophisticated informatics-related education, and that over time this will have an undoubted impact on future professionals. Despite these positive developments, it is important that new ICT-related content that is introduced into education curricula is examined critically to ensure what is taught is actually useful for tomorrow's students.

2. Reform teacher training curricula to include training in informatics

In parallel to reforming primary and secondary education systems, some EU Member States have begun reforming teacher training curricula or providing teachers with new /enhanced tools for informatics and ICT training, albeit to varying degrees. This focus on informatics-related teacher training is linked to the idea that teacher training and continued on-going relevant professional development are essential if benefits from investments in ICTs are to be maximised in the classroom. Despite existing policies and initiatives targeting informatics-related teacher training, around 70% of students in the EU are taught by teachers who have learnt about ICT in their own time ("Survey of schools: ICT in education", April 2013 survey funded by the European Commission's Directorate General for Communications Networks, Content & Technology, examining information from 31 European countries (27 EU Member States, Croatia, Iceland, Norway and Turkey) on the access, use, competence and attitudes of students and teachers regarding ICT in schools). This section examines various teacher training reforms in Finland and Ireland and reviews them against:

- *Number of teacher training curriculums that have been reformed.*
- *Number of teachers having gone through the reformed curricula.*

Finland

Finland's digital agenda, Productive and Inventive Finland 2011-2020 (Finnish National Board of Education, 2014), includes the objective that everyone should have the opportunity and skills to use digital services, including teachers. Furthermore, Finland's Education and Research 2011-2016 development plan (Ministry of Education and Culture Finland, 2012) sets out ambitious strategies to reform the current teacher training curriculum. Both policy documents include key measures to be taken in the next couple of years for teacher training including:

- Improving the use of ICT in education and develop teachers' and students ICT skills.
- Updating teacher training priorities to focus on the use of ICT.
- Establishing and funding, through government means, continuing professional education to prepare teachers and related personnel to use ICT to teach and to establish diverse learning environments through the use of ICT.

Part of reaching these objectives means incorporating ICT use as an integral part of learning at school as well as basic and supplementary teacher training in using ICT in teaching. In practice this means financially supporting on-going Finnish policy initiatives in this area. The most relevant with regard to ICT is the KänGuru, or Kangaroo, online portal (Education Finland, 2013a).

The KänGuru portal was initially developed by the Finnish National Board of Education between 2005 and 2007. Its purpose is to act as an online resource for primary and secondary teacher in-service training on the pedagogical use of ICT. The KänGuru portal is divided into six regularly updated and evaluated sections, covering a range of issues from School Work Culture to Teacher Networks in Finland (Education Finland, 2013b). Two sections are of particular relevance: Pedagogical Methods and Information Technology Solutions. The Pedagogical Methods section offers teachers access to publications on the use of ICT in teaching, teaching examples from different schools in Finland and information about distance-teaching using ICT solutions such as web conferencing. The Information Technology

Solutions offer teachers an array of materials and information related to ICT literacy (i.e. skills necessary to use ICT in teaching and learning), media literacy resources including a vast and up-to-date section on social media (i.e. what it is, how to use/not use it, and its potential dangers for children etc.), as well as detailed information on how to equip classrooms with ICT equipment and maintain this equipment. The portal is seen as being very successful with data indicating the site was accessed by over 20,000/month in 2009, and it is today the 993rd most popular website in Finland according to a website traffic ranking site (Alexa, 2014). It is used in the in-service training process for Finnish teachers working in primary and secondary schools; it does not constitute a compulsory part of teacher training.

Ireland

Ireland's 2012 ICT Action Plan (Department of Education and Skills, 2012a), 2011 National Strategy for Higher Education 2030 (Department of Education and Skills, 2011) and Action Plan for Jobs 2013 (Department of Jobs, Enterprise and Innovation, 2013) all include elements affecting teacher training in Ireland and form the basis for on-going reforms to the Irish educational system. While the teacher training curriculum in Ireland is not being reformed in its entirety, the Irish government has enacted a number of policies of direct relevance to ICT in education.

The Irish ICT Action Plan includes a target of improving the retention rates in the university sector by 7% and by 9% by 2014 in the Institute of Technology sector, and notes that one of the key factors in the high dropout rates is an inadequate level of maths proficiency. Against this background, one policy initiative is of particular relevance, namely the ongoing roll-out of "Project Maths". This includes the establishment of a new continual professional development Postgraduate Qualification for teachers of mathematics. The approach focuses not solely on basic ICT training for teachers but rather on an increase in both volume and quality of mathematics teaching across Irish schools to allow pupils to pursue higher mathematics at a later stage, as well as provide teachers with the necessary skills to teach mathematics at a high level.

Furthermore, the Irish National Strategy for Higher Education 2030 stressed the need to build on the centrality of mathematics and science. The strategy argues that mathematical concepts, models and techniques are central to working in all sectors of employment and the proficiency level of students in mathematics is a key factor influencing the domestic supply of graduates for sectors with growth potential such as ICT, as identified by the Irish Expert Group on Future Skills Needs (Expert Group on Future Skills needs, 2008). Therefore the need to equip teachers with the right skills to teach mathematics is of central importance.

A key deliverable of this initiative was the establishment of a Postgraduate Qualification for "out of field" ('out-of-field' teachers teach a subject for which their current qualification is not recognised as appropriate for teaching the subject) teachers of mathematics. The course is a blended learning programme based on a two-year part-time university accredited diploma; it is delivered through a number of Irish universities as well as through online modules. The course was introduced in 2012 with 390 places and is available nationwide free of charge, with a specific provision for teachers in Irish-medium schools. The first cohort of teachers will complete the programme in September 2014. A second group of more than 300 teachers began the programme in September 2013 (NCE-MSTL, 2013). A third and final group of teachers will be recruited in the spring of 2014, marking the end of the programme. The programme is funded by the Irish Department of Education and Skills as part of the national strategy to support the implementation of Project Maths and improve standards in

mathematics education in post-primary schools by up-skilling out-of-field teachers of mathematics.

Impact

The policy initiatives examined in Finland and Ireland demonstrate two vastly different approaches to increasing the teaching of informatics to teachers. However, it is important to note that the two countries are approaching the issue from different starting points.

In the case of Finland, the country has been going through a wide-ranging process of education reform since the 1970s and until a couple of years ago enjoyed one of the highest ranked educational systems in the world. According to the latest PISA 2012 assessment, Finland's educational system is ranked 12th in the world overall (in terms mean of maths, reading and science scores), and 3rd in the EU after the Netherlands and Estonia (OECD, 2013).

These reforms are on-going and are now focusing increasingly on ensuring that teachers are equipped with the necessary ICT user skills, both for use of ICT in the classroom and for teaching essential ICT skills to pupils. In contrast to the PISA rankings, the European Commission's study Survey of Schools: ICT in Education (European Commission, 2010b) shows that only 19% of Finnish students in grade 4 are taught by teachers for whom participation in ICT training is compulsory, compared to the EU average of 30% of students (15% in grade 8 against an EU average of 25%, and 22% in grade 11 - general curriculum- against an EU average of 24%).

The current renewed focus on ICT training for teachers, including resources like KanGuru for primary and secondary teacher in-service training on the pedagogical use of ICT, could help improve Finnish teachers' confidence in using ICT for learning and teaching purposes. In terms of the number of teaching curricula that have been reformed in Finland the evidence points to an on-going process of reform which is set to be completed by 2016. Meanwhile, successful tools like the KanGuru portal will continue to receive financial support from the Finnish government and act as a detailed ICT resource for primary and secondary teachers. The KanGuru initiative has received extensive praise since its launch, and continues to serve as a good example of an online ICT skills and pedagogy in-service training tool for teachers.

Ireland's need to raise its level of mathematical achievement was formulated in 2008 by the Irish Expert Group on Future Skills Needs (Forfas, 2013) in its Statement on Raising National Mathematical Achievement. Since then, a number of policies target increasing mathematical achievement both among pupils and also in terms of teaching and teachers' ability to teach the subject. Against this background it is worth noting that Ireland is today ranked 20th in the world according to PISA. The impact of the focus on Maths as part of the ICT strategy and the extent to which this will be more successful than a more direct focus on ICT itself, remains to be seen. As in the case of Finland, the reforms undertaken in Ireland have not focused primarily on reforming the national curricula for teacher training, rather it is a target policy approach to solving a particular problem, in this case Ireland's level of mathematical achievement. In practice we can observe that the uptake of the new Postgraduate Qualification for "out of field" teachers of mathematics is very good to date, an achievement praised by the Irish Expert Group on Future Skills Needs in a recent report (ECWT, 2013) which states that the course has had almost 650 participants alongside other improvements in terms of mathematics output including:

- Increased teaching time has been allocated to mathematics in primary schools.
- An increase of 58% in the number of students taking higher level maths since 2011 to 25.6% of all leaving certificate students in 2013, compared to a target of 30% by 2020.

Meanwhile, a third and final intake of teachers are set to enter the Postgraduate Qualification for "out of field" teachers of mathematics in September 2014, meaning approximately 900 teachers will have become fully qualified to teach mathematics in the period 2012-2016.

3. Encourage positive gender balance within Europe's ICT profession

It is well recognised that there remains a lot of work to be done in the area of ICT and gender equality. According to the European Centre for Women and Technology, women make up less than 30% of the ICT workforce in Europe (ECWT, 2013). There is currently a deeply distorted gender distribution both among ICT professionals in Europe and in ICT programmes and courses at university level (according to Eurostat, there were 721,191 students that enrolled in Computing in EU27 in 2011, 595,439 where males and 125,752 were females. For Science, mathematics and computing there were 2,074,407 of students who enrolled in EU27 in 2011, 1,293,543 males and 780,864 females. And for Engineering and Engineering trades there were in total 1,817,901 of students enrolled in EU27 in 2011, 1,497,348 males and 320,553 females. Examine statistics of Tertiary students (ISCED 5-6) by field of education and sex.

. To combat this trend a number of EU Member States have initiated policies to encourage a positive gender balance within Europe's ICT profession. These policies are primarily aimed at promoting ICT-related studies and career paths for young girls and women from an early age. The aim of these policies is to ensure that the economic impact of the dearth of ICT professionals is minimised, and the market can fully capitalise on the knowledge and potential of Europe's female population. This section examines such government-initiated policies in Spain and Sweden against their KPI:

- *Number of women/girls reached/impacted (expressed in projects, events and initiatives).*

Spain

Spain has, in the last 30 years, undergone a process of substantial transformation in terms of gender equality principles. The country has effectively moved from being a dictatorship in the 1970s to becoming a strong democratic player at the forefront of promoting gender equality. Since the establishment of Spain's Ministry of Equality in 2008, the government has focused increasingly on tackling gender inequality in the information society. Spain is one of the few European countries to have developed a dedicated equality action plan for gender imbalance in the information society. Adopted in February 2013, Spain's Digital Agenda is complemented by its 2nd Action Plan for Equality between Women and Men in the Information Society (Gobierno De Espana, 2014). This action plan has yet to be fully ratified by the Government but looks both promising and ambitious. The plan includes equality as one of its key themes, with an associated budget of EUR4.93 million for the period 2013-2015. The seven principal objectives of the plan are to:

- Increase the access, use and development of skills and abilities of women in the information society.
- Increase the presence and participation of women in the information society.

- Increase women's presence in the digital content industry and increase the attractiveness of the digital content industry for women.
- Increase the number of women with ICT skills in business.
- Increase the use of digital public/e-government services by women.
- Build up the confidence of women in the digital environment.
- Increase the number of female role models in the ICT sector.

The action plan and its initiatives are accompanied by a number of targets to reach by 2017 using 2010 as the baseline year for comparison with gender equality statistics pertaining to the ICT sector. Among these objectives, taking into consideration that basic ICT user skills fall outside of this examination, three stand out as particularly relevant:

- Increase women's presence in the digital content industry and increase the attractiveness of the digital content industry for women.
- Increase the number of women with ICT skills in business.
- Increase the number of female role models in the ICT sector.

Unfortunately, the targets for these three objectives have yet to be formalised making an analysis of the potential reach and impact of the plan currently impossible.

Sweden

The Swedish government has a long tradition of working towards gender equality in many if not most sectors, including the ICT sector. Gender equality is a stand-alone pillar of the Swedish government's Digital Agenda launched in 2011. A number of policy initiatives that build on previous work on gender equality in the ICT sector are included. The underlying body of work began in 2007 when the Royal Institute of Technology was tasked with developing an action plan for "gender-equal ICT development for growth". The 2007 plan had three overall aims: to positively influence people's perception of the ICT profession; to generate better career opportunities and to promote role models for women in the ICT sector. This action plan was further expanded upon by the Swedish Agency for Growth Policy Analysis in 2011. This resulted in targeted recommendations for action to be taken at societal level, for actions to be taken by the ICT industry, and for actions to be taken by educational institutions to increase gender equality in the Swedish ICT sector (Tillväxtanalys, 2011). The recommended actions are briefly summed up below:

Societal recommendations:

- Promote female entrepreneurship.
- Establish mentorship programmes for women.
- Initiate company-wide traineeship programmes for women.
- Establish a national portal for ICT related careers.
- Establish further training for guidance counselors.
- Organise special competitions for women in the ICT sector.
- Monitor/measure women's contribution to IT development.

Industry recommendations

- Recruitment theme: gender-friendly recruitment, payroll padding for parental leave, and formal criteria for career advancement within the company.

- Organisation of work theme: ability to take parental leave, shared leadership initiatives, nomination of employees with responsibility of disseminating gender equality values within companies, and the organisation of company activities.
- Information theme: provide managers with gender equality training, "breaking" the image of the traditional IT engineer, and actions to positively highlight women in the workplace.

Education-related recommendations

- Establish sponsorship and mentoring programmes for students.
- Ensure educational programmes include a gender dimension.
- Establish concrete targets for the share of women applying to and enrolling in PhD programmes.
- Earmark research funding for women in ICT research.

Impact

Sweden's on-going efforts to increase gender equality in the ICT sector and within Sweden's information society were last evaluated in 2012 by the Swedish Agency for Growth Policy Analysis (Tillväxtanalys, 2011). They measured the impact to date and examined the degree to which the 2007 action plan had been implemented across Sweden. The evaluation does not go into statistical data regarding the number of women affected; however, it does highlight certain relevant findings about the impact of the policy initiative so far:

- The share of female students starting an ICT-related tertiary degree (see explanation below) has remained relatively stable between 1993 and 2010, ranging from 20% to 30% with a peak of 32% in 1997, a low of just below 20% in 2004, and a 23% share in 2010; this translates into approximately 1,000 female enrolments/year in the early 1990s to just under 3,000/year in 2010.
    - The four types of available degrees considered as 'ICT-related' are "Electronics, Computer Technology and Automation", "Informatics, Computer Science and Systems Sciences", "Computing, general education" and "Computing, unspecified education/other". The two first types making up the majority of awarded degrees based on student enrolment numbers.
- Historically there has been a larger share of women than men starting a first degree in the specific field of Informatics, Computer Science and Systems Science. However, it is also within this field that we observe the biggest decline in the share of new first-degree female students starting such a degree, from 39% in 1997 to 21% in 2004
- In terms of women being awarded a degree, i.e. completing their studies, the share of women graduating with a degree in Informatics, Computer Science and Systems Science represented a total of 19% in 2010, compared to over 40% in the year 2000.
- Overall, looking at all types of IT related degrees, approximately 3,000 degrees are awarded per year (including both men and women) in Sweden. This figure peaked at 4,000 in 2004, and has since been slowly declining for both men and women.
- In 2012, one in five ICT professionals in the Swedish ICT sector was female.
- In 2012, women in the ICT sector are paid approximately 6% less than men. A difference which corresponds to the salary gap that can be observed in other sectors of the Swedish economy.
- The number of female members sitting on boards of IT companies listed on the Swedish stock market was 21% in 2010, an increase of approximately 2% since 2007.

The evaluation concludes that nearly all initiatives in the 2007 action plan have been implemented to some degree, but that more efforts are needed to create a truly gender equal ICT sector.

As Spain's action plan for a more gender equal information society has yet to be finally formalised, at this stage we can only draw conclusions about its future impact based on available performance indicators (Gobierno De Espana, 2013) in the current document. According to the draft plan, a total of 130 measures are planned across the seven different objectives in the 2013-2017 period, with a total anticipated budget of EUR41.6 million. An overview of the number of planned measures for each relevant objective can be found below:

- Increase women's presence in the digital content industry and increase the attractiveness of the digital content industry for women: a total of 83 planned actions.
- Increase the number of women with ICT skills in business: a total of 38 planned actions.
- Increase the use of digital public/e-government services by women: a total of 58 planned actions.
- Build up the confidence of women in the digital environment: a total of 56 planned actions.
- Increase the number of female role models in the ICT sector: a total of 33 planned actions (note: Additional measures that are of interest, but not directly attributable as benefiting the profession include: increase the access, use and development of skills of women in the information society (an overall increase in women's user-level skills): a total of 62 planned actions in 2013-2017; Increase the presence and participation of women in the information society (increase the rate of women's participation on blogs, newsgroups and online discussion forums): a total of 81 planned actions in 2013-2017).

In the case of both countries' policies it is difficult to gauge their Empirical impact. In Sweden, the results of policy initiatives over a number of years point to a relatively stable inflow of women into third level ICT-related education, but with a trend towards fewer women entering degrees in Informatics, Computer Science and Systems Sciences, an area where traditionally there has been a higher share of women entrants starting a first degree, as well as in the other types of degrees. It is important that this overall downward trend is applicable to both men and women, following a peak in 2004.

The numbers of women on boards has increased slowly but steadily, pointing to an impact of the policies on the high echelons of talent, yet the gender pay gap remains. The gender pay gap manifests consistently in all sectors in Sweden, not exclusively in the ICT sector.

However, the ambitious and holistic approach taken to gender equality in the ICT sector and the information society in both Spain and Sweden is a positive sign that Member States are examining ways and means to increase gender equality in a sector which is still dominated by men. The impact of Sweden's on-going efforts and Spain's future efforts are likely to become clearer when these initiatives are quantitatively analysed by the Governments or agencies in charge.

4. Establish national Sector Skills Councils for ICT

This research shows that the establishment of national Sector Skills Councils for ICT was a particularly relevant and valuable policy to examine in further detail. One of the most well-

known examples of such a policy action is the establishment of e-Skills UK (2014a) in the United Kingdom in 2003. Since its inception as a Skills Sector Council (SSC), e-Skills UK has contributed to the UK e-skills landscape through a wide range of initiatives, alongside other key stakeholders such as the UK professional informatics society, the Chartered Institute for IT (BCS) (see more on the British Computer Society at http://www.bcs.org/). Some of the most noticeable initiatives of e-Skills UK are detailed below (this section deliberately does not include the "ITMB Degree" created by e-Skills UK (2014) as this initiative is examined in detail in the Monitoring and benchmarking e-skills policies and partnerships project, 2013h) and analysed against their KPIs:

- *Evidence of ICT Sector Skills Councils.*
- *Evidence of results of existing ICT Sector Skills Councils (projects, council established, results of initiatives).*

To date, the UK is one of the most experienced EU Member States with regard to both the formulation and development of e-skills policies and is often seen as a bellwether of the e-skills domain. e-Skills UK is the UK's Sector Skills Council (SSC) for the IT industry in the UK (this sector is described interchangeably as "Business and Information Technology", "IT & Telecoms", or "IT, Telecoms and Contact Centres sector" depending on the source). It was the first SSC for the ICT sector to be formally established in 2003 (e-Skills UK has existed in name since at least the year 2000. It was at the time one of the UK National Training Organisations (NTO) and given a five-year licence by the UK Government. It is part of the Skills for Business network of a series of not-for-profit, employer-led SSCs. Its overarching goal is to address the current and future needs of the IT sector in the UK by inspiring future talent, by supporting ICT professionals develop their skills, and by promoting the benefits of IT across society (see more on what e-skills UK do at http://www.e-skills.com/about-e-skills-uk/what-we-do/).

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Computer Clubs for Girls (CC4G)

Designed to teach girls aged between 9 and 14 years old about the potential of technology, CC4G was launched in 2005 across 3,600 schools (CC4G, 2014). Since its launch, over 150,000 girls in 4,500 schools across the UK have been involved in the scheme. e-Skills UK reports that 84% of the girls that take part in CC4G state they are more likely to consider further IT studies or careers as a result and 98% of teachers running the clubs say their IT confidence levels have improved.

Big Ambition

Big Ambition is an online initiative aimed at teenagers between 14 and 19 years old. Its main objective is to attract teenagers to ICT education and ICT-related career pathways. It does so primarily by informing teenagers, through their websites, each targeting a country within the UK. On the websites teenagers can learn about life as an IT professional; they can learn about possible future employers; discover various types of IT jobs; get information about technology career trends; and participate in competitions through which they can for example win work experience. According to a survey run by www.bigambition.co.uk, 81% of users said they were more likely to consider an IT career or degree after having used the site.

Additional initiatives

e-Skills UK's scope of activities further includes research on a number of themes such as Women in IT, Future Trends, Employment and Recruitment, and Education and Training. e-Skills UK is also actively engaged in education, having developed the ITBM degree in collaboration with a wide range of UK employers. The ITBM degree is designed to produce graduates with a range of business, technical and interpersonal skills that are needed and in demand by UK employers globally. e-Skills UK is also the official issuing authority for the IT sector apprenticeship frameworks.

Scope of SSCs and cooperation with existing stakeholders

It is important to note that while e-Skills UK is widely seen as a successful example of a sector-specific SSC, there are potential pitfalls surrounding SSCs. Given that SSCs for ICT are a relatively new phenomenon, it is critical that bodies such as e-Skills UK ensure a strong and transparent level of cooperation with other key players such as higher education bodies offering ICT-related degrees, as well as pre-existing professional associations. Bearing this in mind, it is important that SSCs operate within clearly defined remits to avoid scope creep. Without this level of cooperation and clearly defined operational limits, SSCs run the risk of providing markedly less of a benefit to the ICT profession as a whole.

Impact

e-Skills UK is seen as being one of the best established sector skills Councils in the UK, i.e. in comparison to the other non-ICT sector Councils. Its impact has been broad for both current and prospective future ICT professionals. Its success comes with a paradoxical backdrop, where the overall number of those entering ICT-related education in the UK has declined. For instance, while growth in IT professional employment has been 10% over the period 2002-2010, the number of UK-domiciled applicants to IT related higher education courses has declined by 28% (E-skills UK, 2014a). Research by e-Skills UK shows that when comparing UK-domiciled applicant numbers for IT-related degrees in higher education with those to other STEM subjects, the number of applicants to Engineering, Biological Sciences and Physical Sciences grew by 35%, 41% and 34% respectively between 2002 and 2010, while the number of applicants to IT related courses fell by 28% over the same period.

In terms of e-Skills UK's reach and impact it is worth noting the following:

- Its IT Management for Business BSc (ITMB) degree which has been running since 2005 is currently delivered to 1,200 students in 14 universities across the UK and the number of applications is rising by an average of 24%/year (ITMB**,** 2014). However, this should be seen in the context of the total number of applications to IT related higher education courses in the UK: 19,000 in 2010 (E-skills UK, 2014a).
- Computer Clubs for Girls has involved over 150,000 girls in 4,500 schools across the UK since its launch in 2005.
- e-Skills UK's research helps 45,000 people to stay up-to-date with the latest developments in IT and Telecoms.
- Big Ambition has 9,000 registered participants, out of which 73% are girls (E-skills UK, 2014a).

Nonetheless, the UK is now a forerunner in terms of ICT-friendly education reform (see section of reform of primary and secondary education systems) and embedding computing into the national curricula. Furthermore, e-Skills UK's ambitious work is likely to have played

a role in the resurgence of 24% in terms of numbers of applicants to IT related higher education courses between 2007 and 2010 (E-skills UK, 2014a).

It is also worth mentioning that in terms of gender balance, initiatives such as Computer Clubs for Girls (CC4G) are clearly needed to raise young girls and women's interest in computing and technology. Despite such efforts gender imbalance remains a significant issue for the IT and Telecoms sector. In 2011, just 18% of IT and Telecoms professionals were female compared with an overall figure of 48% for the UK workforce as a whole (E-skills UK, 2014a). However, this is not an issue only in the UK; the average among the EU15 countries was only 17% in 2011, with the lowest figure recorded in the Netherlands at 11% and the highest in Greece at 24%.

Finally this research points to the fact that for SSCs for ICT to be successful in the long-term, their scope needs to be clearly defined and cooperation with pre-existing key stakeholders such as higher education authorities and professional associations, needs to be established and maintained.

5. Reform national immigration policy to tackle shortages in supply of skilled ICT practitioners (for non-EU residents)

This research has shown that a small number of Member States have established policies aimed at reforming their national immigration policies. These reforms have been devised to tackle shortages in supply of skilled foreign professionals, including but not limited to ICT practitioners, through facilitating the entry of skilled non-EU residents. These types of policies are examined in Austria, Estonia and France and measured against their established KPIs:

- *Number of practitioners having benefitted from reformed immigration policies.*

Austria

In July 2011, Austria made changes to its immigration system in order to make it possible for skilled workers interested in relocating to Austria to enter the Austrian labour market**.** The government introduced the so called "Rot-Weiß-Rot Karte**"** (Advantage Austria, 2014) (Red-White-Red Card system). This criteria-led immigration system allows qualified workers from third countries along with their family members to permanently immigrate to Austria. Interested candidates can easily confirm whether they are eligible for immigration based on the following criteria, and the associated points for each criterion: qualifications, work experience, language skills, age and studies completed in Austria (this only applies to those who are classified as being very highly qualified, as opposed to skilled workers in so called shortage occupations - see further details below).

As is the case in a number of Member States, certain occupations are in high demand in Austria and to fill these shortages of skilled professionals, the Austrian government each year publishes a list of "shortage occupations". The list for 2014 shows that the biggest shortage reported, by a clear majority, is in the following category: Technicians with a higher level of training (engineer) for data processing (covering up to 88 more specific job profiles) (Migration Austria, 2014). The policy seems to have had some impact, but less than hoped for when launched in 2011. The overall target for skilled foreign professionals was 8,000 in 2012 but in that year only 1,585 people entered the labour market using the new points system (Format, 2014). Available statistical data from Austria points to a very low number of entrants

throughout 2013, in the range of approximately 230 people (Bundesministerium Fur Innes, 2014).

Estonia

Estonia's parliament approved a new immigration reform package in June 2013 aimed at making it substantially easier for foreign students, researchers and highly skilled workers, including ICT professionals to enter the Estonian labour market. The reforms are aimed at facilitating students and skilled professionals, and their families, to obtain temporary residence permits. This follows opinions voiced by a number of critics of Estonia's immigration policies, such as employers seeking specialists from abroad, having said that existing residency laws are overly strict. The current immigration policy in Estonia has been called "closed" and is seen to stem from Estonia being a post-Soviet state. The immigration policy is seen by some to have been designed to safeguard and reinforce the interests and well-being of the majority of ethnic groups in the republics (Estonians, Latvians) at the expense of non-native residents (predominantly ethnic Russians and Ukrainians) who are unable to vote, stand for election or receive the full benefits of citizenship. A similar situation can be observed in neighbouring Latvia, also a post-Soviet state.

On-going consultations have led to major changes being proposed to the Estonian Aliens Act from 1993. Although some of the new changes have yet to come into force, the consultations have included a number of key stakeholders such as government ministries, the Estonian Employers' Confederation, and higher education authorities (European Commission, 2013i). Key amendments that have come into force in September 2013 include:

- A simplified application process for residency permits following a registered short-term stay in Estonia.
- (Highly) Qualified workers from third-countries will have the right to bring their immediate family with them if granted a work permit in Estonia (Aliens Act, 2009).

As the reform process is still on-going in Estonia, there are at the time of writing no defined targets or performance indicators established for the immigration reform as a whole, according to Estonian government sources. This situation is likely to be rectified during the summer of 2014, along with additional amendments to the Aliens Act.

France

Over the last ten years France has introduced a number of changes to its national immigration policy which have facilitated the entry of young students and ICT professionals to the French labour market. These reforms have in particular attracted young migrants from North Africa and Eastern Europe. The process of reforming the French immigration policies began in 2006 with the introduction of a new law on immigration and integration (European Commission, 2009). The law contains a series of measures to attract more qualified workers from abroad and to facilitate temporary migration. The law further creates three new residence permits for three years for highly qualified people.

Additional key changes introduced included:

- A list of professions with a high demand for skilled professionals at a regional level is published each year to facilitate job matching.
- As of July 2006 foreign students benefit from more flexible conditions if they want to get employed during their studies: they can work up to 60% of the annual official

working time (while also studying). Following their studies, those who are awarded a Master degree can get an authorization to stay for six months to find an employment in a profession in connection with their studies, following which they can also, if necessary, be given a resident permit renewable once for a maximum of one year.

Impact

It is important to note that the three examined policies are at different levels of maturity. In France the reforms took place nearly 8 years ago, in Austria they date from 2011, and in Estonia, according to government sources, they are set to be finalised in the summer of 2014. Furthermore the reforms are first and foremost aimed at facilitating the entry requirement for skilled professional non-EU citizens wishing to relocate and enter these three national labour markets. These immigration policy reforms target highly skilled and skilled workers – across the board – as opposed to specifically ICT professionals. Nevertheless, shortages of skilled workers in Austria, France and Estonia do include and cover ICT professionals; this is particularly true in Austria as illustrated by their annual list of professions where a shortage of skilled workers exist (a list of the 53 ICT related professions listed as being in short supply in 2014 is available online. See Migrations Austria, 2014). Likewise, already in 2012, Estonia's IT sector was estimated to be in need of 2-3 times more highly skilled ICT professionals (Estonian Public Broadcasting, 2012). In France, the domestic ICT sector is expected to only create 81,000 net new jobs between 2010 and 2020 (EU Skills Panorama, 2012); meanwhile evidence points towards an existing ICT skills gap of 3,000 masters level professionals per year (European Commission, 2013h).

The little available data on the Austrian card initiative indicates it has had limited success to date. During the initiative's first two years (2012-2013), approximately 1,600 non-EU nationals have entered the Austrian labour market under the programme. Given that the official data on the initiative does not classify the professions or skills of the accepted people, it is difficult to gauge how this has benefited the ICT sector in Austria. Nevertheless, it is an interesting approach to attracting skilled and highly skilled professionals from outside of Europe.

In Estonia reforms are on-going making it currently impossible to gauge their impact. It is however clear that the Estonian government prioritises an increased influx of highly skilled workers from third-countries as a means to plug the Estonian skills gap across the board. This is illustrated by the fact that Estonia has one of the highest shares of foreigners in the total population. In 2012 foreigners made up 15.7% of the Estonian population (European Commission, 2013i). In France, a similar obstacle presents itself in that immigration statistics is not broken down by the National Institute of Statistics and Economic Studies to a granular enough level to analyse the impact of immigration reforms on a particular sector such as the French ICT sector (Insee, 2014).

6. Promote career opportunities in ICT and related career paths

The ICT profession is suffering from poor public image in a number of Member States. High profile cases of failed ICT projects, so called "black swans", are one factor contributing to this perception. In addition, few children and young people are considering a career in ICT as it does not have the same societal status as older professions such as medicine or law. One way to tackle the current ICT skills gap is to implement policies aimed at giving the ICT sector and careers in ICT more visibility and a more positive, and realistic, image. This would likely lead to more young people choosing to study for a career in ICT, which in turn, could stave

off future ICT skills gaps in Europe. This section examines government-initiated policies in France and Germany, and assesses them against their KPI:

- *Number of people reached/impacted (expressed in projects, events and initiatives).*

France

As the future French digital agenda, France Numérique 2020, is still being negotiated by the government at the time of writing, the available information based on the draft plan is included here. However as this is in draft form the content may still be altered. This analysis is based mainly therefore on the former French digital agenda, Plan France Numérique (2012).

According to the draft working document, France Numérique 2020, the digital sector represents a quarter of the national growth in France. The sector has created around 700,000 jobs in the last 15 years and the Government estimates that the sector will create 450,000 jobs until 2015. However, while the Government has realized the importance of investments in the sector and education, the new policy does not include the promotion of career opportunities in ICT (France Numerique 2020, 2014).

The French 2012 digital agenda includes a measure to establish a single online portal through which the public can access a plethora of information about the different "jobs of the internet". The portal, which is now fully implemented and still available, stems from an initiative launched by the French Ministry of Education. The website presents visitors with a comprehensive overview of the different job profiles that exist online grouped visually in seven categories (French Government online, 2014):

1. Communication & Marketing

2. Programming & Development

3. Production & Content Management

4. Interfaces & Digital Creations

5. Infrastructure & Networks

6. Training & Support

7. Project Management

The site provides a detailed overview of specific professional profiles or job titles within families of professions. The information on any specific job role includes a brief presentation of the responsibilities of the role, the overall objective of the role, the range and scope of tasks undertaken, an overview of the skills necessary for the role, as well as links to training and education providers offering the necessary courses/degrees to undertake the role. It also provides recommended reading and resources. In addition, the site provides "portraits" of actual professionals in the various roles.

It is worth noting that this site does not provide the full range of ICT-related job profiles, nor does it aspire to; it focuses only on those associated with the internet. Overall the site provides users with information about over 70 internet-related job profiles. The site appears to be quite

popular with over 4,300 "likes" on Facebook. The number of people reached in total, expressed in visitors to the site, is estimated at 864,928 since its launch in July 2009. At the time of writing the site currently handles 30,000 visits per month.

Germany

Part of Germany's digital agenda, Digital Germany 2015, aims to promote ICT studies and career opportunities through the organisation of nation-wide ICT and engineering related competitions (Federal Ministry of economics and Technology, 2010). A notable example of this policy includes the yearly organisation of a national computer science contest for school children called Informatik-Biber (2014). The competition is aimed at students in grades 5-13 (age 10 to 15-16) in Germany and is held annually in November since 2007; it is funded by the German Federal Ministry of Education and Research. It aims to raise the interest of young students in computer science, without requiring prior knowledge of computer science. It demonstrates the versatility of computer science in everyday life and encourages further studies of computer science. It is part of the international Bebras (2014) initiative started in Lithuania in 2004. In 2012 a total of 186,055 students took part in the competition in Germany drawn from 1,097 schools. In 2013 a total of 206,430 students took part in Germany (Informatik-Biber, 2014).

Impact

The impact and benefit of the French awareness raising initiative can be assessed based on website visitor statistics. According to the latest data provided by the French government the site was visited 109,041 times in 2010; 134,077 times in 2011; 202,292 times in 2012; and 296,573 times in 2013. According to a website traffic ranking website, the portal is the 5,791st most popular website in France. Based on steadily increasing visitor numbers to the website, it is clearly a tool that is enjoying a strong growth in popularity which represents significant value to future students as well as future and current ICT professionals in France (Alexa, 2014). The site presents a holistic overview of the various online professions, the educational paths leading to each job profile, as well as additional resources for further information.

The Biber contest in Germany, although part of a larger international network of similar contests run in 24 countries around the world (Bebras, 2014), is by far the most successful with the most participants. Data pertaining to the two last years of the competition in Germany (2012-2013) shows the contest is extremely popular with over 200,000 students having taken part in 2013, representing an increase of 10.9% compared to 2012. Despite this, it is important to note that the competition has been running in Germany since 2007 and that Germany has a long tradition of organising nation-wide science and engineering related competitions and contests. Nonetheless, a nation-wide contest that introduces young children to Computer Science at an early age and involving over 200,000 children annually is likely to have an overall positive effect on the e-skills landscape in Germany over time.

7. Establish granular labour market monitoring programmes/mechanisms which include the ICT sector

In order to tackle the current skills gap in Europe and provide insight to support a more effective approach to the identification, targeting and assessment of policy actions that will most benefit European professionals in the ICT labour market, granular labour market information is needed to a much greater extent than what is currently the case. Few Member

States have such granular labour market monitoring mechanisms and statistics at hand. Furthermore, different EU Member States are taking varying approaches to how they gather statistics, making pan-European analyses troublesome and less meaningful. This section examines policy initiatives in Germany and the United Kingdom in this area and how it fares when assessed against the established KPIs:

- *Evidence of monitoring programmes with direct relevance to ICT Professionals.*
- *Evidence of results from monitoring programmes.*

Skilled Workers Offensive ("Fachkräfteoffensive")

The Skilled Workers Offensive programme was initiated by the Federal Ministry of Economy and Technology in 2012 and is still on-going today. It is an ambitious multi-pronged programme with the overarching goal of tackling the German skills gap by attracting skilled workers. It includes measures ranging from promoting the inclusion of groups such as women and people with disabilities into the German workforce to attracting highly qualified workers from abroad. Critically it also includes the establishment of a dedicated Labour Market Monitoring platform as part of the German Federal Employment Agency.

This labour market related initiative includes a "bottleneck monitor" webpage, hosted on the Skilled Workers Offensive website (Fachkraefte Offensive, 2014). The page allows visitors to visually identify where staffing difficulties are already affecting particular sectors or professional groups, including ICT professionals, as well as where staffing bottlenecks are expected to occur in the future (Fachkraefte Offensive, 2014). The page builds upon data sourced from federal labour agencies and can for instance display how many registered unemployed ICT experts there are in a particular German province and what the indicated demand for such experts is in that particular province. The page includes a number of relevant professional groupings for the ICT sector including:

- Computer Science (Expert)
- Software Development & Programming (Expert)
- IT Systems Analysis, IT Application & Sales (Expert)

Linked to this is another initiative, also established through the Skilled Workers Offensive programme, taking the form of a Centre of Excellence aimed at supporting SMEs to meet their skills requirements (Kompetenzzentrum Fachkraeftesicherung, 2014). In addition to providing SMEs with practical advice on staffing and recruiting people with the right skills set, the Centre also produces ad-hoc research on demand and supply of highly skilled experts within the German labour market. For instance, the latest study from August 2013 identifies so called "bottleneck professions" and notes that out of 114 such professions in Germany, 51 professions are directly linked to STEM skills and qualifications. The research further includes a certain degree of foresight analysis, looking at where potential gaps might develop in the future. The Centre also provides high-level information on future trends (Kompetenzzentrum Fachkraeftesicherung, 2014) relating to the German labour market across the board, not just for ICT related professionals.

e-Skills UK research publications

As part of its remit as the UK's Sector Skills Council for ICT, e-Skills UK produces a range of research reports, including its Technology Insights and Labour Market Bulletin series. Both publications provide labour market relevant information on key trends, opportunities and challenges facing the ICT sector in the UK (e-skills UK, 2012). Technology Insights,

formerly called IT & Telecoms Insights and IT Insights, is published on an annual basis since 2005. As an example, the latest report (E-skills UK (2014a) from 2012 provides an in-depth look at the existing IT & Telecoms landscape in the UK (the report is broken down into four reports; one for the UK plus 3 summary reports for Northern Ireland, Scotland and Wales) including forecasts for the future. The reports go into substantial detail about the changing ICT environment, demand and supply of ICT labour and skills, and IT related education and qualifications data, including:

- Geographic demand for IT & Telecoms professionals.
- Nature of demand for IT & Telecoms professionals (i.e. demand by role).
- IT & Telecoms workforce growth dynamics 2011-2020.
- Trends and their associated skills need (broken down by immediate, developing, horizon, and future skills issues).
- Statistical data regarding applicants and acceptances to IT related higher education courses as well as data relating to the uptake of IT related A-Levels (A-Levels is an academic qualification offered by educational bodies in the United Kingdom and the British Crown dependencies to students completing secondary or pre-university education).

The quarterly Labour Market Bulletin, first issued in 2002, covers ICT labour market related statistics and data including (E-skills UK, 2014b):

- Employment numbers
- Demand for skills
- Pay rates
- Education and training trends
- Predictions for future recruitment activity
- Reports on stock market performance
- Spending patterns
- Company failures and redundancies.

Together, among other e-Skills UK research publications, these provide stakeholders and policy makers with a vast array of data on the ICT sector in the UK. The data is drawn from both government and private sources, including input from close to 5,000 employers across the UK (E-skills UK, 2014a).

Impact

While the two examined policies are different in nature, one focusing specifically on the ICT sector while the other examines the labour market across all sectors, both are good examples of mechanisms allowing for more granular labour market monitoring.

Mechanisms like the German “bottleneck monitor” and the associated Centre of Excellence for securing skilled labour, and the research and analysis of e-Skills UK are vital for stakeholders to understand the changing landscape of the ICT profession.

Granular labour market monitoring data is likely going to remain more relevant to policy makers than ICT professionals; however, these kinds of data points are necessary to formulate policies that will support a growing and dynamic European ICT profession in the future. It is hoped that these types of initiatives will increasingly allow policy makers across Europe to

devise evidence-based policy actions to tackle the EU skills gap. There is currently a lack of harmonised granular market labour monitoring mechanisms in Europe and these initiatives from Germany and the UK represent a positive step in the right direction.

8. Promote the uptake of ICT competence frameworks with relevant stakeholders

As ICT has become the backbone of the European economy, the sector itself has grown exponentially and is facing a chronic shortage of skilled individuals. One of the reasons behind the challenges recruiting ICT workers lies in the prevalence of a fragmented approach in terms of competences and skills. Indeed Europe has been lacking a continent-wide approach in terms of competences. Over the past decade, ICT competence frameworks have started to blossom following the impulse from industry and governments wishing to define ICT roles using a more structured approach. In particular, a European e-Competence Framework has been developed in several iterations since 2003 within the European Committee for Standardization (CEN) and is considered to be the common language for describing e-competences in Europe. This section examines government-initiated policies relating to competence frameworks in the Netherlands, France, and the UK, and assesses them against their KPI:

- *Number of stakeholders having implemented ICT competence frameworks.*

The Netherlands

Over the past few years, a lot of effort has been invested in promoting the use of the European e-Competence Framework (e-CF). The Ministry of Economic Affairs contributes to the implementation of e-CF in the Netherlands through the e-CF Working Group which was setup in 2011. The ministry is one of the founding partners of the Working Group. The e-CF Working Group brings together a wide range of partners from the government, industry, and education. It is part of the Digivaardig & Digiveilig (Digitally Skilled & Digitally Safe) Programme (Digivaardig and Digiveilig, 2014), a joint initiative by the Dutch government and private sector actors, which has identified the large-scale adoption of the e-CF by the Dutch ICT-labour market as a key priority (Digitally Skilled & Digitally Safe, 2012).

The e-CF Working Group appears to be a key driver for the adoption and implementation of the e-CF in the Netherlands. The Working Group meets regularly and focuses on raising awareness on the e-CF in the Netherlands by advocating its value at meetings and events (European e-competence Framework, 2014a). In November 2013, 21 Dutch organisations have signed a covenant to agree on the use of the e-CF in their recruitment and training activities (Government of the Netherlands, 2012).

In 2012, the Dutch government decided to integrate the European e-Competence Framework at the core of its iStrategy (European e-competence Framework (2013) to streamline the use of ICT in the public sector. The iStrategy stresses the importance of staff quality and the importance of having the right digital expertise and skills. One of the central elements of the iStrategy with regards to e-skills is the implementation of a Quality Framework for Information Management (Kwaliteitsraamwerk voor de Informatievoorziening) with a view to improve internal and external labour market policy and personnel planning in ICT.

The Quality Framework was developed by the Dutch government in 2010 based on the EU's e-Skills Programme and the e-CF (Rijksoverheid, 2012). It specifies the required levels of

knowledge and competence for all ICT-related job categories and levels in order to harmonize the descriptions of the ICT career profiles within the Dutch public sector. According to the iStrategy, the Quality Framework was introduced in 2012 for all matching and training operations, and in 2013 a full range of training courses was made available for senior government staff.

The Dutch government and Nederland ICT, a trade association of over 550 ICT companies in the Netherlands totalling 250,000 employees, signed a cooperation agreement in 2012 to optimize the collaboration between the public and the private sector. The agreement highlights the importance of retaining and improving ICT talent in the Netherlands, and both parties agreed to use the Quality Framework for Information Management within the public and private sector.

United Kingdom

The Skills Framework for the Information Age (SFIA) is considered to be the standard ICT competence framework for the industry and government in the United Kingdom. The latter uses the SFIA framework to describe IT roles and their related skills in the Government IT Profession competency and skills framework (UK Civil Service, 2014). This government framework was developed with a view to providing a consistent approach to skills identification, recruitment, performance management and workforce planning across the profession. SFIA is owned and managed by the SFIA Foundation since 2003 (the SFIA Foundation is a consortium formed in July 2003 by the Institution of Engineering and Technology - IET, Institute for the Management of Information Systems - IMIS, e-skills UK, and the British Computer Society - BCS. The itSMF subsequently joined the consortium in 2008). It is worth noting that SFIA was originally developed by the UK government, in collaboration with a group of industry actors (Jeges, 2012), to optimise the allocation of IT resources across multiple departments (NPA, 2005).

France

The French Ministry of Education launched an online portal on the different "jobs of the internet" in 2008 (see section 6. 'Promote career opportunities in ICT and related career paths'). The website has been regularly updated since then and it features over 80 job profiles; each of them outlines the competencies typical for the job. The content of the portal has been developed in partnership with 16 relevant actors from the ICT sector such as professional associations, companies, and training providers (French Government Online, 2014). Among those, we can mention Federation Syntec which represents 910,000 ICT professionals, and CIGREF which brings together 130 large French companies and organisations from all sectors. CIGREF has its own "HR Nomenclature" which provides a description of the roles existing in the Information Systems Departments of large companies. This nomenclature is fully based on the e-CF (Cigref, 2011) and is updated regularly.

Whilst the Portal is not a competence framework per se, it acts as a library of competencies that are organised along three categories (knowledge, know-how-to-do, and know-how-to-be) for each job profile. With this portal, the French Ministry of Education intends to contribute to the formalization of the e-competences that businesses need. Therefore this portal can be considered as a positive example of a policy promoting a better understanding of ICT careers through the prism of e-competences.

Impact

Government policies appear to be focussing initially on the adoption of competence frameworks for ICT professionals in the public sector. This is illustrated by the developments in the Netherlands and in the United Kingdom where both governments have formally adopted well-known competence frameworks for their civil servants.

It can be expected that the uptake of competence frameworks in the public sector will create a virtuous circle, whereby industry will increasingly adopt these frameworks across Europe. The Netherlands appears to be one step ahead of the other countries in this regard as indicated by the adoption of an agreement between the public and the private sector on the use of a common competence framework.

9. Establish multi-stakeholder partnerships benefitting the ICT profession (e-Skills Alliances, apprenticeship programmes)

Multi-Stakeholder Partnerships (MSPs) can be highly effective partnerships for enhancing available resources and achieving results quickly. In recent years, a substantial increase in the number of MSPs focusing on e-skills policies can be observed across the EU. Ideally, MSPs bring together all key stakeholders at the national level within a particular e-skills domain, or focused on a particular e-skills issue, including private-sector partners and government. The principal idea behind MSPs is that industry and the private sector can complement and build upon services traditionally provided by the public sector, particularly in the education and training sector. Given that EU-level and general MSPs focusing on e-skills are covered in detail in previous initiatives (European Commission, 2013h) this section examines specifically those MSPs that stem directly from government policy and that are seen to have particularly benefited the ICT profession in Malta and the United Kingdom. We examine how they fare against the following KPIs:

- *Evidence of MSPs with direct relevance to ICT Professionals.*
- *Evidence of results of initiated MSPs (projects, council established, results of initiatives).*

Malta

In October 2010, the Malta Information Technology Agency (MITA) established the eSkills Alliance Malta. It was founded on the principle that it is vital for Malta to ensure a focused and continued improvement of the ICT competences available in the country. The aim of the Alliance is to support the Maltese government, the private sector and Malta's educational authorities to produce and sustain a productive and competitive workforce (E-skills Malta, 2014).

The Alliance brings together a raft of stakeholders including the Malta Chamber of Commerce, Enterprise and Industry, the Ministry for Education and Employment, educational authorities including the University of Malta, the Malta Employers Association and representatives from the private ICT sector. During the course of the last three years the eSkills Alliance Malta has developed and led a number of initiatives of benefit to the Maltese ICT profession, including creating a Maltese e-Skills competence framework called Standards for ITalent with support from e-Skills UK (Malta Information Technology Agency – MITA, 2014a). The 'Standards for ITalent' competence framework covers 7 ICT-specific

professional competence areas (Sales and Marketing; Business Change; IT Project Management; Architecture, Analysis and Design; Solution Development and Implementation; Information Management and Security; and IT Service Management and Delivery) as well as Transferable Competencies as a non-ICT specific area (Malta Information Technology Agency – MITA, 2014a). Each competence area is further divided into sub-disciplines and competences are described in terms of Knowledge, Understanding and Performance Criteria. The competence framework is further mapped to 12 job descriptions that were developed alongside the framework (Malta Information Technology Agency – MITA, 2014b).

In addition eSkills Alliance Malta has, over the last three years, co-organised business seminars on how to foster e-skills with partners such as the Malta Business Bureau and participated in the organisation of e-Skills Week in Malta. The Alliance is widely seen to have had a very positive impact on the ICT profession in Malta. Following a change in government in 2013 the alliance is currently undergoing a process of re-organisation as a foundation; following this process a new strategic plan for the eSkills Alliance will be developed and will set the Alliance priorities for the years to come.

United Kingdom

In recent years, particularly given the global economic climate, the UK government has increasingly focused on breathing new life into its long-standing apprenticeship culture. This process began in early 2008, when the UK Labour Government published a document called Strategy for the Future of Apprenticeships in England (Department for Children, Schools and Families, 2008). It introduced a new quango (a quasi-autonomous non-governmental organisation to which the government has devolved power) called the National Apprenticeship Service (NAS). This government-led push for more apprenticeships, coupled with increased government funding since 1997 (Apprenticeships UK, 2013a), culminated in the launch of the NAS (Apprenticeships UK, 2013b) in April 2009.

The NAS was created with the intention of generating much needed growth in the number of employers offering apprenticeships across all sectors, including the IT & telecom sector in the UK. There are already signs that the new service has had a positive net impact. According to the NAS there were 279,700 apprenticeship starts in the 2009/10 academic year in England, compared to 239,900 in 2008/09. Meanwhile completion rates are increasing substantially with 171,500 people successfully completing an apprenticeship in 2009/10 compared to 143,400 in 2008/09. Completion rates were 74% in 2009/10, compared to 37% in 2004/05 (Apprenticeships UK, 2013b).

The NAS provides information about apprenticeships across 10 categories of sectors, including within Information and Communication Technology. Available statistics point to an impressive growth in terms of annual ICT apprenticeship starts from the year 2005/06 to the year 2010/11 (Department for Business innovation and skills, 2014). In 2006, 6,500 apprenticeships in ICT were started, growing steadily year on year, reaching 19,500 in 2010/11. However, in 2011/12 there was a slight drop in numbers to 18,500 which continued in 2012/13, with a total of 14,100 begun ICT apprenticeships.

Impact

The two examined multi-stakeholder partnerships, the eSkills Alliance Malta and the National Apprenticeship Service in the UK, are both seen to be successful MSPs. The eSkills Alliance Malta, although currently going through a process of re-structuring, has behind it a string of

highly relevant initiatives and deliverables for the Maltese ICT sector. Meanwhile the NAS in the UK has directly contributed to a strong rise in ICT related apprenticeships in the UK since its launch in 2009.

eSkills Alliance Malta has, in only three years of existence, helped develop a competence framework for ICT professionals in Malta; contributed to the debate around e-skills and necessary actions in the area in Malta; participated in the organisation of e-Skills Week in Malta; along with organsing forums and seminars on the importance of e-skills in Malta with its partners.

Based on available statistics we can observe a positive rise in ICT apprenticeships since the establishment of the NAS in the UK in 2009. Available data shows that there were 239,900 apprenticeships that were begun in 2008/09, compared to 279,700 apprenticeships begun in the 2009/10 academic year in the UK. Furthermore, begun apprenticeships in ICT reached a high of 19,500 in 2010/11. Despite the decrease in recent years (14,100 in 2012/13) the number of started ICT apprenticeships per year in the UK is today much higher than for instance in 2006 when only 6,500 were begun.

10. Match training/educational curricula and labour market demand

The mismatches of ICT skills remain a persistent problem across Europe as indicated by the high number of unfilled vacancies in the ICT sector. Rapid changes in digital technology and in the market mean that the range of skills needed by the sector evolves at a fast pace. As a result, meeting the e-skills requirements of the ICT sector is a complex challenge for policy-makers. Educational and professional training systems are failing to deliver the relevant skill sets required by the ICT sector and ICT-enabled sectors to sustain and secure their growth.

Over the past years, as awareness of skills mismatches has increased; in some Member States new policies have emerged that aim to better match training/educational curricula to labour market demand. These policies focus on providing individuals with a solid set of e-skills that will enable them to adapt to rapidly changing specialist skills demands, and they place partnerships with industry at their core.

This section examines policies in Belgium and Ireland, and assesses them against their KPIs:

- *Number of programmes aimed at matching ICT training/education with labour market demand.*
- *Number of people having gone through such programmes.*

Belgium

Evoliris is a prime example of the efforts made by the Brussels-Capital region to match ICT training with labour market demand. It is the ‘reference centre’ for ICT professionals in the Brussels-Capital Region which coordinates and provides training in the ICT sector (Evoliris, 2014a). It was launched in 2006 as a joint initiative of the Minister of Employment of the Brussels-Capital Region, Benoit Cerexhe, and the economic and social partners in order to tackle labour market shortages and the lack of qualified ICT professionals in the region (Evoliris, 2014b). The importance of reference centres, such as Evoliris, and the training opportunities they provide were restated in the policy statement of the government of the Brussels-Capital Region for 2012-2013

Established as a non-profit organisation, Evoliris aims to coordinate and provide ICT training by bringing together the relevant actors from the job market and the education sector. It also monitors developments in the ICT sector and assesses their impact on available training offerings to ensure adjustments are made so that training modules match labour market demand. In addition, Evoliris analyses the profile of unemployed people in the ICT sector to identify their needs against labour market demands.

The centre provides different types of ICT training for jobseekers, workers, and students. In 2013, Evoliris provided ICT training directly to 752 individuals (549 unemployed people, 203 workers) totalling approximately 20,000 hours of training. These figures have increased compared to 2012, during which 524 individuals undertook ICT training at Evoliris, giving a total of 13,000 hours.

Evoliris also makes its infrastructure available to other training providers. In 2012, its partners provided ICT training to 1,084 individuals (580 unemployed people, 183 workers, 320 students). Its partners include CEFORA, an organisation that represents 55,000 companies in Belgium, and the Microsoft Innovation Centre, a private-public partnership between the Brussels-Capital Region and Microsoft to support the development of the IT sector in the region (Le Parlement Bruxellois, 2012).

Ireland

The establishment of a new high-level ICT Foresight Group is one of the measures included in the Irish ICT Action Plan to better align higher education programmes to changing labour market needs. This group will advise on ICT programme development and it will include representatives from industry and from higher education institutions. The Irish ICT Action Plan was developed in conjunction with industry, to increase the domestic supply of ICT graduates in Ireland (Department of Education and Skills, 2012).

The ICT Skills Programme is another measure of the Irish ICT Action Plan. It is an intensive programme of study and work experience designed and delivered in partnership with industry. It targets jobseekers that already hold a bachelor degree or equivalent qualification and wish to acquire a bachelor degree in ICT programming skills. The ICT Skills Programme provides an opportunity for graduates from other disciplines to develop expert-level ICT skills, gain work experience in industry, and potentially benefit from the increasing demand for qualified IT practitioners. The 2013 Irish Action Plan for Jobs includes a series of measures to support the expansion of the ICT Skills Programme and in particular its links with industry (Department of Jobs, Enterprise and Innovation, 2013).

In 2012, over 700 places were provided across 17 new graduate skills conversion programmes (Department of Education and skills, 2012b). Each programme provides for a work placement of 3 to 6 months with an industry partner. A second phase of programmes was rolled-out in 2013 with 760 places available on 15 individual programmes in public and private higher education providers. The programme is fully funded by the Irish Department of Education and Skills and is therefore free of charge to participants.

Impact

The initiatives in Belgium and in Ireland have been successful, judging by the hundreds of individuals that have participated in the Belgian and Irish programmes. Such a high level of participation is an indicator that the two initiatives have proved to be an adequate response to

labour market needs. The Belgian initiative focuses more on matching the training of unemployed people and workers, whilst the Irish programme is specifically targeted at graduates. In 2013, Evoliris provided ICT training directly to 752 individuals (549 unemployed people, 203 workers) totalling approximately 20,000 hours of training. These figures have increased compared to 2012, during which 524 individuals undertook ICT training at Evoliris, giving a total of 13,000 hours. However in both Belgium and Ireland the involvement of industry representatives appears to have played a key role in securing their success and their ability to tackle ICT skills mismatches.

11. Encourage up-skilling and re-skilling of experienced ICT professionals

The demand for skilled workers in the EU is increasing. This is partly due to the fact that some professionals are being marginalized because of lack of skills. This development is linked in some instances to offshoring, automation and the pace of technological change. The demographic situation is also changing, health systems are improving, and workers stay active longer than before; in addition the number of young professionals entering the work market is decreasing. It is in this context that some countries in Europe have realized that there is a need to up-skill and re-skill their experienced ICT professionals to reduce the outflow of these from the sector. These efforts are aimed at retaining them in the sector and further specializing them. Measures like this will contribute to reducing the EU's skills gap, but also to the development of the ICT sector. This section examines government-initiated policies in the Netherlands and Germany and assesses them against their KPIs:

- *Number of up-skill/re-skill programmes/initiatives.*
- *Number of up-skilled/re-skilled ICT professionals having gone through programmes.*

The Netherlands

One of the main objectives of The Technology Pact 2020 in the Netherlands is to retain technology workers in the ICT sector, and find alternative jobs for those workers with technology backgrounds that have been marginalised or are at risk of being marginalised. The Technology Pact uses the scope defined in the Science and Technology Master Plan ('Masterplan Bèta en Technologie') (Topsectoren, 2014). It refers to technology in a broad sense and defines technologists as follows: "technologists have the technical expertise to build devices, maintain installations, run systems, develop and implement new technologies, find out new scientific knowledge, combine interdisciplinary forms of sciences, transform knowledge and technology to apply it to innovations". The Technology Pact considers ICT professionals as falling within the definition of technologists.

The Technology Pact 2020 has begun to deliver measures to re-skill technology workers and up-skill young and unemployed technology workers. In 2013, industry partners from the technology sector signed an agreement, whereby they established sector plans for the second half of 2013 with the aim of:

- Reducing the outflow of young workers and recently unemployed by providing them with opportunities as qualified technicians through training and by upgrading their skills.
- Providing the same target groups with coaching from more experienced workers.

The Technology Pact 2020 has also established another national measure to boost training and re-skilling schemes for redundant technology workers aimed at finding them alternative jobs

and providing them with professional mobility. The objective of these measures is to enrol 15,000 technology workers per year (Scribd, 2014). The first sectoral plan was initially set to be submitted between the 1st of October and 31st of December 2013. The second sectoral plan is planned to be submitted between 1st of April and 31st of May, 2014 (Agentscap SZW, 2014). According to one of the partners (Platform Beta Techniek, 2014) of the Technology Pact the first sector plan has been submitted and is currently being evaluated for implementation. The first sector plan will focus on the construction and infrastructure sectors. The plan aims to retain skilled workers and increasing the influx of new workers. Teachers involved in the programme must be skilled workers of more than 55 years. They have to transfer their knowledge to students who follow the training.

At the time of writing, it is impossible to estimate how many ICT professionals will be included in the up-skill and re-skill training programme in total, as this data is not available.

Germany

In Germany, between 1999 and 2009, the proportion of 50+ year old workers increased from 12.5% to 18.5 %, while the proportion of younger workers dropped from 55.9% to 41.8 % (Bundesministerium fur Bildung und Forschung, 2010). For this reason, a joint initiative, "IT 50 Plus", was set-up between the German Federal State, the trade union IG Metal and BITKOM, the German association of ICT employers. The initiative was established in 2008 and it remained active until 2011.

The aim of the initiative was to up-skill ICT workers above the age of 50 to improve their employability, facilitate their reintegration into the workforce after periods of unemployment and to further develop the so called Advanced IT Training System (AITTS) (Kibnet, 2014) to facilitate access for unemployed professionals to training and certification (50 Plus, 2012). This initiative was one of the measures falling under the pillar of continuing education and training in Germany's digital strategy, Digital Germany 2015 (Federal Ministry of Economics and Technology, 2010).

According to BITKOM representatives the initiative was not as successful as intended and ended up as a means to encourage companies to provide training to unemployed IT professionals over the age of 50. Only a small number of companies implemented the programme and provided in-house training to unemployed ICT professionals (IT 50 Plus, 2012). Additional initiatives implemented as part of the IT 50 plus initiative were branded FUTEX. FUTEX aimed to demonstrate that skilled ICT professionals could combine work and learning to achieve specialist ICT certifications (Futex, 2014a). As part of FUTEX 52 ICT professionals job seekers were involved in two programme pilots in 2010 and 2011. The pilots aimed to train the participating ICT professionals to achieve certifications in: software development, IT testing and IT project coordination (ISO 17024 certification). 49 out of the 52 IT professionals were able to obtain these specialist ICT certifications (Futex, 2014b).

Impact

It is important to note that the two examined policies are at different levels of maturity and have different objectives. In the Netherlands, the Technology Pact 2020 aims to up-skill experienced professionals and young workers to retain the former and avoid the outflow of the latter from the labour market. Further, it aims to re-skill redundant workers in order to provide them with additional labour market mobility. As the Technology 2020 sector plans

are still in a phase of discussion it is very difficult at the time of writing to gauge the impact this policy initiative will have in terms of up-skilling and re-skilling of ICT professionals.

Meanwhile, in Germany, the objectives of IT 50 Plus were seen as being innovative at the time the initiative was established. The aim was to up-skill ICT professionals over the age of 50 to increase their employability and facilitate their reintegration into the workforce after periods of unemployment. In parallel, sub-programmes were rolled-out, in particular FUTEX, aimed at demonstrating that skilled IT personnel could combine work and learning to achieve ICT specialist certifications. Despite ambitious objectives the initiative ended up focusing on encouraging companies to undertake training for unemployed IT professionals with a low number of IT professionals benefitting from the initiative.

Given that there is limited data available regarding both initiatives, and bearing in mind that the available data points to a limited impact to date, the initiatives cannot be seen as having provided a significant benefit to the ICT profession in the respective countries. Nevertheless, both policies are examples of how Member States are trying to reduce the EU's skills gap through measures focusing on up-skilling and re-skilling ICT professionals.

12. Match jobs and ICT professional competences for worker and workplace mobility

In Europe, the mismatch between the demand and supply of ICT jobs remains a problem. While many ICT positions remain vacant, employers are finding it difficult to fill them, as they cannot match their needs to the appropriate ICT professional competences. Recent initiatives have been developed in different countries to raise awareness about ICT professional competences and to support the implementation of ICT professional competence frameworks as a means to match jobs and ICT professional competences.

This section examines policies in Italy, Belgium, the Netherlands as well as in the case of a cooperative effort between the Belgium region of Wallonia and the French region of Nord-Pas-de Calais, and assesses them against their KPIs

- *Number of evidence of jobs/competence matching programmes/initiatives*
- *Number of people having gone through these programmes/initiatives*

Italy

In Italy, the national association of ICT companies Assintel (Assintel, 2013) and the Syndicate Networkers (UILTuCS) (Uiltucs, 2014) have created an online portal called JobICT. The portal provides a platform to match supply and demand of ICT professionals. The portal aims to promote the use of the e-CF (European e-Competence Framework) among jobseekers. The portal encourages jobseekers to express their competences using the e-CF Framework. The aim is that jobseekers can improve and accurately express their ICT profile through the use of the e-CF Framework. Meanwhile, companies will be able to use the e-CF framework as a reference point to seek out specific ICT profiles (Job ICT, 2014) among jobseekers. Given that the initiative has just been started, the website being launched in February 2014, there is at the time of writing no data to quantify the impact or success of the initiative. According to Assintel there are currently no specific targets or performance indicators set against which the website will be measured. This situation might change in the future. The website will in 2014 be promoted through a Facebook advertising campaign funded by the partners, as well as

presented at ICT conferences and forums across Italy, starting with ICT Days (ICT Days, 2014) in April 2014.

Belgium

In Belgium, Evoliris, is an initiative by the Brussels-Capital Region that started in 2006 (Evoliris, 2014b). Evoliris is a centre for ICT professionals in the Brussels-Capital Region. The centre coordinates and provides ICT professional training. The centre analyses the profiles of the people registered through the centre in order to adapt their ICT training offerings (Evoliris, 2014c). Although the centre does not have specific activities or initiatives to directly match ICT professional competences with jobs, it aims to ensure that the jobseekers have the competences needed to match market needs. In 2010, 218 jobseekers underwent training at the centre, 43 of them secured a job following the training and 35 found a job after 6 months (Evoliris, 2011). In 2011, the employment rate of people who have trained at the centre has further improved. Out of 191 jobseekers that undertook training, 77 found a job immediately following the training and another 59 found a job within 6 months of the training (Evoliris, 2012). In 2012, 182 jobseekers that undertook training were contacted by potential employers and at least 55 had found a job by March 2013 (Evoliris, 2012).

Belgian-French cooperation

Belgium and France established in 2010 a partnership between Technofuturic (Techno Futur, 2014), a regional initiative in Wallonia in Belgium and Le Pôle Régional Numérique (PRN) (Pole Regionale Numerique, 2014), an initiative from the region Nord-Pas-de Calais in France. The partnership aims to identify the essential ICT skills needed in companies in the ICT sector (Metiers du Web, 2010). The cooperation is part of the programme INTERREG IV France - Wallonia – Flanders, a border cooperation programme which aims to strengthen economic and social exchanges (INTERREG IV France, Wallonie, Vlaanderen, 2014). The ICT related partnership seeks to identify and match the ICT skills needed for the development of the ICT industry in the cross border region and to anticipate trends in the regional labour market with regard to required skills and training needs. The partnership also aims to advise and support training and education institutions about how to adapt the courses and training they offer to match market needs. It also aims to support and guide youngsters and jobseekers in the ICT sector by raising awareness about the need for ICT competences (Metiers du Web, 2010). According to Technofuturic, the project has to date been quite successful. The project initially aimed to organise 40 training sessions and 1 online informational platform. To date 52 training sessions have successfully been organised along with a total of 3 online platforms. A further 38 seminars have been successfully organised in cooperation with industry, with a total of 843 companies being directly involved in the project. Finally, a total of 1,236 ICT professionals have been directly involved in the project. The project is now coming to a close; however, its success has led to a discussion at a regional level about creating an "internet academy" offering vocational training courses to future ICT professionals.

The Netherlands

In the Netherlands, ICT professional competences are promoted through the implementation of the e-CF with the overall aim of improving and facilitating mobility for ICT professionals (Digivaardig and Digiveilig, 2014). The e-CF working group is the platform in charge of promoting the uptake and adoption of the e-CF in the Netherlands. In the Digivaardig & Digiveilig annual plan for 2013, the adoption of the e-CF in the Netherlands was considered key to improving matching between supply and demand of ICT professionals (Digitally

Skilled & Digitally Safe, 2012). An important agreement on the e-CF was signed in November 2013 through which 21 Dutch organisations agreed to use the e-CF for recruitment and selection purposes for ICT professionals as a means to reduce the gap in supply and demand of ICT professionals. The president of Digivaardig & Digiveilig stated, in November 2013, that an increasing number of Dutch companies will adopt the e-CF as a reference tool in the future and that by 2017 the supply and demand gap in the Netherlands will have been reduced by 6,800 ICT professionals (European e-competence Framework (2014b).

Impact

The four examined policies all focus on matching jobs to ICT professional competences; however they do so from different perspectives. While the policies in Italy and the Netherlands focus on the use of the e-CF as a point of reference for companies and jobseekers, the initiatives in Belgium and in the Belgian-French cooperation between the French region Nord-Pas-de Calais and Wallonia in Belgium focus primarily on mapping and identifying labour market needs, in terms of ICT competences, in order to adapt ICT training offerings and support existing initiatives in this domain.

The bourgeoning status of the JobICT.it portal makes it difficult to draw any definite conclusions about its benefit at the time of writing. However, it is important to stress that it is the first online ICT job matching platform, based on the e-CF, of its kind in Italy. If the portal is well funded and maintained, in addition to becoming popular, it could very well act as a template for similar job matching websites across Europe.

In Belgium, Evoliris, focuses on the Brussels Capital region and aims to ensure that jobseekers have the ICT competences needed to match market needs by providing tailored ICT training. Although not all jobseekers that undertook Evoliris training could secure employment afterwards, we can observe an increase in jobseekers securing employment following the training in 2010 and 2011. We also see that in 2011 more than 70% of jobseeker that followed the training found a job immediately following the training or within 6 months of completing the training.

The Belgian-French cooperative project has to date been very successful based on the assigned KPIs and has led to a regional debate among the project partners focused on establishing a new ICT training body. In terms of deliverables we can see that the project has directly involved over 1,200 ICT professionals and a total of 843 companies, along with a raft of dissemination initiatives such as online portals and seminars.

In the Netherlands, the initiative is strongly supported by the government. The e-CF working group is raising awareness among ICT professionals about the use of the e-CF. We can see that the initiative is boosting the use of the e-CF for recruitment and selection of new ICT professionals by companies. This is a particularly good example of matching jobs to ICT competences and a step in the right direction in terms of reducing the supply and demand gap of ICT professionals at national level.

Results: practitioner perspectives

As previously outlined, as part of the analysis a survey was conducted with experts drawn from the pan-European CEPIS network. The survey was run in order to capture the views and opinions of ICT practitioners from across Europe with an expert understanding of the EU policy landscape. Additionally, the survey was designed to add value to, and further validate, the quantitative analysis of key e-skills policies in Europe.

As explained in the methodology section, the experts were asked two questions regarding the identified 12 key e-skills policies (see below). The experts represent 23 EU Member States as well as a select number of non-EU Member States with strong ties to the EU ICT labour market (Bosnia-Herzegovina, Iceland, Montenegro, Norway, Serbia, Switzerland and Turkey).

Throughout the course of the survey, several experts expressed positive feedback regarding the survey itself, and importantly on the opportunity to express their views on the impact and benefit of e-skills policies affecting the European professionals in the ICT labour market. In this section, an overview of the main results from the survey is presented, including tentative key findings.

Overview of responses to Question 1

1. *Looking back over the past five years, to what extent do you believe the following e-Skills policies have benefited European Professionals in the ICT labour market, including new graduates?*

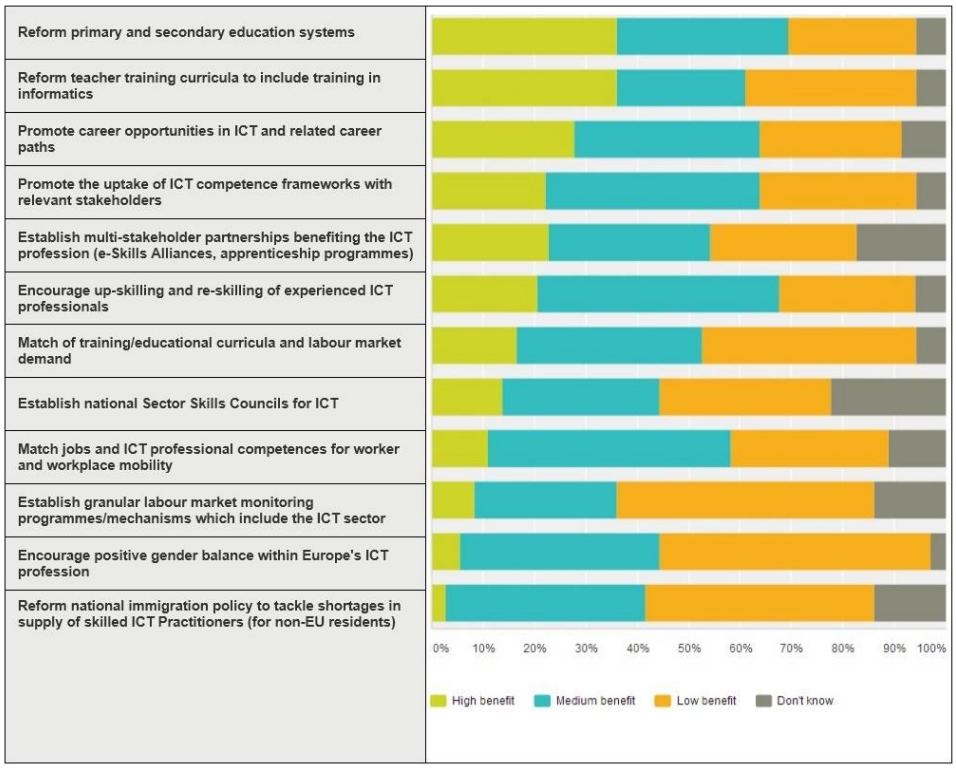


Figure 82: Benefits of e-skills policies to the labour market over the past 5 years.

Overview of responses to Question 2

1. *Looking ahead to the next ten years, to what extent do you believe the following e-Skills policies will benefit European Professionals in the ICT labour market, including new graduates?*

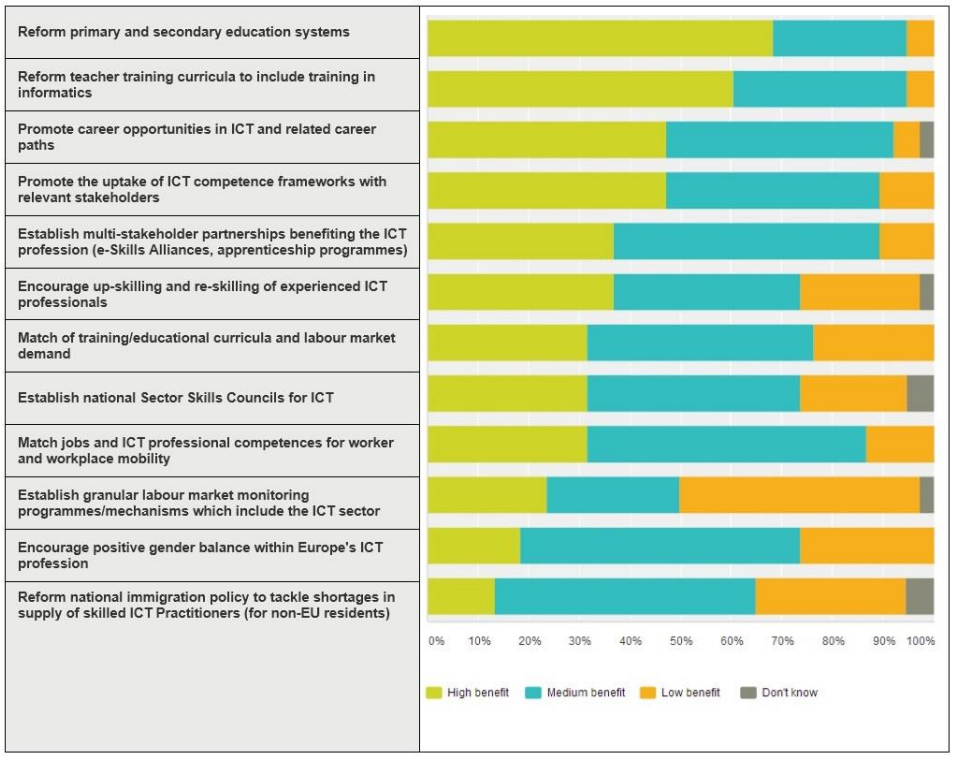


Figure 83: Benefits of e-skills policies to the labour market over the next 10 years.

Reform primary and secondary education systems to include informatics as a core competence

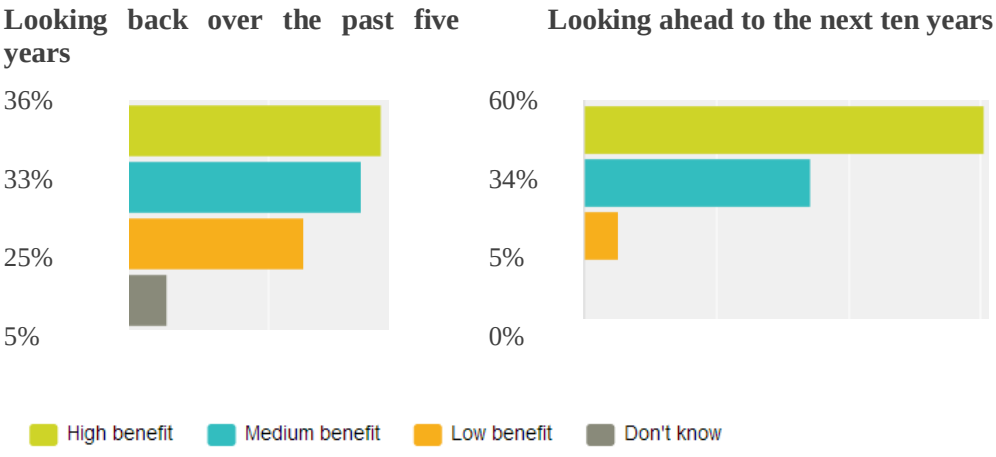


Figure 84: Reform primary and secondary education systems to include informatics as a core competence

Key findings: Close to 70% of experts believe that reforming primary and secondary educational systems to include informatics as a core competence has represented a high or

medium benefit for the European ICT profession in the last five years. Meanwhile, close to 95% believe it will represent a high or medium benefit to the profession in the next ten years. Education is therefore the single most important factor that experts believe will have a positive impact on the ICT profession over the course of the next decade.

Reform teacher training curricula to include training in informatics

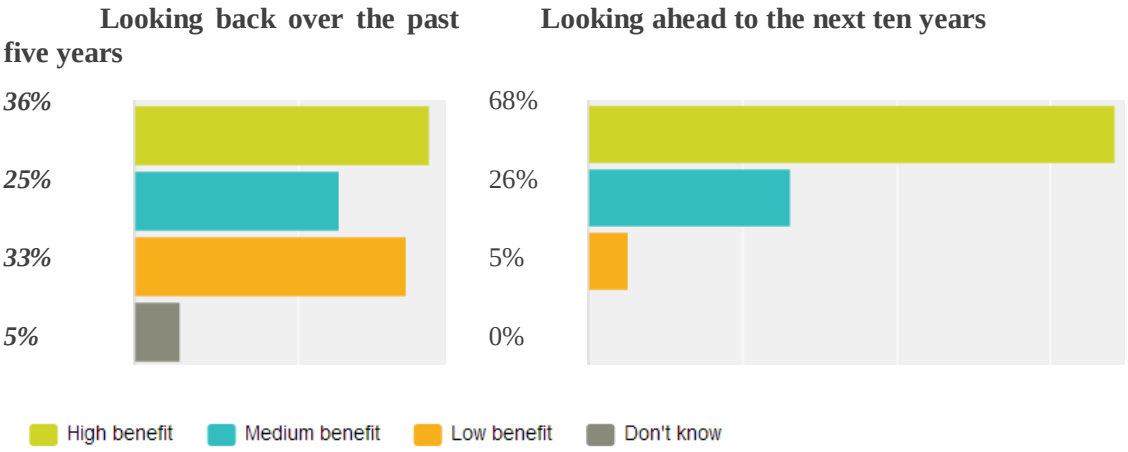


Figure 85: Reform teacher training curricula to include training in informatics

Key findings: Opinions of teacher training reform are mixed. Just over 33% of experts believe that reform of teacher training curricula has been of low benefit to the profession in the last five years, while just over 36% state it has been of high benefit. Meanwhile 25% say it has been of medium benefit in the last five years. However, looking ahead to the next ten years, close to 95% say it will represent a high (68%) or medium (26%) benefit. As with reforming primary and secondary educational systems, this indicates a clear belief that this is one of the most effective measures to benefit ICT professionals.

Encourage positive gender balance within Europe's ICT profession

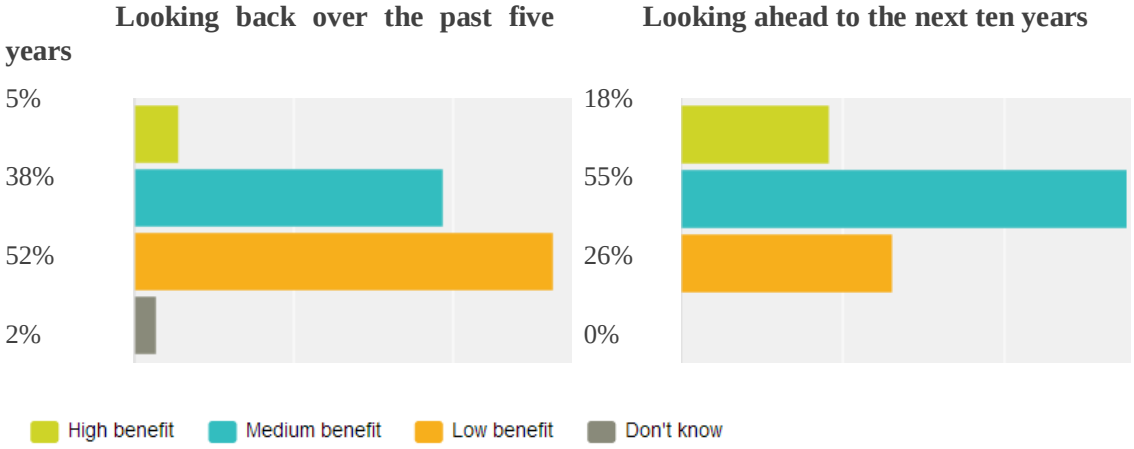


Figure 86: Encourage positive gender balance within Europe's ICT profession

Key findings: Over half of the experts believe that encouraging a positive gender balance within Europe's ICT profession represented a low benefit in the last five years; with only 5% stating it has highly benefited European professionals. Looking ahead, 18% state it will highly benefit the profession, while more than half of the experts (55%) say it will represent a medium benefit. It is encouraging to see that the future outlook is believed to be slightly more

positive as increasing the number of women entering Europe's ICT sector could go a long way towards plugging Europe's skills gap.

Promote the uptake of ICT competence frameworks with relevant stakeholders

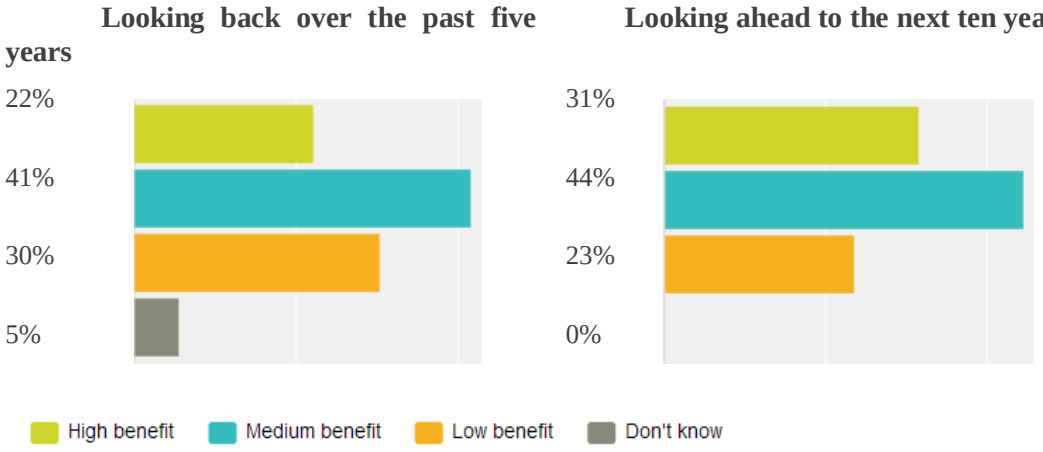


Figure 87: Promote the uptake of ICT competence frameworks with relevant stakeholders

Key findings: Just over one fifth (22%) of the experts indicated that promoting the uptake of ICT competence frameworks has highly benefited European ICT professionals, with 41% stating a medium benefit, and 30% indicating a low benefit in the last five years. Experts indicate a similar picture in the next decade with 31% stating it will highly benefit professionals, 44% indicating it will be of medium benefit, and almost a quarter (23%) stating it will be of low benefit. The similarity of responses, looking back five years and looking ahead ten years, possibly indicates that ICT competence frameworks are still not ubiquitous nor fully understood and valued - a situation which is likely to change in the coming years.

Establish multi-stakeholder partnerships benefitting the ICT profession (e-Skills Alliances, apprenticeship programmes)

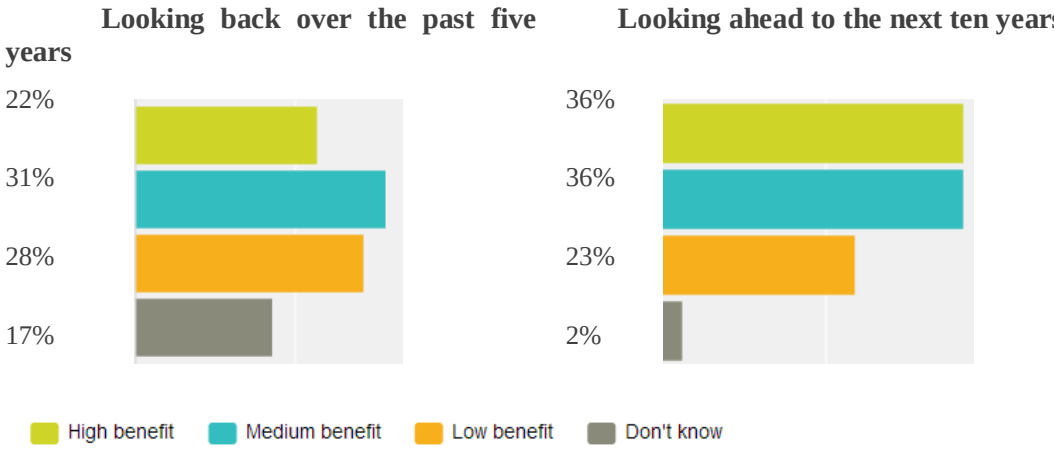


Figure 88: Establish multi-stakeholder partnerships benefitting the ICT profession

Key findings: Over half (53%) of experts believe that the establishment of multi-stakeholder partnerships (MSPs) has been of high (22%) or medium (31%) benefit to professionals in the last 5 years. It is worth noting that almost one third (28%) of experts indicated they believed establishing MSPs had been of low benefit to professionals in the last five years. Looking ahead, 72% of experts stated that the establishment of MSPs will be of high (36%) or medium

(36%) benefit. Meanwhile, close to one quarter (23%) of experts indicated they believe it will be of low benefit in the next ten years. The varied opinions voiced on the value of establishing MSPs benefiting the ICT profession might point to the various levels of maturity and success of MSPs within different Member States.

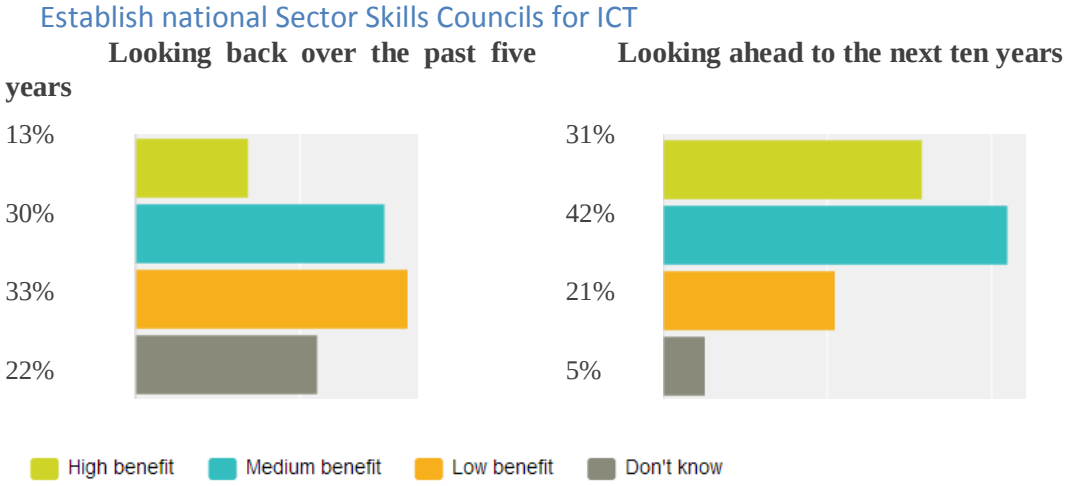


Figure 89: Establish national sector skills councils for ICT

Key findings: 13% of respondents believe that establishing national Sector Skills Councils for ICT has been of high benefit to professionals in the last five years. Almost one third (30%) believe it has been of medium benefit, while just over half (55%) of respondents state it has been of low benefit or they have indicated they don't know how beneficial it has been. Over 73% of experts believe that in the coming decade the establishment of national Sector Skills Councils for ICT will be of high (31%) or medium (42%) benefit to professionals. Only about one quarter (26%) of experts believe that Sector Skills Councils will be of low (21%) benefit or they do not know how beneficial they will be (5%). The increased belief in the value of Sector Skills Council in the next ten years might point to the recent successes of established Councils, in particular e-Skills UK, and to the fact that Councils are still in the early stages, if at all, of being established in a number of Member States.

Reform national Immigration policy to tackle shortages in supply of skilled ICT Practitioners (for non-EU residents)

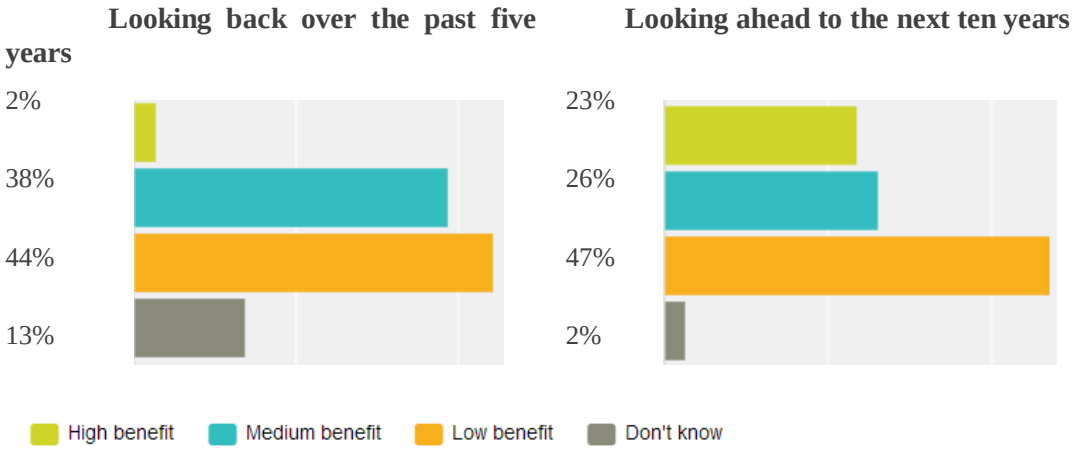


Figure 90: Reform national immigration policy to tackle shortages in supply of skilled ICT practitioners

Key findings: Nearly half (44%) of experts believe that reforming national immigration policies to tackle shortages in supply of skilled ICT practitioners represented a low benefit for European professionals in the last five years. 38% state they believe it has been of medium benefit to the profession and less than one fifth (13%) state they do not know how beneficial it has been. Looking ahead to the next ten years, over one fifth (23%) of experts believe immigration reform will prove highly beneficial for professionals, one quarter (26%) believe it will be of medium benefit. Close to half (47%) believe it will be of low benefit to the profession in the future. The fact that over one fifth of experts believe immigration reform will be of high benefit in the future, as opposed to in the last five years, could indicate the beginning of a shift in opinion towards "importing" skilled ICT professionals from outside the EU to help solve Europe's skills gap.

Match jobs and ICT professional competences for worker and workplace mobility

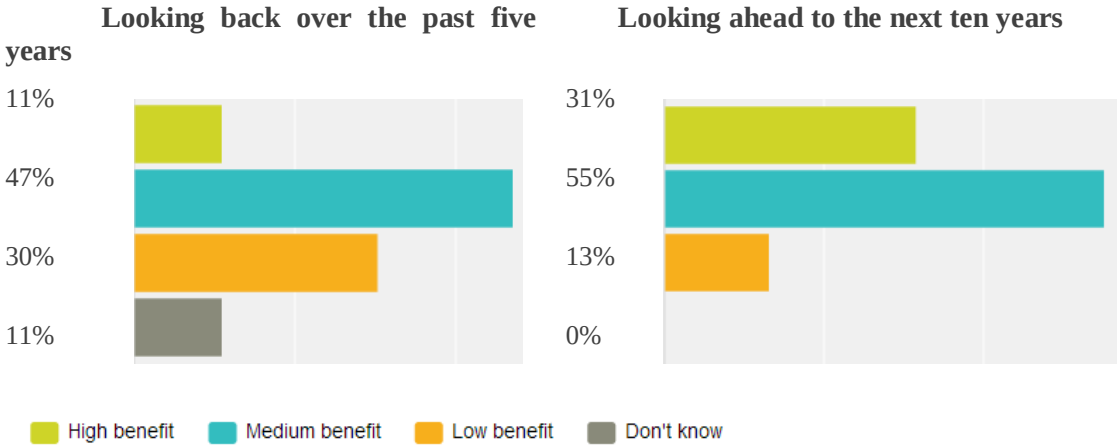


Figure 91: Match jobs and ICT professional competences for worker and workplace mobility

Key findings: Nearly two thirds (58%) believe the matching of jobs and ICT professional competences has been of high (11%) or medium (47%) benefit in the last five years.

Meanwhile, almost one third (30%) of experts indicate they think it has been of low benefit. When looking to the future, experts paint a more positive picture with over 86% saying it will be of high (31%) or medium (55%) benefit, with only 13% indicating it will be of low benefit. These results might indicate that experts believe that matching of jobs and competences will be increasingly important in the future, perhaps also more prevalent in line with an increasing number of competence frameworks being adopted in Europe.

Promote career opportunities in ICT and related career paths

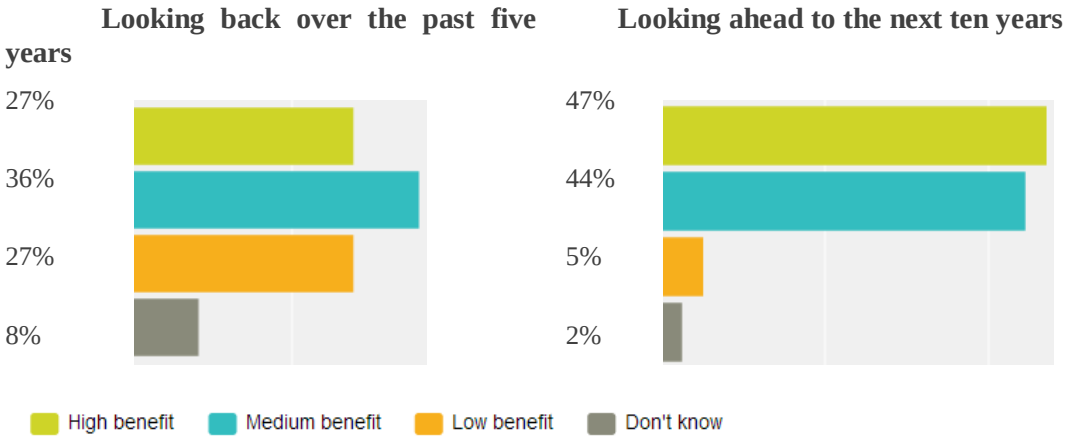


Figure 92: Promote career opportunities in ICT and related career paths

Key findings: Almost two thirds (63%) of respondents indicated they believe the promotion of career opportunities in ICT has been of high (27%) or medium (36%) benefit in the last five years, while nearly a third (27%) of respondents state is has been of low benefit. In the next ten years over 90% of experts believe that the promotion of ICT careers will be of high (47%) or medium (44%) benefit to European ICT professionals. Only 5% believe it will be of low benefit. These results may suggest that ICT experts believe that policies of this type will be a key lever in terms of helping to plug the European skills gap in the years to come.

Match training/educational curricula and labour market demand

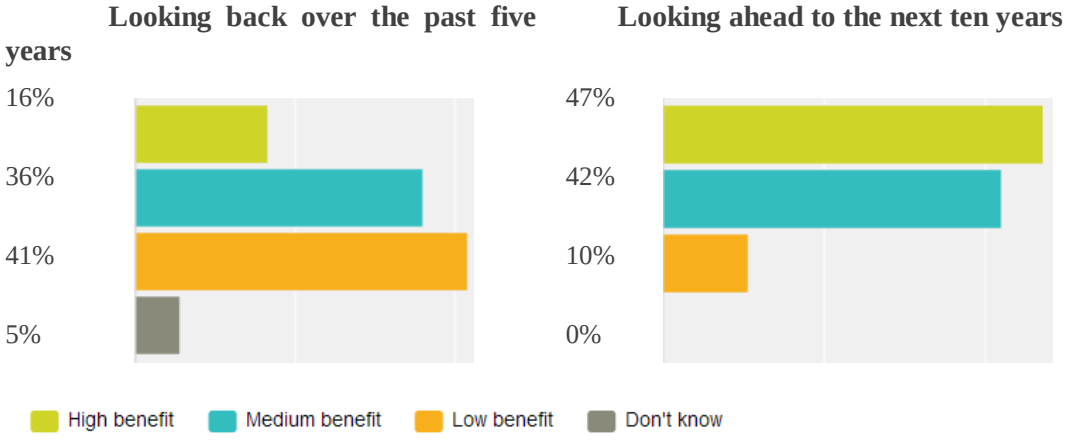


Figure 93: Match training/ educational curricula and labour market demand

Key findings: Looking back at the last five years, over two fifths (41%) of experts believe the matching of training/educational curricula against labour market demands has represented a low benefit. Only 16% of experts state they believe this matching has been of high benefit. A large majority (89%) of the consulted experts believe that in the next ten years this kind of

policy will be of high (47%) or medium (42%) benefit to the profession, while only 10% believe it will be of low benefit. These results may indicate a notion that matching of training/educational curricula and labour market demand is a bourgeoning issue that will positively escalate in the coming years.

Encourage up-skilling and re-skilling of experienced ICT professionals

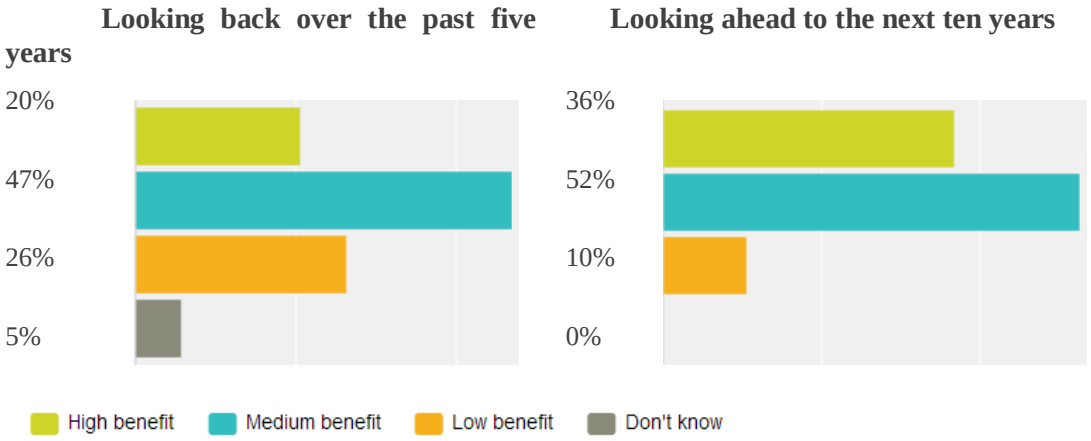


Figure 94: Encourage up-skilling and re-skilling of experienced ICT professionals

Key findings: One fifth (20%) of experts believe the encouragement of up- and re-skilling of experienced ICT professionals is of high benefit to ICT professionals, with just less than half (47%) stating it is of medium benefit, and less than one third (26%) saying it is of low benefit. Looking to the next decade the number of experts who stated this policy to be of high benefit nearly doubled to close to 40% (36%), while the experts indicating it to be of medium benefit increased slightly to just over half (52%). These results could indicate that the ICT workforce in Europe is ageing; hence there will be an increasing need for up- and re-skilling of experienced professionals.

Establish granular labour market monitoring programmes/mechanisms which include the ICT sector

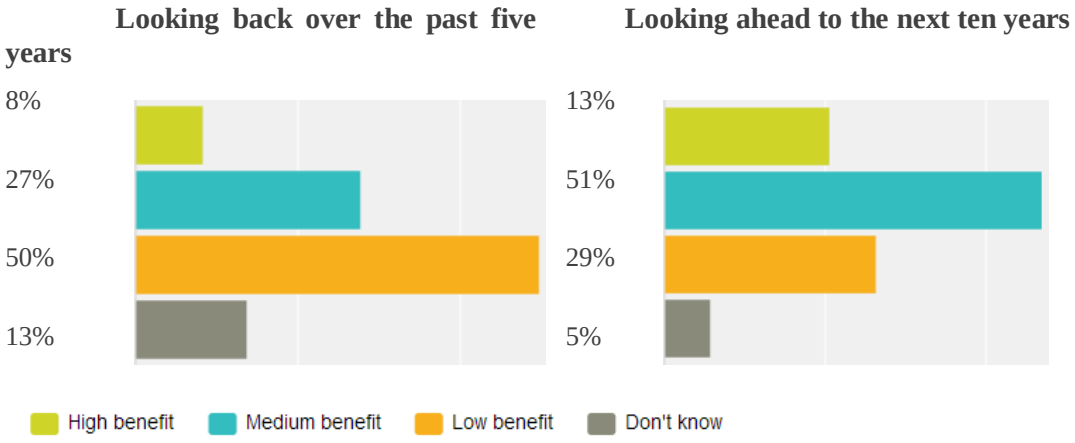


Figure 95: Establish granular labour market monitoring programmes which include the ICT sector

Key findings: Just over 8% indicated they believed establishing market monitoring programmes/mechanisms to be of high value to professionals in the last five years. Half (50%) of the experts stated they believe it to be of low benefit and almost one third of experts

(27%) believe it to be of medium benefit. Looking forward, the number of experts who stated this policy to be of high benefit nearly doubled to just over 13%, while almost one third (29%) now believe it to be of low benefit. Over half (51%) of the experts think monitoring mechanisms will be of medium benefit in the future. These results could indicate that although this policy is seen as being of importance in the future, it might be perceived as more beneficial to policymakers rather than professionals themselves.

Conclusions and recommendations

The lack of available data has been a challenge throughout this assessment. It is no surprise that national policies steer clear of including concrete success metrics for political reasons; however this also means that measuring the success of any policy is subjective even within its national context. The lack of quantitative data, while expected, is nonetheless an important barrier to effectively evaluating policies within and across countries. It renders the comparison of the impact of similar policies from across different Member States onerous and fraught with inconsistencies.

Recommendations

- **Not enough countries have policies that focus on ICT professionals**. Although it is increasingly recognised that the gaps in the supply and demand of ICT professionals in Europe will continue to impact the performance of the sector, there are not enough countries that have translated this into national policy as a priority. E-inclusion as a policy is relatively prevalent, however a clear message needs to be delivered, that ICT professionals, and the development of the ICT profession should become a complementary policy priority. This is not a zero- sum game and the inclusion of professionals and the development of the profession as policy focus should not be to the detriment of user level skills and ICT addressing societal challenges.
- **Policy metrics are needed**. European countries, by and large, do a poor job in the domain of measuring the impact of polices in an objective manner. The establishment of key success factors as part of the policy or policy implementation and monitoring process is something that would facilitate better understanding of the impact of policies on their target audience and would enable member states to learn from each other.
- **Governments need to have monitoring systems in place**, based on concrete, granular data, to enable more agile reactions to skills gaps and shortages in the ICT sector. Greater granularity of data gathered would provide a basis for more accurate workforce planning and more targeted policy making to facilitate the above-mentioned agility, both now and in the future. Consistency in the types of data gathered between Member States would facilitate information sharing (and gathering) on a European level. Meanwhile more granular data should increasingly be accompanied by foresight studies and analyses rather than simply focusing on the analysis of past data.

In terms of the individual policies, the data points to:

- **Education reform to include ICT is considered to be the single most important factor that will benefit the profession**. Primary and secondary education reform needs to focus more on providing pupils with access to the foundations of computing and computer science if Europe is to increase its output of ICT graduates and over time professionals. It is important that the increased focus on professional level skills

does not take away from digital competence and user level skills however, as this is likely to prove short sighted for general employment. Current reforms and the extent to which these focus on computing and computer science differs widely from country to country, with a number of countries concentrating their efforts on teaching skills related to the basic use of ICT. We also see that secondary level education reform is more common than primary level, although studies increasingly point to career preferences being made at younger ages. The introduction of standalone subjects such as computational thinking and computing, as observed in 26% of Danish high schools, can be expected to lead to a new generation of European pupils more inclined, and better equipped, to pursue higher education and careers in ICT. While skilling students for jobs of the future is a particularly challenging issue when it comes to ICT, the focus on computer science, computational thinking, and the foundations of computing is generally believed to provide a solid basis upon which to further develop skills. Our survey results show the impact of education reform on current professionals already in the labour market may be low; however the anticipated benefit to the profession as a whole in the future is high. In fact education is a top concern of experts and the policy area that is believed to be key for the next decade.

- **Teacher training curricula need to focus increasingly on informatics,** including the way it is taught and how to use it in the classroom as a mandatory component. Primary level should increasingly be targeted for integration of ICT and informatics skills. As it can be observed with the reforms of primary and secondary curricula, Member States take different approaches to teacher training. This is most likely due to the reforms being formulated against national, as well as local needs. Furthermore differences in maturity between Member States' educational systems, and teacher training curricula, means policy initiatives in this area are likely to remain tailored to local conditions. Exchange of best practice across Europe is vital to allow less mature Member States to capitalise on the learnings of forerunners in teacher training, as echoed by consulted experts who believe reforming teacher training curricula will in the future be one of the most effective measures to benefit ICT professionals.
- **Digital strategies should include a gender dimension**. Additional long-term actions are needed to improve the gender balance in the ICT sector across the EU. The current gender gap in Europe is worrying with women making up less than 30% of the workforce. While some Member States are clearly taking the issue very seriously, it is a predicament which demands commitment to long-term policy action at a number of levels across society (education, business, academia, etc.). Forerunners in Europe are implementing digital strategies which include a gender dimension, some going as far as developing stand-alone strategies for a more gender balanced information society. Data indicates that encouraging a more positive gender balance within Europe's ICT profession has to date had limited impact, however it is noted that the impact is likely to clear over longer periods of time. It is positive to see that looking to the next decade experts believe this area to have a slightly more beneficial impact in Europe. It is also worth noting that the prevalence of men in the profession is mirrored in the national experts that responded. Had there been a 50/50 division of male and female expert views, one could imagine that the expectation for future gender balance might be more optimistic.
- **Every Member State should create an e-Skills Sector Council**. Establishing Sector Skills Councils (SSCs) for ICT should be encouraged across Europe. Dedicated, well-funded SSCs for the ICT sector that enjoy broad national support and work well with the body that represents ICT professionals, can in a Member States context bring with it tremendous benefits for the ICT sector in that particular country. As can be observed

in the UK, e-skills UK being representative of the most advanced SSC in the EU, a national SSC can act as a central hub for the ICT sector and coordinate national efforts to deal with pertinent national issues that the ICT sector is facing. Furthermore, SSCs once established, are well-placed to initiate actions across a number of policy areas relevant to the ICT sector including the promotion of ICT studies, conducting research, and working towards the reduction of the gender gap at national level. Consulted experts have expressed an increased belief in the value of SSCs in the next ten years.

- **Immigration policy reform is not currently being used to its full potential** to tackle shortages in the supply of skilled ICT practitioners and evidence is scare of its success for ICT roles specifically. A small number of EU Member States have enacted immigration policy reform to tackle shortages of skilled professionals across the board, including ICT professionals. In the particular case of Austria, data indicates that the reforms have yet to deliver the desired impact. Only around 1,600 foreign nationals have entered the Austrian labour market under the Rot-Weiß-Rot programme, against a set target of 8,000. A fifth of consulted experts believe that reforming immigration policies will be of high benefit to the profession in the next ten years, as opposed to only 2% when looking back at the last five years. This could indicate the beginning of a shift in opinion towards using immigration reforms to "import" skilled ICT professionals from outside the EU.
- **Career opportunities in ICT and related career paths should be strongly promoted** and encouraged at national level. The promotion of career opportunities in ICT goes hand in hand with improving the negative perception of the profession that is held by many young people. There is a clear need to highlight, from an early age, the role ICT plays in today's modern European society. The image of a broad, dynamic and varied profession, offering opportunities to women and men, should be further highlighted beyond simply focusing on niches such as coding, despite the success of for instance code.org. There are a multitude of ways to promote the ICT profession, such as online portals offering an overview of the profession to innovative contests for young people offering incentives to them to become interested in computer science. When asked only 5% of the consulted experts indicated they thought the promotion of career opportunities in ICT would be of low benefit over the course of the next decade. This suggests they believe that these types of policies can be a key lever in terms of helping to plug the European skills gap in the years to come.
- **Granular labour market monitoring is needed at national level to tackle the EU skills gap effectively.** In order to evaluate the skills gap in Europe, at a truly pan-European level, there needs to be a consistent approach in how countries monitor their skills and competence data at national level and such data monitoring must be granular and specific to the ICT sector. 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. It is worth noting that just over 10% of consulted experts believe that labour market monitoring will be of high benefit to the ICT profession looking at the coming decade. Meanwhile nearly a third of experts believe it will be of low benefit in the future. This might indicate that although this type of policy is seen to be of importance in the future, it might be perceived as more beneficial to policymakers rather than ICT professionals themselves.
- **The uptake of ICT competence frameworks should be promoted across the EU.** ICT competence frameworks, in particular the EU-wide European e-Competence Framework (e-CF), are necessary to ensure a harmonised and structured approach to

ICT competences. ICT competence frameworks can over time and through high adoption ensure ICT professionals use a common language to describe their skill sets allowing for competences to be clearly understood by different individuals, in various organisations, across a number of countries. ICT competence frameworks can greatly help in a number of areas including workforce/training/career planning, recruitment and education. A common language to describe ICT competences is of obvious benefit to the European ICT profession. Experts consulted expressed opinions that point to the fact that the promotion of ICT competence frameworks has been of primarily medium benefit in the last five years and will continue to be of medium benefit in the next decade. The similarity of responses possibly indicates that ICT competence frameworks are still not ubiquitous nor fully understood and valued, a situation which is likely to change in the coming years.

- **European governments should consider multi-stakeholder partnerships (MSPs) as a viable option for tackling the skills gaps.** The establishment and funding of MSPs that benefit the ICT profession represents another avenue for governments to consider in terms of achieving e-skills policy goals, in partnership with private sector partners. MSPs can be highly effective in terms of enhancing available resources and achieving results quickly. The examined government-initiated MSPs, while very different in nature – one being an e-skills alliance of relevant stakeholders, the other a modern apprenticeship service – are both seen to be effective, successful and of benefit to the national ICT profession. When asked, over half of the consulted experts believed that the establishment of MSPs had been of high or medium benefit in the past five years. Looking ahead to the next ten years, nearly three-quarters of experts believe it will be of high or medium benefit. Meanwhile over a fifth of experts believe that establishing MSPs will be of low benefit in the next ten years, possibly reflecting the various levels of maturity and success of MSPs within different Member States.
- **ICT Training and educational curricula should converge with labour market demand.** This is crucial for ensuring that educational and professional training systems deliver professionals with the right skill sets onto the European ICT labour market. Without this, Europe's current skills mismatches will continue to exist and hamper the development of the ICT sector. Examined initiatives in Ireland and Belgium are both seen as highly successful. In both cases, the involvement of industry representatives appears to have played a key role in their ability to tackle ICT skills mismatches at national level. A large majority of consulted experts believe that this type of policy will be of high or medium benefit over the course of the next 10 years.
- **Up-skilling and re-skilling measures can help save ICT professionals in roles that are becoming marginalised,** due to for instance automation and offshoring**.** Given that ICT, by its very nature, is continually changing and evolving, the skill sets needed by ICT professionals are also a moving target. The need to increase the supply of ICT professionals with up-to-date skill sets is likely to increase as new software and hardware is developed, and as new ICT growth sectors emerge linked to technological trends such as mobile, big data, cloud computing and information security. A number of European Member States have realised and acted on the need to up-skill and re-skill their experienced professionals. By up-skilling and re-skilling experienced professionals the outflow of ICT professionals from the sector is reduced. Further, measures related to continual professional development can help shift ICT professionals with backgrounds or roles that are becoming marginalised, due to for instance offshoring, automation and the pace of technological change, into new and emerging roles and areas of ICT. Consulted experts have expressed a strongly increased belief in the value of up-skilling and re-skilling in the future.

- **Matching of jobs and ICT professional competences needs to increase in Europe.** To counter both the current skills mismatch and skills gap that exists in Europe, it is vital that once people have acquired a set of ICT professional competences, be they graduates, experienced professionals, or unemployed, they have access to a mechanism by which they can understand what roles are available to them. A key component of developing job matching services in Europe, whether at national or regional level, is the further uptake and adoption of ICT competence frameworks, such as the European e-Competence Framework (e-CF). A higher level of adoption of ICT competence frameworks will allow ICT professionals and employers to use the same language to describe competences. Further, adoption of a single ICT competence framework across the EU such as the e-CF would allow national employment agencies to define ICT roles in a consistent manner, which is likely to facilitate the mobility of European ICT professionals. A large majority of consulted experts believe that matching of jobs to ICT professional competences will be of high or medium benefit in the next ten years. This might indicate that ICT experts believe that this type of policy will be increasingly beneficial to the profession in the coming years, perhaps also in line with an increasing uptake of ICT competence frameworks.

The remainder of this section presents conclusions drawn from comparing the quantitative findings with the perspectives of the experts surveyed for each generic policy type. It is worth pointing out again that the quantitative findings should be seen in the context of their assigned KPIs.

- **Reform primary and secondary education systems to include informatics as a core competence.** Our research shows that the benefit of reforming primary and secondary school curricula has been limited to date and any potential future benefit for the ICT profession will only become clear in the years to come. For instance, while UK primary pupils will be taught coding as of September 2014 the impact this will have on, for instance, applicant numbers towards tertiary ICT related degrees, will likely only become clear in about a decade's time. Looking ahead to the next ten years, our survey results show that 94% of consulted experts believe this type of policy action will represent a high or medium benefit. The apparent discrepancy between the quantitative and survey findings could potentially be explained by a firm belief among European e-skills experts, that despite tangible results to date, curricula reform has and will prove to be of tremendous benefit for the profession over time.
- **Reform teacher training curricula to include training in informatics as well as digital competence.** Examined teacher training curricula reforms have had a mixed, or medium benefit according to our research. As with student curricula reform, the return on investment in terms of reforming teacher training to include informatics to a greater degree will only become apparent as time goes by. In addition, again as with student reforms, the impact and the relevance of the content taught to teachers will only be tangible in years to come. Consulted experts believe that this type of policy has had a higher impact than our quantitative research has shown in the last five years, with 61% stating it has been of high or medium benefit. As with student curricula reform, this is believed by a clear majority of experts to be very important for the profession in the future, with 94% stating it will be of high or medium benefit. Similar to the above policy, the discrepancy between the mixed results achieved so far and the survey results is likely due to the fact that experts believe this is indeed a very important

policy action that will prove beneficial over time. Yet so far, quantitative analysis points to moderate benefit.

- **Encourage positive gender balance within Europe's ICT profession.** Quantitative data shows that this type of policy action is seen as very important and something that is being championed by gender equality-aware Member States such as Spain and Sweden. Yet, the impact of these types of actions is difficult to gauge due to the nature of these types of policy initiatives, i.e. gender balance within one sector is often tied closely to gender balance within the society as a whole, and in turn linked to a host of levers across many levels of society (e.g. education, politics, culture etc.). This limited benefit is mirrored by the survey results with 52% of experts stating is has represented a low benefit in the past. It is however positive to see that looking ahead 55% of respondents say it will be of medium benefit. While the quantitative findings closely match the survey results in this context, it is worth noting that a vast majority of consulted experts were male. Additionally, although the quantitative impact is limited, the scope and ambition of the national policies in this area are not; quite the opposite they are ambitious and truly in favour of a more gender balanced ICT sector.
- **Promote the uptake of ICT competence frameworks with relevant stakeholders.** Our research shows that impact and progress to date in this policy area is moderate to high. During the course of the last decade ICT competence frameworks have begun to prosper at both national and European level. This is particularly true with the creation, and increasing uptake, of the European e-Competence Framework (e-CF) at European level, and through for instance SFIA in the UK. This building momentum is reflected in the survey results. A relatively limited share of participants said it has been of high benefit in the past (22%) with increasing numbers saying it will be of high benefit in the future (31%). The correlation between the quantitative and survey findings makes sense. Competence frameworks are increasingly being used by public authorities as well as industry, a trend which it is hoped will continue.
- **Establish multi-stakeholder partnerships benefitting the ICT profession (e-Skills Alliances, apprenticeship programmes).**Quantitative data points to the success of the examined MSPs in both Malta and the UK being high, providing convincing benefit to ICT professionals in both national markets including new graduates. These findings are echoed by the survey results, to a certain degree. While 53% of experts think MSPs have provided high or medium benefit in the past and 75% think that it will going forward, 30% and 23% respectively in both scenarios think it will be of low benefit. This relative incongruity between the results is likely linked to the fact that the examined MSPs are both seen as being successful and as having an impact, while survey respondents are likely basing their opinion on a range of MSPs, including less successful or mature ones.
- **Establish national Sector Skills Councils for ICT.** The quantitative findings show that Sector Skills Councils (SSCs) for ICT can be of high benefit for the profession. This particular kind of policy only examines one such initiative, e-Skills UK. For this reason it is important to note that the success of this policy initiative is naturally linked to the maturity of the ICT profession in the UK as well as the maturity of the UK in terms of formulating e-skills policies. Survey results paint a different picture with over half of respondents indicating the establishment of SSCs to have been of low benefit in the past or they do not know what the impact has been. Looking forward one can observe an increased belief in the value and benefit of SSCs. The differences between the quantitative and qualitative data are also likely a result of SSCs being a relatively new phenomenon, and still today rather UK centric.

- **Reform national Immigration policy to tackle shortages in supply of skilled ICT Practitioners (for non-EU residents).**Quantitative findings point to immigration reforms in the examined countries proving to be of limited benefit to the European ICT profession. It is important to point out that these findings were themselves based on available immigration data which unfortunately is far from being granular enough to draw entirely conclusive remarks about such policy initiatives. Meanwhile survey results show that a majority of consulted experts, both looking to the past (44%) and to the future (47%), believe this type of policy to be of low benefit. While this is in line with the quantitative findings, i.e. low benefit overall, it is important to note those findings were based on limited KPI data. The low belief among experts on the benefit of immigration reform could potentially also reflect a fear of domestic jobs being lost to foreign nationals.
- **Match jobs and ICT professional competences for worker and workplace mobility.** Our research shows that the examined initiatives have been of medium to high benefit to the profession and are likely to continue to deliver benefit for European ICT professionals, particularly as ICT competence frameworks are increasingly adopted across Europe. Survey findings match this as 47% of experts indicate that this has been of medium benefit in the past, while looking forward 55% think it will be of medium benefit and 31% (as opposed to 11% in the past) think it will be of high benefit in the next ten years. The survey results, looking ahead, seem to indicate that matching of jobs and ICT professional competences will be of increasing benefit in the future, echoing the quantitative result which points to increased benefit as e-competence frameworks are increasingly adopted.
- **Promote career opportunities in ICT and related career paths.** While different in nature, the policies in Germany and France have both been determined to be of high benefit based on the quantitative research. Career opportunities in ICT and related careers paths should be strongly promoted and encouraged; these types of policies go hand in hand with improving the negative perception of the profession that is held by many people. Survey data mirrors this conclusion with 63% of respondents saying these types of policies have had a high or medium benefit in the last five years. Looking ahead 91% say it will be of high or medium benefit, indicating a clear belief that this is a key policy type for reducing the EU skills gap in the future.
- **Match training/educational curricula and labour market demand.** Quantitative data shows that the examined policies in Belgium and Ireland have so far been successful with hundreds of individuals having gone through the respective programmes. The quantitative data also confirmed that the involvement of industry representatives appears to have played a key role in the success of both initiatives. Our survey results indicate that this type of policy has been primarily of low (41%) benefit or medium (36%) benefit in last five years. However, looking ahead, 89% of consulted experts believe this type of policy will be of high or medium benefit. The discrepancy between the quantitative and the qualitative data might point to a belief that these types of policies are still in their infancy and their impact is set to grow in the coming years when they are scaled up further at national or indeed pan-European level.
- **Encourage up-skilling and re-skilling of experienced ICT professionals.** The examined policies in Germany and the Netherlands have to date provided only limited benefit based on the quantitative analysis. This is partly due to the initiatives being at different stages of maturity and limited available data regarding their impact. Consulted experts echo this conclusion, with 47% of respondents saying these types of policies have represented a medium benefit and nearly a third (26%) of experts saying they have represented a low benefit in the past. However, as can be observed with the

above policy type the share of experts believing that this will have a high impact in the next ten years nearly doubles from 20% to 36%. This difference in results could be linked to an ageing European ICT workforce, i.e. this will increasingly represent a higher benefit to (ageing) ICT professionals.

- **Establish granular labour market monitoring programmes/mechanisms which include the ICT sector.** Quantitative findings indicate this policy represents a moderate to high benefit based on the examined policies in Germany and the UK; it is particularly beneficial to policymakers at national level who are in position to use increasingly granular labour market data in the formulation, implementation and assessment of e-skills policies. This could in the longer term prove to be highly beneficial for ICT professionals at national and European levels, including new graduates. In stark contrast to the quantitative findings, only 8% of consulted experts believed this type of policy to have been of high benefit in the past, while 13% believe it will prove highly beneficial in the future. However, an important shift can be observed; looking back 50% of experts believe this policy has been of low benefit, looking forward 51% believe it will be of medium benefit. The variation between the findings can likely be ascribed to the fact that this type of policy and the deliverables it generates is likely to be of higher benefit and value to policymakers than it is to ICT professionals and new graduates, despite the fact that a labour market monitoring mechanism is likely to indirectly provide benefit to the ICT profession.

CHAPTER 10: POLICY RECOMMENDATIONS

Introduction

It is essential for Europe's competitiveness that e-skills policy supports the creation of a workforce that is capable of competing in a global economic context. In this chapter, we have extended our analysis of best practices in order to define new proposals that can be used specifically to enable Europe to better respond to the challenges relating to ICT professionalism and globalization in the longer term.

In practice, it is difficult to separate out practices addressing the specific challenge of globalization from practices that address ICT professionalism and e-skills as a whole. The reason for this is that, ultimately, the primary strategy for tackling the emerging e-skills gap as well as enabling European competitiveness in e-skills on a global stage is to develop and maintain a workforce with superior e-skills in the areas that are growing in demand. Given this overlap, it is understandable that a single given policy action may address both the challenge of globalization as well as the challenge of improved levels of e-skills/ICT professionalism, as can be seen in several of the policy actions described below.

Thus far, ICT-related policy actions have typically focused on ICT practitioners, computing graduates, and digital literacy, with the addition of very recent policy actions aimed at meeting the rapidly growing demand for e-Leaders. However, as the importance and pervasiveness of ICT evolves and expands into the business, it is important that policy actions also adequately address the rapidly growing population of "advanced ICT users" - a population that is perhaps better captured here using the term "digital creators", reflecting their ability to bring about the existence of new ideas and solutions using digital technologies. Given the projected demand for advanced users in this area, it is essential that policy actions appropriately target this group (e.g. via relevant education and training initiatives).

In constructing the list of policy actions below, the research team has also taken into consideration the fact that while globalization is often perceived as a threat, it must also be considered a potential opportunity in certain circumstances. For this reason, we have identified a small number of policy actions that aim to foster increased demand for e-skills stemming from the opportunities presented by participating in a global digital economy. In doing so, it is important to note that we have focused solely on policies that have a direct relationship to e-skills. That is, it could be argued that policies that drive increased economic activity as a whole will stimulate increased demand for e-skills. However, for the purposes of scope we have largely avoided examining generic policies related to taxation, regulation, inward investment, etc. as they will be better served by documents specifically targeted with the objective of stimulating economic growth specifically.

Similarly, we have avoided describing policies that may be interpreted as protectionist. However, the situation regarding the precise nature and objective of policies is open to interpretation. For example, following recent privacy and security concerns, the German government has now cited open source software among its IT policy priorities, as an alternative to closed proprietary systems, ostensibly to protect its citizens from overseas intelligence agencies. Similarly, it advocates that core technologies related to security should be built using proprietary technology platforms and production lines in Germany or Europe (CIO.com, 17 Dec 2013: German coalition favors German-owned or open source software,

aims to lock NSA out). The Free Software Foundation Europe has voiced its support for this change, while stating that the policy could go still further. However, the Business Software Alliance has stated that it is concerned that procurement preferences based on country of origin may impede innovation and create barriers to trade.

Note: For each identified policy, the descriptors below outline the key evidence/ findings from the study supporting the policy, together with proposed mechanisms to support policy implementation.

Policy Recommendation 1: World-class e-skills excellence

Drive commitment to ICT practitioner up-skilling with a focus on world-class excellence

Evidence/ Findings

Without doubt the new wave in information and communication technology innovation is fundamentally changing the demand for current and future ICT practitioner skills. There is an emerging view of the skills landscape that segregates skills along a knowledge spectrum with many of the more traditional ICT skills, such as programming, networking, and infrastructure management moving down the knowledge spectrum, with skills relating to activities such as business analytics, enterprise architecture, and data visualisation and analysis moving up the knowledge spectrum and therefore becoming more in demand. Because of this shift in the type of skills being demanded, many more traditional skills are now at risk of being offshored, and/or automated. According to IDC global sourcing models are driving many low-level ICT entry-level jobs offshore, or to be automated. 76% of CIO's surveyed as part of this research see automation as having a moderate to very high impact on the future demand for the *type* of skills required for the ICT worker. One, is for example where automation will make a significant impact is in the area of software quality testing. This shifting ICT landscape is driving ICT practitioners, through the use of the technology, to engage more proactively with the organizations in which they are embedding the technologies. The ICT practitioners of the (near) future will need to augment their skill sets with skills that traditionally they did not require. These include skills that will allow them to engage more effectively with users of their technology solutions, but also to better understand how technology can be harnessed to deliver the organizational, or societal objectives. A growth in the importance of managerial and interpersonal skills for ICT workers, and a shift in ICT expenditure to the business, away from traditional ICT Operations, reflects a further requirement for quality-focused up-skilling.

This challenge raises another fundamental concern: How do we ensure we are providing our workforce with the appropriate skills to meet the current and future economic and societal challenges? Our education establishments must form a part of the answer. Educational attainment outside of Europe at primary and secondary education levels is increasing rapidly, and hence future workers will face increasing international competition for jobs e.g. there is a rapid growth in the number of engineers outside of the EU. Many countries within the EU are seeing a significant fall off in the number of students applying for and completing technology based undergraduate courses. What is an absolute truth is that the EU is competing at a global level for key skills, and the levels of competition are increasing. The need for education providers to engage with industry and government to understand the changing demand of skills is vitally important. There is a growing mismatch between supply of skills by the education system and demand by the industry in Europe, which is one of the factors contributing to the high level of youth unemployment. This is a general trend, but is particularly evident for ICT skills. Universities and business schools are struggling with the

contrasting needs to adapt to new demand, but also maintain their focus on learning achievements for the longer term. Another aspect to be considered is the gender imbalance in the number of women seeking a career in technology dominant subjects at second and third level education. This is feeding the gap in the supply of ICT skills particularly for new emerging technologies. Gender issues cannot be overlooked when developing policies for world-class ICT practitioners. In fact the conversation concerning the promotion of ICT skills development must be opened up to not only address gender issues, but to include issues relating to all minority groups that are, or have excluded themselves from the ICT workforce.

Finally, it is not practical to expect member states, or regions to develop excellence in all current and future e-skills. Skills take time to develop and embed and their impact felt within industry, and therefore, the selection and focus of key skills is a strategic imperative. Skills current and future demand needs to be matched also to the economic development plan, based on the identification of the critical industries (including SMEs) that will drive that development. To that end, member states need to be able to identify critical industries and the skills that will be required to drive a sense of excellence. Currently, there are many centres of excellent dependant on ICT skills emerging across the EU. These include Finance and Banking in the UK and Germany, High Tech Manufacturing in the UK, Ireland, and Poland, Pharmaceutical manufacturing in Ireland, Supply Chain Management in the Czech Republic, Telco's in Spain, Netherlands, and France. This is not a definitive list, nor is it likely to stay as it is. As globalisation and automation mature the skills required to service these industries will change. The new currency for success truly is knowledge, and these industries will re-define themselves based on the demand and supply of the current and future e-skills that will provide the foundation for this knowledge.

Mechanisms

In order to overcome the challenges relating to developing world-class e-skills excellence, a number of mechanisms are outlined in this section. Although these are presented as discrete actions they should be considered as part of an overall strategy for improvement. No one mechanism will achieve the desired objective of world-class e-Skills excellence. Therefore, all recommendations should be considered and implemented appropriately.

Identify at a EU, and National level, the skills required to build and establish world-class excellence in those strengths that will continue to ensure the EU can play a competitive role in the global economy. However, the mechanisms for attracting and retaining key talent in key areas are vitally important. If this is overlooked the EU will simple be a source of highly trained workers for other competing economic regions. Focus should be given to the following actions:

- Accept that the EU will not develop centres of e-skills excellence across all skills areas. The EU should help facilitate member states and economic regions to understand their skills profile and what skills they can focus on developing. What is important is that the skills selected are matched to a level of demand from industry; with a clear understanding of the value those skills will bring to both the region and industry. Some skills will be aligned to industries that require the skills to be located physically near to the point of manufacturing or service delivery, whilst other skills can be provided from any location within or outside of the EU. Both options will need to be supported differently. For those skills required at the point of delivery, industry will need to be encouraged to locate within the region looking to build skills excellence, whereas, for those skills that can be delivered remotely the region will

need to focus on attracting the individual with the skills. This will drive different incentive plans for development.

- Develop a series of relevant education and training initiatives that foster creation of an ICT workforce with increased quality and professionalism.
- Expertly exploit technology in learning, and on-line education / training delivery to remove barriers of distance and time. In terms of increasing workforce mobility this will have the potential to significantly increase number of individuals up-skilling, and re-training. Successful Member States' initiatives in this area include Academy Cube (Germany), the Tiger Leap Initiative and the BeST and VANKeR programmes (Estonia) and the E-Education initiative (Slovenia).
- Develop new curricula focused on skill-sets that address the increasing demand for advanced ICT user skills. These skills should also include e-leadership skills necessary for building digital capability. Include the latest ICT research in curricula development to ensure on-going relevance to the students in a way that ensures familiarity with the latest developing technology trends. Successful Member States' initiatives in this area include the Swedish government's Strategy for Entrepreneurship in the Field of Education and the Bulgarian's Software Industry push for Educational System Reform.
- Increase speed of response of education institutions through the development and delivery of short courses designed to provide access to knowledge relating to key technology innovations and initiatives, such as 'big data boot camps'. These could be delivered in parallel to the more traditional undergraduate / postgraduate modules. Fostering such an agile approach to ICT education and training will help to maintain the currency of practitioner skills throughout their careers/ re-develop skills following a career break. Successful Member States' initiatives in this area include Finish IT (Germany), FORMATIC Wallonie (Belgium) as well as the Level 8 Conversion Programme and Fast Track to IT (FIT) in Ireland.
- Develop and facilitate more formal channels of collaboration between academia and industry for the purpose of developing new, relevant course content. Development in this area has already stated with initiatives that have been identified through the European Commission's Grand Coalition for Digital Job. However, this needs to be adopted and driven at a national level throughout the EU. Successful Member States' initiatives in this area include Denmark's Growth Team for ICT and Digital Growth, the GetQualified Scheme in Malta and Netherlands's National Information Society Platform ECP, which is responsible for the major "Digivaardig & Digiveilig - Digitally Skilled & Digitally Safe" programme.
- Identify ways to collaborate with industry to provide placements and internships for students during their studies to increase practical focus and motivation. In order to get SMEs engaged in this initiative some form of incentive will be needed to encourage their participation. Examples of initiatives with tangible success in this field include eSkills UK, the Jobbridge National Internship Programme, Skillnet and the Level 8 Conversion Programme (Ireland), the ICT Practice programme (Lithuania), MITA's Student Placement Programme (Malta), Sweden's Higher Vocational Education initiative and its emphasis on "Lärande i arbete", E-Placement Scotland, IT Academy programme (Estonia), FORMATIC (Belgium), TECHNIKUM (Germany), NEXTLEVEL.LU (Luxembourg), UchastStudent·ski praktiki (Bulgaria) as well as the company-initiated Internship Programmes of HP and IBM, which are playing an important role especially in some of the East European Member States (e.g. Romania).
- Encourage more students into STEM subjects, with a particular focus on addressing any gender imbalances. Women alone account for approximately 50% of the

workforce, and to exclude them from this type of education and training greatly reduces the EUs ability to close the growing skills gap. Education at second level also needs to consider how best to prepare students for STEM courses. Consideration should also be given to re-focusing and re-naming courses to broaden appeal specifically amongst girls and women. Examples of initiatives with tangible success in this field include Germany's long-running "Girls' Day", Frauen in die Technik (Women Into Technology, Austria), the Rails Girls campaign which originated in Finland, France's Women of the Digital Sector Commission, England's "Join the Girls in IT" campaign and the Swedish Government's 2011 Digital Agenda for Sweden with is clear focus on "increasing the proportion of young people, especially girls and young women, who apply to study ICT-related subjects and programmes in higher education".

- Improve career guidance at second-level education to positively demonstrate the benefits to the individual, society, and economy that being an ICT practitioners can have. Better understanding also needs to be gained of the issues that lead to higher than average drop out rates for third level ICT courses (low performance of STEM subjects prior to entry appears to be one factor). Examples of initiatives with tangible success in this field include: Sparkling Science and fti-remixed (Austria), Nemaj na salame ("Mind Your Future", Slovakia), the CoderDojo campaign which originated in Ireland but has become global by now, as well as various activities of France's Syntec Numérique.
- Improve methods through competency-based education to focus educational effort by pre-ceding update/CPD courses with assessments indicating specific skill gaps and then tailoring content to up-skill in those areas. Examples of initiatives with tangible success in this field include Finish IT (Germany), FORMATIC Wallonie (Belgium) as well as the Level 8 Conversion Programme and Fast Track to IT (FIT) in Ireland.

These initiatives will need to be focused in a way that can leverage existing assets, including regional, national, and local clusters/ecosystems/markets, to compete on a global stage.

Roles of Key Stakeholders in Implementing this Policy

In order to maximise the impact of the initiatives identified in the mechanism section, key stakeholders will need to be identified, engaged, and their activities coordinated. This section will identify those stakeholders, and the roles they will play in realising the policy recommendations.

- Role of European Commission: The EC should drive this effort by, including, promoting and supporting public-private partnerships between education and training organizations-industry-policy makers.
- Role of Member States: Participate actively to European coordination and collaboration efforts, as well as develop national plans and initiatives for ICT skills development, coherent with the international framework.
- Role of Industry/ Employers: Collaborate with universities/business schools. Increase internships, pre-job training, and mentoring schemes.
- Role of Education and Training Institutions: Take a leadership role in the collaboration effort to develop an e-skills delivery framework, but also revise curricula/ education methods, increasing their innovation strategies and investments, adapting to new demand. Also develop new patterns of collaboration with industry without losing sight of their primary role in education.

- Role of Professional informatics associations/computer societies: Promote awareness actions to increase STEM enrolment and collaborate to the EU framework specifically for the adaptation and innovation of curricula and requirements. Support the harmonization of certified, universally recognized professional requirements. Work with first and second level teachers to develop easy to use curricula tools.
- Role of Social Partners Collaborate: Improve working patterns of ICT practitioners, for example to combat ageism, gender bias, and any other forms of discrimination, and to provide mechanisms to facilitate re-skilling and updating after a career break. Challenge prevalent ICT image as 'only for the young' and 'those prepared to work very long hours'. Ensure that the cost and time burden of training and CPD does not unduly fall on the workers. See successful initiatives such as IT 50plus (Germany).

Policy Recommendation 2: Foster entrepreneurship, innovation, and jobs creation in Europe through the promotion and development of e-leadership skills

Evidence/ Findings

E-Leadership skills are key for innovation and entrepreneurship (e-Leadership: skills for competitiveness and innovation). This is not a new concept, but one that denotes a higher level of organizational, managerial, and leadership skills necessary for delivering high performance in technology driven organizations. With the increased pervasiveness of technology the role of ICT has become integral in every aspect of business life. Because of this, technology is playing an ever-increasing role in how quickly organizations benefit from innovative and entrepreneurial ideas. When considering new business models for competitive e-positioning, technology must be considered as a key enabler for success. However, recent research has confirmed that the shortage of e-leadership skills across Europe is significant, and will have a major impact on indigenous industry's ability to react in an entrepreneurial manner to opportunities driven through technological innovation (www.eskills-guide.eu) For effective e-leadership, the skills required are seen as 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. Their success is defined as making best use of developments in ICT and delivering value to their organizations.

Coupled with this growing inability to react to advances and opportunities being presented through technological innovation, is the fact that other economic regions in general, and emerging economic regions in particular, are growing fast, with a growing focus on developing their digital capabilities. In fact innovation and entrepreneurial initiatives that leverage digital technologies are expected to be the most important drivers of new growth in European mature economies. For example, the European app economy already counts revenues of 17.5 billion euros and has created 1.8 million jobs, with very high potential of growth (Eurapp study, 2014). Therefore, it is an economic imperative that organizations are given the necessary skills and tools to start driving initiatives that leverage digital technologies. Unfortunately, in terms of organizations that are already doing this the signs are showing a relatively low base. According to the Global Entrepreneurship Monitor, in 2010 "early stage" entrepreneurs made up only 2.3% of Italy's adult population, 4.2% of

Germany's and 5.8% of France's compared to America's 7.6% and China's 14%. Therefore, there is a real and urgent need to promote digital entrepreneurship in Europe.

Mechanisms

In order to overcome the challenges relating to fostering entrepreneurship, innovation and jobs creation in Europe a number of mechanisms are outline in this section. Although these are presented as discrete actions they should be considered as part of an overall strategy for improvement. No, one mechanism will achieve the desired overall objective. Therefore, all recommendations should be considered and implemented appropriately.

- Develop and promote skill sets at an individual, organizational, and national level. Awareness needs to be raised concerning the strategic imperative nature of the requirement for a changing set of e-skills. Individuals and organizations also need to be made aware of the benefits of developing these skills for both the employee and the overall benefit of the business or organization. In essence, the demand for these skills needs to be stimulated. The skills should include, but not be limited to, e-Leadership, entrepreneurialism, and innovation skills. These should be presented in a way that is accessible to all levels of management and experience. In effect the message should not just be about the 'how to…' but also the 'why you should…'. In a number of Member States, first promising approaches are in evidence: For example, Denmark, Malta and the Netherlands have a well-developed system for entrepreneurship training. In Finland initiatives in response to the crisis of the Nokia eco-system have included large-scale promotion of entrepreneurship predominantly in the digital domain. In Germany the Software Campus set up in 2012 is among the first major initiatives in Europe that focuses explicitly on e-leadership skills. In the U.K. increasing emphasis is put on e-leadership skills with the advent of the Information Economy Strategy and Council. Identify core in-demand skill sets by industry sector, and provide tax / financial/ funding incentives to help companies in those sectors to employ / train ICT professionals. Particular focus, however, should be on the use of technology in developing business opportunities, as opposed to developing a deeper understanding of how to deploy, and maintain technology. This will help organizations better understand how to integrate technology around the needs of the business, and help the ICT intern understand how technology needs to align and support, and enable the business in a way that develops competitive advantage. See Malta's GetQualified scheme for a successful initiative in this area.
- Provide specific funding to education providers to design, develop, and delivery undergraduate, postgraduate, and professional training courses that will focus on developing e-leadership, innovation, and entrepreneurial skills to meet the initial demand over the next 2-3 years.
- Better utilise the skills and knowledge of strategic management consultancy organizations. Taking a connected view of how skills fits within the overall economic plan for any region requires a specific skill set that is not usually present with local government, or civil / public service organizations. These professional consultancies can work with key stakeholder groups to identify e-leadership skills gaps across critical industries and supporting SME clusters. For an example, see the Brainport

Talent Region in the Netherlands, which ascribes strategic importance to skills development in the e-leadership and digital entrepreneurship areas.

Roles of Key Stakeholders in Implementing this Policy

In order to maximise the impact of the initiatives identified in the mechanism section key stakeholders will need to be identified, engaged, and their activities coordinated. This section will identify those stakeholders, and the roles they will play in realising the policy recommendations.

- Role of European Commission Roles of Member States: This is a coordinating role to help identify they type of skills driving demand across the economic region, and how, and from where those skills are being supplied.
- Role of Member States: 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 supporting SME sectors).
- Role of Professional informatics associations/computer societies: Work to promote awareness of e-leadership, innovation and entrepreneurial skills amongst their members. Also, expand their certification / CPD programmes to acknowledge skills development in these areas.
- Role of Industry/ Employers: Identify ways of engaging more directly with academia to develop relevant content for the purpose of developing practical e-leadership, innovation and entrepreneurial skills. Also, look at ways of identify and assessing these skills amongst their workforce, and how to nurture and develop these skills through career development.
- Role of Education and Training Institutions: Work with industry partners to better understand the demand for e-leadership, innovation and entrepreneurial skills. Look to industry to actively participate in the design and delivery of professional skills development courses.
- Role of Social Partners Collaborate: Encourage workers to re-train, seek re-skilling opportunities within their work environment. Also work with industry to identify how the workforce can be best support in transitioning to higher ICT skills.

Policy Recommendation 3: Promote SMEs competitiveness and integration into global digital value chains

Evidence/ Findings

The skills shortage is truly a global issue, which is impacting business at a local level. Through the ubiquitous access to technology (high speed internet and cloud computing) organizations are increasingly able to quickly identify and source skills from around the world. These global sourcing models are being increasingly adopted by organizations of all sizes to build flexible, responsive business models. SMEs are not immune to the impact of global sourcing and need to increase their capacity to integrate into an increasingly competitive global digital market palace. ICT provides access to services and technologies for SMEs previously only available to very large companies. However, SMEs need to have the skills and ability to be able to identify and seize on opportunities to move their business from a national to a global level and compete accordingly. With this opportunity also comes risk. Many low-skilled ICT tasks are being automated and / or offshored. This externalisation of liability helps reduce cost in a way that allows organizations to react faster to market forces. By pushing non-critical ICT tasks to low cost centres, many organizations are developing leaner more cost effective business models. Therefore, SMEs need to understand the implications of the global sourcing model and what it means in terms of their own competitiveness.

A failure for SMEs to realise and react to the implications of global sourcing will have a significant impact on the jobs profile across Europe. Existing SMEs in high volume, knowledge intensive industries need to understand the impact of their competitors sourcing their ICT skills overseas, and what this will mean in terms of cost and pricing strategies. Those SMEs at the other end of the knowledge spectrum need to better understand how they identify high value ICT skills that they can develop and protect in a globally competitive skills market. The very skills they build to give them competitive advantage, and entry into global value chains will make them targets for other organizations wishing to acquire those skills.

In terms of competitive positioning, this policy is complemented by the recommendations in 1 and 4. As SMEs cover a wide and varied array of businesses, in terms of sector, structure, size (revenue and workforce), offering (product and/or service), and reach, the manner in which they will engage with technology, and demand e-skills, will vary considerable. Therefore, understanding the demand SMEs will place on the development and provision of skills will need to be established. Certainly, key industries will drive demand, and these industries' will, in turn, be services by these SMEs. Because of this a clustering approach can be developed to establish an understanding of the growing need amongst SMEs for key e-skills.

Mechanisms

In order to overcome the challenges relating to improving SME competitiveness, a number of mechanisms are outlined in this section. Although these are presented as discrete actions they should be considered as part of an overall strategy for improvement. No one mechanism will achieve the desired overall objective. Therefore, all recommendations should be considered and implemented appropriately.

- Engage with leading representatives from government, industry, and academia to determine and target priority areas for investment, and explicitly link this to research funding mechanisms at a EU and national level. In accordance with policy recommendation 1 EU regions should identify and cluster those SMEs engaged in supporting strategic competitive industries. It is important to develop this view within 12-18 months. This view, once validated, will enable academic and legislative policy makers to service these industries through the provision of training and education courses, and supportive employment and immigration regulations (as per policy recommendation 4).
- Foster initiatives to promote the potential benefits of digital platforms and roadmaps for SMEs to encourage them to adopt digital technologies. Successful examples of initiatives in this area include the Netherlands' "Slimmer & veilig ondernemen in 1 minuut" programme, the FIT-IT and "e-Skills im Mittelstand" programmes in Germany, the e-Volve programme in Cyprus, PME Digital (2012-15) in Portugal, several iniatives by eSkills UK, as well as activities under Hungary's Digital Renewal Action Plan 2010-2014.
- Improve capability of SMEs to exploit potential of ICT by promotion of SME focused mechanisms such as ICT capability frameworks. This will better help SMEs to make the link between skills development and overall organizational capability, which in turn will drive business performance. Successful examples of initiatives in this area include Italy's RETE Competenze per l'EconomiaDigitale (Italian Competence Network for the Digital Economy) and the Netherlands' ECF-NL Working Group.
- Engage education providers to develop education and training content specific to the needs of SMEs. This will not only focus on the content but also on the manner in which the SME can engage with the training and education. Time and funding will be scarce so this will need to be delivered in a way that works within both constraints.
- Support SMEs in attracting and retaining critically skilled employees. This could be tied to some form of 'pay-back' period of employment post training. However, it is better to attract as opposed to force retention through a holding agreement, as motivation will factor into the performance of the individual.

Roles of Key Stakeholders in Implementing this Policy

In order to maximise the impact of the initiatives identified in the mechanism section key stakeholders will need to be identified, engaged, and their activities coordinated. This section will identify those stakeholders, and the roles they will play in realising the policy recommendations.

- Role of Member States: Provide financial mechanisms for indigenous SMEs to identify how to best utilise those key critical skills required for global value chain engagement. Also promote through local enterprise agencies the value to the SME for developing and maintaining these critical skills.
- Role of Member States: Establish a mechanism to identify SME clusters that support critical industry sectors. Work with industry leaders, academics and professional societies to understand and define the skills required to support economic development.
- Role of Professional informatics associations/computer societies: Identify key critical skills and define their market value. This will help ensure individuals with these skills

can assess how well they are being rewarded within the organization. Also promote the development of these critical skills amongst their professional membership. The scope of the organizations may need to be re-defined to include the expanding multi-disciplined nature of these critical skills.

- Role of Industry/ Employers: Develop and deploy HR strategies for attracting and retaining key critical skills. Also, identify how these skills will not only drive ICT performance, but how they will contribute to the overall global competitive strategy.
- Role of Education and Training Institutions: Work with SMEs, and SME associations to better understand the demand for critical skills that enable value chain engagement. Look to SMEs and SME associations to actively participate in the design and delivery of critical skills development courses.
- Role of Social Partners Collaborate: Encourage workers to re-train, seek re-skilling opportunities within their work environment. Also work with SMEs and SME associations to identify how these skills can be developed in a way that does not impact to heavily in terms of cost or time.

Policy Recommendation 4: Foster mobility and become a magnet for talent

Promote immigration and mobility policies to address short-term skills gaps

Evidence/ Findings

This policy recommendation is closely linked to the previous three recommendations, but specifically relates to the identification and attraction of ICT related talent to the EU. There is a growing projected inadequate supply of skilled ICT professionals across Europe, with a possible gap of up to 1.3M by 2020. This will provide a massive impact on the EU to compete globally. That said, other economic regions are also facing similar shortfalls in skills over the next 5 – 10 years. The issue is somewhat clouded by the fact that there is a surplus of certain skilled ICT workers in some European countries, at the same time as a skills gap exists in other countries. This is being driven by two factors; the need to identify relevant and changing skills for future growth, and the mobility of the ICT workforce with and across the EU. The distribution of skills is uneven, with certain regions developing as hot spots for certain skills, whilst certain industry sectors are also driving demand. Existing research highlights the disproportionately high contribution immigrants are making towards business start-ups. What is obvious is that talent will attract talent. This is something to be exploited as these hot spots and industry preferences for certain skills can act as a catalyst to attract other talented skilled workers, which in turn can act as an incentive for foreign investment. However, like the recommendations in Policy recommendation 3, some means of protecting the skills base will need to be implemented, or the regions and industries will have to fend off stiff competition for skills from other competitors, in other economic regions. This recommendation also complements the 1st recommendation, in that regions need to assess what skills they want to invest in. Becoming a talent magnet for all skills will not be practical. Therefore, regions need to understand what industry sectors they wish to develop, and then focus on the skill sets required to achieve excellence in these areas. Universities and providers of academic and professional training will need to be part of this conversation, as they will need to develop the engine to provide the skills to support the competitive economic growth strategy for the region.

Mechanisms

In order to overcome the challenges relating to improving migration and mobility a number of mechanisms are outline in this section. Although these are presented as discrete actions they should be considered as part of an overall strategy for improvement. No one mechanism will achieve the desired overall objective. Therefore, all recommendations should be considered and implemented appropriately.

- The EU needs to consider the development and promotion of immigration policies that recognize and attract a worldwide pool of talent. A recent European Commission report (European Commission, 2013h) revealed that past and current policies in the 'immigration' area are not seen as appropriate and effective, have not revealed benefits, and are not seen as very relevant and appropriate to the EUs current and future e-skills challenge. Certainly, at a national level, the policies targeting facilitation of 3rd country immigration have underperformed and there is no evidence of their positive impact. Therefore, a review would be both timely and necessary. For example:
    - Promote elite education and visa opportunities that attract key talent/ entrepreneurs and promote Europe as an attractive option in which to study and set up new businesses.
    - Support a review of the existing Blue-card system to drive wider adoption of the EU scheme to facilitate immigration of non-EU migrants with specific in-demand skills.
    - Provide training and mentoring on cultural issues for incoming workers and existing workers.
    - Identify the complimentary benefits that may be associated with re-locating to, and from within the EU.
    - Although national policies concerning employment and immigration regulations need to be updated, the process will need to be coordinated across the EU. If this is not conducted as a coordinated activity they imbalances in employment and immigration practices may start to appear across the EU, which may result in unfair competitive positioning amongst EU members.
- Facilitate enhanced transparency of competences across borders stemming from increased adoption of a common e-skills framework such as the e-CF
- Align mobility and immigration policies (including a review of the blue-card system) with up-skilling initiatives, as this supports alignment of critical skills to economic policy, and the long-term realisation of these skills at an economic and societal level (e.g. allow immigrant students to remain in country and start their own company and/or get a job).
- Identify core in-demand skill sets by industry sector, and provide tax / financial/ funding incentives to help companies in those sectors to employ / train ICT professionals in those in-demand skill sets.

For successful initiatives in this area, see Germany's "Academy Cube" as well as Estonia's IT Academy Programme.

Roles of Key Stakeholders in Implementing this Policy

In order to maximise the impact of the initiatives identified in the mechanism section key stakeholders will need to be identified, engaged, and their activities coordinated. This section will identify those stakeholders, and the roles they will play in realising the policy recommendations.

- Role of European Commission: Conduct a review of current EU policies concerned with workforce mobility. Also look at how existing initiatives can be fine-tuned to support the attraction and retention of key skilled workers.
- Role of Member States: Work with the EU to refine immigration policies to fit with national economic policy. Then implement policies to attract and retain key skilled workforce, but to also improve mobility of workforce across national boundaries.
- Role of Industry/ Employers: Identify demand for key skilled workers, and engage with education providers to build capability. Also, work with professional associations to identify ways of raising the profile of these critical skills, and interest from the indigenous workforce for up-skilling opportunities.
- Role of Professional informatics associations/computer societies: Work with industry bodies to identify skills shortages and where, if any, overabundance of these skills may exist within the EU. Also work with professional membership to raise awareness of skills and identify ways to acquire these skills through either professional or academic education.
- Role of Education and Training Institutions: Work with industry partners to better understand the demand for key critical skills. Look to industry to actively participate in the design and delivery of professional skills development courses that address the particular skills talent shortage.
- Role of Social Partners Collaborate: Encourage workers to re-train, seek re-skilling opportunities within their work environment. Also work with industry to identify how the workforce can be best support in transitioning to higher ICT skills.

Policy Recommendation 5: Support a Global ICT profession

Foster the establishment of a global ICT profession.

Evidence/ Findings

Due to the nature of global business ICT practitioners are being required to increasingly work in global virtual teams as part of global digital value chains. This reflects different historical precedence from other professions such as law, medicine, and engineering. All of which collaborate and interact at an international level, but the focus and need for regulatory compliance happens at a national or regional level. ICT practitioners, on the other hand, find themselves delivering global solutions that transcend international borders, cultures, and work practices. Unfortunately, those who find themselves operating in this environment are supported by a very young, fragmented, and immature profession. The current situation sees multiple associations vying for dominance, albeit at national and regional levels. What constitutes a 'profession' and indeed a 'professional' is still contested by the various stakeholders in the discussion of professionalism. This has resulted in the development of multiple competence frameworks, educational standards, code of ethics, and bodies of knowledge. This is a global issue and not just one particular to the EU. However, in order to

help achieve all the policy recommendations in this report there needs to be a global initiative to start to address this challenge. Although this is a multi-stakeholder discussion the existing professional societies at a national and international level must play a key-defining role. This is not required simply to provide ICT practitioners with a sense of worth, but to ensure that the quality of work delivered by ICT practitioners anywhere in the world can be assured against a set of criteria designed to demonstrate competence, experience, and ability of the individual to delivery. This becomes even more important when one considers the ethical and safety implications of some of the technologies being deployed to manage personal and financial information. Recent cyber attacks have highlighted the need for competent, ethical ICT professional to be involved in the design, and implementation of key technologies. However, many organizations such as the IEEE, ACM, and many national Professional Societies, such as the BCS, ACS are working to identify how best to prepare their members for the future. What is needed now is a collaborative initiative to start addressing the challenge from a global community perspective. During the recent International e-Skills workshop (March 24-25 2014) organised by the European Commission in Brussels, it became apparent that all represented economic regions are struggling with the same issues (ethics, professionalism, bodies of knowledge, and the use of appropriate use of frameworks to help make sense of the changing ICT landscape). However, the regions are at different stages in addressing the challenges, with many novel and effective solutions being employed to resolve regional issues. What was agreed, was the need to raise the level of the conversation and cooperation to a global level. To that end, there was agreement that some form of international collaboration needs to be established and supported. The initial form of such 'collaboration' should primarily focus of knowledge and best practice sharing between the economic regions.

Mechanisms

In order to overcome the challenges relating to fostering a global ICT profession a number of mechanisms are outlined in this section. Although these are presented as discrete actions they should be considered as part of an overall strategy for improvement. No one mechanism will achieve the desired overall objective. Therefore, all recommendations should be considered and implemented appropriately.

- Identify ways to promote information-sharing initiatives between countries related to ICT professionalism. This means connecting with all the key stakeholders representing ICT practitioners at a regional, and international level. Organizations such as the IEEE, the ACM, IFIP, CEPIS, METIs (Japan) and representatives from emerging economies such we Africa, India and China need to be included in any of these initiatives. This would provide the perfect forum for understanding and sharing best practices, and how local / cultural challenges need to be considered as part of any globally defined solution. This activity should also include the co-ordination and collection of accurate and comparable data on ICT skills in each country or economic region. This can be used to better understand the current and future skills that will be required by ICT practitioners going forward. Even though consensus may not be reached within the next 12 months, it would be a significant step forward if the structure and governance of international information sharing collaborative can be presented at the up-coming OECD's 'Internet Economy on the Rise' conference in 2016.

- Instigate coordinated campaigns to raise awareness of the economic and societal need for professionalism nationally, regionally and globally. Include national and regional representatives to ensure cultural and societal factors are taken into consideration as part of the campaigns.
- Develop a campaign to raise awareness amongst individuals highlighting the benefits of attaining professional status. This will also need to be run at a national / regional level so gender, culture, and societal factors can be considered and targeted locally.
- Work with industry and government to develop a recognised ICT Professional status in the same way medics, lawyers, and chartered engineers benefit from a protected status.
- Develop and implement a series of initiatives targeting each individual component of the ICT profession (BoKs, Ethics, Competence Frameworks, and Education and Training). This should connect at an international level to allow cross comparison of ICT professional status, but be delivered and run at a national or regional level. For this to happen IT professional societies must take a leading role. Without their involvement this initiative will fail.

Roles of Key Stakeholders in Implementing this Policy

In order to maximise the impact of the initiatives identified in the mechanism section, key stakeholders will need to be identified, engaged, and their activities coordinated. This section will identify those stakeholders, and the roles they will play in realising the policy recommendations.

- Role of Professional informatics associations/computer societies: Work with other associations at a global and national level to define the nature and structure of an agreeable ICT profession. These associations will also need to work with industry and government to ensure the profession fits with industry, legal, regulatory, and societal requirements.
- Role of European Commission: Facilitate and support the formation on an international knowledge sharing cooperative forum. This will help inform policy in terms of which best practices are suitable for adoption within the EU. This forum should be made up of representatives from all economic regions, and should focus (initially) on identifying appropriate best practices in terms of developing skills, ethics, professionalism, foundational BoKs, and frameworks. This should be established during 2014, and scheduled to meet every 6 months. Provide guidance on the formation, structure and need for the ICT profession. Also support the dissemination of material promoting professionalism across the EU member states. The commission can also act as a catalyst to encourage and facilitate collaboration amongst the member states and key industry leaders.
- Role of Member States: Promote the role of the ICT professional as a rewarding career option for current and potential ICT practitioners. Also, look at ways of formally recognising the status of ICT Professional, much in the same way are medics, engineers, architects etc.
- Role of Industry/ Employers: Work with professional informatics associations to define what is required of a professional in modern society. Industry can also help define the scope of roles that will form part of the profession.
- Role of Education and Training Institutions: These must work with ICT professional societies to define course content in line with professional development. This is a practice that already exists for many engineering, legal, and medical under and

postgraduate courses. By making this link ICT courses will support the progression along the professional path, and create demand for the courses from individuals hoping to progress along that path.

- Role of Social Partners Collaborate: By defining a professional path for ICT practitioners' trade unions and labour relations associations can look at ways for developing pathways into the profession that will support up-skilling and re-training initiatives.

Policy Recommendation 6: Dealing with the risks of a social disruption as a result of the implementation of digital business models.

Identify the main risks of the increasing automation of high value knowledge intensive jobs and the potential shocks to the e-skills market, promoting a socially responsible transition process to a new employment balance

Evidence/ Findings

Recent advances in technology (e.g. high speed internet, cloud) are changing business models in a way that is re-shaping how employees and customers interact with businesses. Recent research by Oxford University and MIT's Center for Digital Business have pointed out the increasing impacts of digital technologies and the automation of some knowledge intensive work is having on skills and employment. Common to these studies is the recognition of the faster than expected change in the profile of skills needed with many skills expected to become obsolete, and the need for investments and innovation in education and training, not only for the ICT sector but across the economy. According to Andrew McAfee, co-author with Erik Brynjolfsson of the MIT studies, there are three possible scenarios of labour market evolution:

1. **A conservative scenario**: whereby a painful transition will end up with a new employment equilibrium, as has already happened with previous technology innovation waves.

2. **A multiple shocks scenario**: in which several waves of innovation will make recovery, re-skilling and re-training extremely difficult, but eventually equilibrium will be reached.

3. **A new world scenario**: where the painful transition will be followed by a new kind of employment equilibrium, with a small group of highly professional jobs and the majority of the population unemployed or working in menial jobs.

As of yet, it is not clear which of these scenarios will prevail. However, what is common to all three scenarios is a painful transition between skills within and across the workforce. This transition will need to be managed and the faster this can be done to achieve a stable state of employment equilibrium the faster economic recovery or stability can be achieved. That said, in order to understand the new skills and employment practices that will be influenced by new technology innovation, a view of areas ICT practitioners currently work in, and type of services and products they deliver needs to be understood. Currently, however there is limited data on the breakdown of skills and roles across the ICT practitioner population, and, therefore, the impact automation and offshoring is going to have, and the impact of existing employment practices is difficult to gauge. This certainly makes it more difficult to manage the transition towards a new employment equilibrium. This challenge is further compounded by the fact that existing employment work practices and policies have not been pressure tested

to see how they help compensate for automation and offshoring practices. Fundamental to surviving this, and future waves of technology innovation is the need to be able to continually sense opportunity and re-skill / up-skill accordingly. Change is inevitable, and must be managed. This is a multi-stakeholder activity where dialogue and transparency are vital. The development of appropriate education and training is important, as is the formation of an ICT profession in order to better understand the ICT skills landscape. However, current and future practitioners, and employers need to be convinced, motivated, and incentivised to take up the challenge of re-training in a way that builds a supply of skills inline with, and possibly even ahead of increasing demand.

Mechanisms

In order to overcome the challenges relating to the race against the machine scenario a number of mechanisms are outline in this section. Although these are presented as discrete actions they should be considered as part of an overall strategy for improvement. No one mechanism will achieve the desired overall objective. Therefore, all recommendations should be considered and implemented appropriately.

- Undertake research on the social and personal costs of the rapid change in demand for existing and future skills. This initiative should also strive to develop understanding and assess the risks related to the increasing automation of knowledge intensive ICT jobs and the implications particularly for the ICT profession.
- Promote an increased awareness of the speed and depth of change in e-skills demand between the social partners and the general population. Also highlight the need to increase investments, both in terms of industry engagement and funding, into education and training to manage the transition.
- Improve the granularity, reliability and comparability of data collection on ICT skills and the impact of related policies at national and EU regional levels.
- Proactively drive to strengthen and maintain social cohesion by:
    - Promoting widespread understanding that a long term focus on growth, employment, and competitiveness, essentially the creation of wealth, is of benefit to the entire economy.
    - Establish training/ re-training opportunities for those social groups that are not part of the key talent pool with a view to removing apprehension that those social groups "will be left behind".
    - Engage with relevant stakeholders to communicate the potential impact of proposed changes, including employers, trade unions, ICT associations, etc.
    - Ensure that dialogue embraces different stakeholders at different levels, including at a local level.

There are some successful initiatives at Member States level in this field, e.g. the Level 8 Conversion Programme and Springboard in Ireland, the ICT Reference Centre Evoliris (Belgium), the Literacy Plan and digital training for Barcelona 2010-2015 (Spain), the First Step and Second Step ICT Training Programmes in Malta, as well as IT 50 plus, Academy Cube and SAP's "Bildungspartner" (Training partner) programmes in Germany.

- Promote and socialise the idea of a global 'ICT professional' at a practitioner level across the EU. Start to get buy-in from those who are actually engaged in developing and delivering ICT products and services and understand what is the 'lowest common denominator' in terms of what practitioners want.
- Ensure the impact of proposed policies on specific populations is predicted and managed throughout the change process, using required metrics.

Roles of Key Stakeholders in Implementing this Policy

In order to maximise the impact of the initiatives identified in the mechanism section, key stakeholders will need to be identified, engaged, and their activities coordinated. This section will identify those stakeholders, and the roles they will play in realising the policy recommendations.

- Role of European Commission: 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. Provide guidance and direction to member states in building effective multi-stakeholder plans to manage the transition to a new employee balance.
- Role of Member States: Work with professional societies, education provides, industry representatives and employee representatives to build a national plan to outline a response to managing the transition to a new employee balance.
- Role of Professional informatics associations/computer societies: 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.
- Roles of Industry/ Employers: 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 and growth at a national, and regional level.
- Role of Social Partners Collaborate: 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 going forward

In conclusion

These policy recommendations are designed to support and develop a capability across the EU to sense and respond to the changes being driven through technology innovation. They focus on the need to build and maintain a relevant skills base that will allow organizations to perform and compete within a digital marketplace. The policies are dependent on stakeholder dialogue and transparency at national, regional, and in some cases global level. The

recommendations certainly call for action around the resolution of some complex issues. However, all the stakeholders are in position, and aware of the issues. What is now needed is the will and guidance to achieve what has been set out in terms of recommendations in this report.

Although there are no explicit timelines identified against the mechanisms or roles, the imperative to resolve the e-skills issue is clear and urgent. The timeline to commence these recommendations starts now. Most of the recommendations talk about a change in the way we assess demand for skills. The ability to do this is going to be an on-going and increasingly important capability for all economic regions, and therefore, there is no completion date against the recommendations. What we are striving for is the development of a responsive, flexible profession, based of a skills base, which can continually flex and respond to an ever changing economic market forces.

CHAPTER 11: CONCLUSION

Introduction

The current international landscape for e-skills and ICT professionalism is one paved with divergent paths and complexity. Given the pervasive role played by technology in all aspects of business operations, the ability to leverage technological innovations plays a distinctive role in business competitiveness in the current dynamic and globalised business landscape. The importance of technology in global economic growth and stability reinforces the need for ICT skills that allow technology to be exploited successfully. However, this report has clearly outlined the many challenges to ensuring the availability of a stream of appropriately skilled workers available at the right time and in the right place.

e-Skills gap

The world is currently confronted with an e-skills gap of growing magnitude. Many countries are reporting difficulties in creating sufficient numbers of workers with the right e-skills, in the right place, at the right time. "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" (World Economic Forum & Boston Consulting Group, 2011). Figures outlining the severity of the e-skills challenge are alarming, with for example, Empirica and IDC (2013) forecasting skills gaps of up to 1.3M practitioners in Europe by the year 2020. Similar e-skill mismatches are reported for the United States, Canada, Brazil, and Australia. The extent of these skills gaps can act as a brake on economic competitiveness and recovery, given ICT's role as an enabler of business value. 70% of the CIOs surveyed "agreed" or "strongly agreed" that a serious ICT skills gap/mismatch is hampering the growth of companies, and approximately 50% of CIOs felt that the lack of high level ICT skills was impacting on their ability to grow their businesses.

Macro-economic trends - Job crises and youth unemployment

At the same time as a shortage of skilled workers being experienced, the world is confronted by a jobs crisis, with in excess of 197 million individuals without a job in 2012. In the advanced economies, over 40 million are unemployed at a time when businesses complain of a lack of skilled workers. The situation is particularly alarming for young people, with for example, more than half of young adults unemployed in Greece, Spain and South Africa. Using figures from ILO, OECD and 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" (The Economist, 2013). The high levels of youth unemployment coincide with reports from many employers that a skills shortage is a cause of entry-level vacancies. More than half of the CIOs surveyed in this study felt that recent ICT graduates lacked the necessary combination of skills to contribute to the business without additional training. Together, these two divergent patterns of youth unemployment and inadequate availability of skilled entry level workers illustrate the nature of the current skills gap, and underline the need to improve skills development for this age group in parallel with efforts to create jobs.

ICT profession immaturity

A contributing factor to the availability of an adequate e-skills supply is the perceived immaturity of the ICT profession compared to other professions. This manifests itself in many ways including, for example, poor public perception of the ICT profession thereby impacting on the numbers entering the profession, and a high rate of ICT project failures. There is also an important international dimension to the challenge of maturing the ICT profession - the fact that ICT practitioners are increasingly working in global teams, operating as parts of distributed global digital value chains. For a profession where standards have not yet been defined and accepted at a national level in many countries, the challenges of dealing with other practitioners across borders with potentially 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 profession.

Societal trends

Additional factors impacting on the e-skills talent pool include the emergence of developing markets such as Africa, the ageing population of many countries that may reflect the requirement for employees to work beyond current retirement ages; and the growth of women in the workplace but their apparent inability to participate in the workforce on an equal footing compared with their male counterparts. For example, 89% of women who voluntarily leave their jobs due to maternity leave want to return to work but only 40% have been able to find full-time, mainstream employment (World Economic Forum & Boston Consulting Group, 2011).

Emerging technological trends

In addition to the existence of an e-skill gap during a period of high unemployment, a wave of emerging and interconnected technological trends, including for example cloud computing, big data, cyber security, social business, mobile technologies and internet of everything, represent important shifts in the application of ICT. Such changes are causing substantial alternations 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 skill sets are required in different locations, and new technologies are demanding changes in the type of skills required. These technological trends are likely to act as further drivers of increased demand for ICT practitioners over the coming years. In this study's survey of CIOs, data visualisation, information security, and user experience design were identified as the skill sets most likely to experience growth in demand. If estimates are to be believed, the growth in demand for skills related to new technological trends in these areas will outnumber the workers with skills that are no longer in-demand. The logical conclusion is to reassign and re-train workers to take advantage of opportunities, and demand the emerging technological areas will create. However, the reality is that doing so will require substantial re-skilling in many instances, and this will demand the engagement of all relevant stakeholders to develop meaningful, pragmatic solutions.

Demand for ICT workers in Europe is likely to change and increase significantly by 2020. Many of the skills currently utilized in the IT units of European organisations will no longer be required/ desired at the current cost levels. The encroachment of automated software and cost arbitrage opportunities from developing countries suggests that the employment outlook for a significant proportion of ICT workers, particularly those working in ICT support, coding

and testing, will be challenging, with these skill sets expected to be ones most likely to be offshored.

The impact of globalisation on ICT delivery – offshoring and global sourcing

The provision of offshore services is not a new phenomenon and essentially comes in two flavours: captive operations and external services provision, both gaining 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, have developed better tools, improved delivery processes (e.g. through CMMI certification), and increased their ambitions, increasingly they have taken on driving operational improvements of complex processes and transforming and standardizing processes for their customers. Over 60% of the respondents surveyed in this study felt that offshoring was likely to have a moderate/high/very high impact on their organizations in the coming years.

Although there is considerable variety in the skill sets 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. Application-based-services is the area where offshoring has been most strongly used in the past decade and this does not look set to change out to 2020. 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. However, the increasing use of automation tools, standardisation of processes and re-use of assets, combined with cloud, brings extra complexity to the offshore global value chain, which should increasingly more correctly be termed a 'global sourcing value chain'. Many of the skills that are based offshore are lower-level skills – but increasingly are also of higher skill and experience levels as companies no longer only look to offshoring tasks for labour arbitrage, but rather for gaining access to skills that may be in short supply locally.

The use of offshoring has important repercussions for the types of skills that are likely to be in demand in Europe in the coming years. However, it is important to bear in mind that even if tasks are undertaken in a nearshore or offshore location, this does not necessarily mean that all the positions onshore are lost. In fact, studies clearly suggest otherwise. Nevertheless, it is important to understand, which skills may be most vulnerable and what to do to up-skill or re-skill these individuals – but the vulnerability will not only be from offshoring. Cloud and automation will also play key roles. Reflecting technological innovation, growth is witnessed in skill sets such as cloud computing, social computing, mobile computing, and big data. The study's survey of senior ICT executives outlined that skills such as information security, enterprise architecture, and ICT supplier management are least likely to be offshored, while skill sets such as coding, software testing, and ICT support are those most likely to be offshored.

The complexity of the global value chain brings requirement for new skills onshore to manage and/or complement the many elements. Managing teams of people (even through a partner), 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.

Requirements for new curricula for future skills and jobs

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 industry demands against the backdrop of newly emerging mega trends in ICT. Higher and executive education institutions are not well prepared to address these issues. The necessary dialogue with industry for agreeing on the industry requirements to be addressed is not in place. The learning objectives of education and training courses to properly address these have not been made explicit and remain diffuse. The development of suitable curricula and courses is still in its infancy. Many universities shy away from new Bachelor and Master programme curricula and course development given the complexity, bureaucracy and time involved for proper certification and accreditation within the Bologna process – a need for action.

This report presents an approach to support 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). In addition, it describes the roles involved as per the existing ICT professional job profiles that build on the e-CF and were developed for CEN (European e-competence Framework, 2014c). 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 (an approach for ICT curricula development is outlined in more detail in a forthcoming publication: Hopi, H., Conboy, K., Donnellan, B., Ramesh, V., Wright, R.T. 'Moving Toward the Next Generation of Graduate Degree Programmes in Information Systems', in: Communications of the Association for Information Systems).

The approach in this report is offered to higher and executive education institutions who may want to use the guidelines and formats to develop courses that fit with the newly emerging skill requirements resulting from the new technology social, economic, and industry 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.

The new skills need to be taught at different levels to ensure their widest possible availability. This is the task of higher education institutions but also those active in executive training and further training. For reasons outlined above, many universities and business schools are not active in this field although there are different ways of teaching skills in newly emerging ICT areas – bypassing the bureaucratic, strongly regulated and long-winded Bologna process. These include the following:

- Teaching new skill requirements as an integral part of already existing 'Informatics' or 'computer science' study programmes, offering them as 'tracks' in different master's programmes during the Masters studies (or in the last year of the Bachelor study) as per universities in Germany, Finland and the United Kingdom (Technical University Berlin is a good practice example)
- Non official degree programmes (titulo propio) offered in cooperation with industry next to the strongly regulated official Bachelor and Master degree studies, resulting in a university certificate in countries like Spain (University Valencia is a good practice example)

- 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' (INSEAD, Fontainebleau is a good practice example).

Different good practices have been identified and described. In addition, MOOCs could be seen as an add-on that may increase the reach of and access to appropriate educational offerings and thereby more quickly spread the required skills.

E-skills policies in the EU

The far-reaching impact of mismatches and shortages of ICT professionals on society, employment, and the future economy, points to the urgency of developing the currently fragmented ICT profession in Europe. Yet few EU Member States consider ICT Professionalism to be a high policy priority. Those policies that do address relevant elements fail to establish performance metrics that would allow objective evaluation of their impact. Without such data, Member States have subjective views of their own policies and in the absence of granular and comparable labour market monitoring systems, the transfer of successes from one Member State to another is inhibited.

Nonetheless there are clear indicators of where Member States would be best served in focusing their policy efforts. Reforming curricula to include an early focus on computer science and computational thinking in tandem to ensuring teacher training contains the necessary skills to embed ICT into pedagogy are two measures believed to have a high, if long-term, value for the profession.

Wide-scale member state adoption of frameworks such as the e-CF can facilitate mobility, help map people to jobs and serve as the competence-based common language for up-skilling and re-skilling current roles that may become marginalised due to automation or off-shoring. Skills sector councils, working with professional bodies and effective labour market monitoring can enable governments to develop informed and agile responses to the sector's needs. Such agile responses could include immigration policy reform as source of talent. Additionally, transversal polices to build a gender-balanced profession coupled with providing a positive high profile image of ICT roles can bring clear results.

Some good policies already exist but examples their application is ad hoc and sporadic. In general policies lack scale, transferability and critically, therefore, they fail get to get the policy priority needed to stave off future storages and develop the profession in Europe.

Policy recommendations

A series of new policy recommendations to enable Europe to better respond to the challenges relating to ICT professionalism and globalization in the longer term were presented in this study. Conclusions in relation to these policies are outlined in this section. Specifically these policies are designed to support and develop a capability across the EU to sense and respond to the changes being driven through technological innovation. The policies are dependent on stakeholder engagement, dialogue, and transparency at a national, regional, and in some cases, a global level.

- Policy Recommendation 1 - World-class e-skills excellence: The new wave in 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 failure to attract and retain women to ICT careers is having a serious effect on the skills gap and must be addressed as a priority.
- Policy Recommendation 2 - Foster entrepreneurship, innovation, and jobs creation in Europe through the promotion and development of e-leadership skills: Technology in itself will not drive innovation and growth unless organizations are given the necessary skills and tools to start driving initiatives that leverage these digital technologies. Therefore, there is a real and urgent need to promote digital entrepreneurship in Europe**.** For effective e-leadership, the skills required are seen as 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.
- Recommendation Three - Promote SMEs competitiveness and integration into global digital value chains: SMEs need to understand the implications of the global sourcing model and what it means in terms of their own competitiveness. A failure for SMEs to realise and react to the implications of global sourcing, in terms of automation and the movement of low-skilled ICT tasks off shore, will have a significant impact on the jobs profile across Europe. It is therefore, essential, that SMEs are enabled and empowered to fully utilise these new opportunities through appropriate training and support mechanisms. This can be achieved through developing SME clusters within different member states that support key critical skills.
- Recommendation Four – Foster mobility and become a magnet for Talent: This policy recommendation specifically relates to the identification and attraction of ICT related talent to the EU. Becoming a talent magnet for all skills will not be practical. Therefore, regions need to understand what industry sectors they wish to develop, and then focus on the skill sets required to achieve excellence in these areas. Universities and providers of academic and professional training will need to be part of this process as they will need to develop the mechanisms to provide the skills.
- Recommendation Five - Support a Global ICT profession: Due to the nature of global business, ICT practitioners are being required to increasingly work in global virtual teams as part of global digital value chains. They are increasingly delivering global solutions that transcend international borders, cultures, and work practices. This has resulted in the development of multiple competence frameworks, educational standards, code of ethics, and bodies of knowledge. This lack of coherence, which exists at a global level hinders progress in fostering ICT as a more mature global profession. It needs to be addressed as a global initiative through dialogue and cooperation.
- Recommendation Six - 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 re-shaping how employees and customers interact with businesses. This change in the profile of required skills will result in many skills becoming obsolete which presents serious challenges to workers who have those skills, and has the potential to reduce social stability. There is a need for investments and innovation in education and training, not only for the ICT sector but across the economy, to manage this transition for workers and to mitigate as far as possible, any negative social effects.

Concluding remarks

A lot of work to address the shortage of e-skills is being carried out not only across the EU, but across other major economic regions. Through a number of interactions with representatives from stakeholder groups across all the major economic regions it is clear that the concerns and challenges addressed in this report are shared, understood, and agreed. However, the manner in which they are being tackled in disconnected, with initiatives being developed at local levels to resolve what are perceived to be local problems. This is at the crux of the issue, because although the shortage in skills is being felt at a local level, the problem is truly global. Therefore, an awareness of how stakeholder groups are mobilising and developing mechanisms to resolve the issues of skills shortages needs to be developed, and quickly. If one accepts that knowledge is the true currency of the 21st century the skilled work force will be the main enabler for competitive growth and sustainable competitive advantage. Therefore, any initiatives to build such a work force need to be matched to the current and future demand for such skills. However, this relationship is not simply a case of supply and demand. Technology is not only changing the skills sets now required to contribute to economic growth, but also the way we interact, our work practices, and how we engage with our customers, and how we learn. Therefore, Industrial and social policies need to flex and respond proactively to these changing conditions. The issue of skills is now defining a very complex relationship between multiple stakeholders or which the actual worker is but one participant.

How we respond to the challenges facing us will depend on how quickly we can mobilise the key stakeholders identified in this report. The policy recommendations, outlined in this report, provide a starting point for stakeholders to rally around, and an initial road map to start proactively managing the complex relationships and issues being shaped by the skills shortage. What is certain is that this will require active participation by stakeholders at a local, regional, national, and in some cases international level. The components needed to resolve the skills shortage issues are already largely in place, what is now needed is the collective cooperation and focus of the stakeholder community to proactively drive the necessary changes.

APPENDICES

APPENDIX A: COUNTRY PROFILES

European Country Profiles

Country Profile Template			COUNTRY	AUSTRIA
			POPULATION	8,443,018 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Federal Ministry of Science, Research and Economy	http://www.en.bmwfj.gv.at/Seiten/default.aspx	Vocational training, economic policy
		Federal Ministry of Science, Research and Economy	http://bmwf.gv.at/home/	University level education
		Federal Ministry for Education, Arts and Culture	http://www.bmukk.gv.at/enfr/min_en/index.xml	School education and further education
		Federal Ministry for Transport, Innovation and Technology	http://www.bmvit.gv.at/en/	FIT-IT ICT Research programme
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific	No specific agency responsible		

	agency responsible".			
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Austrian Computer Society OCG (Österreichische Computer Gesellschaft OCG) App. 1800 members	http://www.ocg.at/	The objective of the Austrian Computer Society (OCG) is the comprehensive and interdisciplinary promotion of information processing, with due regard to its effects on man and society. To achieve this, the OCG undertakes the following: • It serves as the focal point of associations, organisations, and institutions in Austria involved in information processing (institutional members). • It represents Austria to CEPIS (Council of European Professional Informatics Societies) and IMIA (International Medical Informatics Association) and IFIP. • It provides services, information and consultation for its members. • It promotes research and development projects, especially those of an interdisciplinary nature. • It has established several Working Groups dealing with specialized aspects in the field of information technology. It organizes international conferences and congresses and supports its member institutions in organizing such events.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their	None		

	work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	ÖGB (Österreichischer Gewerkschaftsbund)	www.oegb.at	The Austrian Trade Union Federation and its member unions represent the economic, political, social and cultural interests of all employees against employers, government and political parties. ÖGB has 1.2 million members.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	WKÖ Wirtschaftskammer Österreich UBIT, Fachverband Unternehmensberatung & IT	http://portal.wko.at/wk/startseite.wk www.ubit.at	Austrian Chamber of Commerce IT subgroup of WKÖ (Austrian Chamber of Commerce)
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Multi-stakeholder partnership: Internetoffensive	http://www.internetoffensive.at	Cooperation of governmental and industrial partners to enhance ICT technology in Austria. Education is a part of this initiative
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries.	eFIT21	http://www.efit21.at/	National ICT Strategy New technologies and digital media are changing teaching and learning sustainably. “efit21 – digital Agenda for Education, Arts and Culture” is putting

	E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	eEducation	http://www.eeducation.at/	the focus on priorities in the application and use of new information and communication technologies in the Austrian education, arts and cultural facilities. e-Learning initiative aimed at the digital literacy of students in the entire school system - to strengthen - from elementary school to university. Part of eFIT21
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	None		
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Some examples OCG (Austrian Computer Society) TUV CIS Complete list of accredited certification bodies:	www.ocg.at www.tuev.at http://at.cis-cert.com/ http://www.en.bmwfj.gv.at/technicalaffairsandsurveying/Accreditation/Seiten/ListsofbodiesaccreditedbytheFeder	ICT skills certification, ECDL Technical certification, quality management systems ISMS

			alMinistryofEconomy,FamilyandYouth.aspx	
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Österreichischer Akkreditierungsrat Fachhochschulrat Federal Ministry	www.akkreditierungsrat.at www.fhr.ac.at http://www.en.bmwfj.gv.at/technicalaffairsandsurveying/Accreditation/Seiten/default.aspx	Accreditation of private universities Accreditation of "Fachhochschulen" (Universities of applied sciences) Accreditation for certifying bodies
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education (2012) Number of private education providers for ICT education (2012)			About 1000 CS graduates per year (bachelor) More than 500000 participants in ECDL programmes (6% of population) 19 tertiary state education institutes for ICT education About 200 private education providers in ICT education
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and	Bildungsstandards	http://www.bmukk.gv.at/schulen/unterricht/ba/bildungsstandards.x	Framework for Schools, defining standards for different subjects and ages (e.g. Informatics/IKT for 14 year old pupils) development/ implementation

	proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.		ml	process is ongoing. In the spring of 2013, educational standards were raised nationwide for the first time at the elementary schools.
Promoted By	Body promoting/advocating the above skills framework.	BMUKK (Federal Ministry for Education, Arts and Culture)	http://www.bmukk.gv.at/enfr/min_en/index.xml	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	No special code of ethics		The law defines the code of conduct
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Universities		

CONTACTS		
Type	**Guidance**	**Specifics**
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Mr. Gerald Futschek, dk@dke.univie.ac.at, Österreichische Computer Gesellschaft (OCG) Mr. Ronald Bieber, dk@dke.univie.ac.at, Österreichische Computer Gesellschaft (OCG)
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	Professionalism is not a used term in Austria; it is also a discussion if the correct translation to the German language is “Professionalität” or “Professionalismus”. “Professionalität” does not fit perfectly. “Professionalismus” is not used. In Austria we do not have a culture of accreditation. Universities and schools are usually owned by state and are not accredited; only “Fachhochschulen”, private schools and private universities have to be accredited.

Country Profile Template			COUNTRY POPULATION	BELGIUM 11,094,850 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education and Training (Flemish) Ministry of Employment, Labour and Social Dialogue (Federal) Minister for SMEs, Self-Employed, Agriculture and Science Policy (Federal) Minister of Enterprise and Simplification (Federal)	http://www.ond.vlaanderen.be/dvo/english/index.htm http://www.emploi.belgique.be/home.aspx http://www.belgium.be/en/ http://www.belgium.be/en/	Flemish agency for quality assurance (Agentschap voor Kwaliteitszorg in Onderwijs en Vorming, AKOV). Federal Public Service Employment, Labour and Social Dialogue deals with areas as diverse as labour, collective relations, standards of welfare to work, etc. as well as offering a variety of information services and documentation to the public.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas.			No specific agency responsible

	If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".			
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Federation of Belgian Informatics Associations (FBVI-FAIB)	http://www.bfia.be/	CEPIS Member Society for Belgium
		Agoria	http://www.agoria.be/	Agoria is Belgium's largest employers' organisation and trade association. The companies represented by Agoria are active in 13 branches of the technology industry. Agoria provides services for its members on international business development and specialized clubs which focus on enhancing business opportunities for its members.
		SAI	www.sai.be	SAI is a non-profit that aims to target computer scientists and information specialists. The association exists since 1966/1967 and currently has 1000 members. SAI organizes evening conferences, workshops, courses, and special events and various trainings.
		BMIA	www.bmia.be	BMIA is the Belgian Medical Informatics Association and offers information about medical informatics and organises events relating to medical informatics.
		CIO Forum	www.cioforum.be	The CIOforum is a networking community where professionals can share knowledge and collaborate with peers on strategic IT issues. The CIOforum was created to allow members to ask and share information to the benefit of the entire Belgian IT

				community. The CIOforum provides a network to address the issues and trends that IT professionals face, in an increasingly changing business environment. They organize networking events and provide an interactive social platform to bring IT professionals together in an open and trustworthy community.
		K VIV (Koninklijke Vlaamse Ingenieursvereniging /Royal Flemish Society of Engineers)	http://www.kviv.be/default.aspx	The Royal Flemish Society of Engineers (KVIV), founded in 1928, is a membership association of and for bio-and civil engineers.
		ISACA (Belgian Chapter)	http://www.isaca.org/chapters5/belgium/Pages/default.aspx	The ISACA Belgium Chapter is a not-for-profit association established in Belgium and is part of the global ISACA membership association. ISACA Belgium's aim is to sponsor local educational seminars and workshops, conduct regular chapter meetings, and help to further promote and elevate the visibility of the IT audit, IT governance, IT risk and information security profession throughout Belgium.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Agoria	http://www.agoria.be/	Agoria is Belgium's largest employers' organisation and trade association. The companies represented by Agoria are active in 13 branches of the technology industry. Agoria provides services for its members on international business development and specialized clubs which focus on enhancing business opportunities for its members.

Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Confederation of Christian Trade Unions (ACV/CSC) General Confederation of Liberal Trade Unions of Belgium (ACLVB-CGSLB) General Federation of Belgian Labour (ABVV/FGTB)	http://www.acv-csc.be/ http://www.aclvb.be/index.php?st=home&st1=&st2=&st3=&st4=&st5=&taal=en http://www.abvv.be/	The ACV/CSC has 22 regional federation and 16 sectoral unions, with a membership of 1.7 million (almost 16% of the total Belgian population). It was founded before the turn of the 20th century, and represents 230,000 workers. It organizes unions directly, without an occupationally based union structure. A socialist national trade union federation in Belgium. It was founded in 1898 and took its present name in 1937. It is affiliated with the International Trade Union Confederation and has a membership of almost 1.2 million.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Belgian Chambers (Federation of Belgian Chambers of Commerce and Industry)	http://www.belgianchambers.be/en/homepage_84.aspx	The Federation of Belgian Chambers of Commerce is the umbrella organisation for all chambers of commerce in Belgium. In addition, it represents the interests of 31 Belgian-Luxembourg chambers of commerce abroad. Through its accreditation programme, the Federation ensures the Belgian companies a quality service by its members.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, and international collaboration initiatives.	Agoria e-Skills Interface3	http://e-skills.agoria.be/ http://www.interface3.be/	Online e-Skills platform Interface3 is working to expand and diversify the fields of professional women and enable them to build foundations effective for a career in a labour market in which computer skills are an asset.

Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Information and Communication Technology Federal Public Service (FPS)	http://www.fedict.belgium.be/en/	Fedict – the Federal Public Service for Information and Communication Technology – was set up in May 2001 and became fully operational in 2002. As a federal public service, Fedict defines and implements the federal e-government strategy. It uses innovative information and communication technology (ICT) to help the various federal public services to improve their service portfolios and tailor them to meet the needs of the general public, businesses and civil servants.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Belgium (German) Belgium (Flanders)	N/A http://www.ond.vlaanderen.be/	Similar to the UK, Belgium is seeing the development and implementation of more than one NQF. The German speaking community has not taken any initiative to develop an NQF. On 30 April 2009 the Flemish Parliament and Government in Belgium adopted an Act on the qualification structure (kwalificatiestructuur) introducing a comprehensive qualification framework. While the Flemish framework is seen as a precondition for referencing to the EQF (8 level structure adopted), it is primarily an instrument for improving the national qualifications system. It is an integrated framework for professional qualifications and educational qualifications at all levels, including educational qualifications of higher education. The 2009 Act defines the Flemish qualification structure (FQS) as 'a systematic classification of recognised qualifications based on a generally

				adopted qualifications framework (FQF)'.
		Belgium (Wallonia - French)	http://www.febisp.be/view/fr/FeBISP/Reseautage/Mandats/SFMQ_mandat.html	The French speaking communities have also begun NQF development. Suggestions have been made, following a change of government, to build a framework on the principles outlined in Flemish qualifications framework (see above). A national coordination point for the EQF referencing will be established from September 2010. This NCP is under the responsibility of the Service francophone des metiers et des qualifications (SFMQ).
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Major vendor certification activity including Microsoft, CISCO, CompTIA, Xerox, HP, IBM		
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	NVAO (Nederlands-Vlaamse Accreditatieorganisatie)	www.nvao.net	The quality assurance of higher education qualifications from level five to level eight is followed up through the NVAO (Nederlands-Vlaamse Accreditatieorganisatie). The NVAO is the accreditation organisation of the Netherlands and Flanders for higher education established by an international Treaty.
		Agentschap voor Kwaliteitszorg in Onderwijs en Vorming (AKOV)	http://www.ond.vlaanderen.be/wegwijs/AKOV/	Flemish agency for quality assurance (Agentschap voor Kwaliteitszorg in Onderwijs en Vorming, AKOV).
		As above	As above	The EQF coordination point was designated in February 2010: it is the new Flemish agency for quality assurance (Agentschap voor Kwaliteitszorg in

				Onderwijs en Vorming, AKOV).
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			Estimated number of computer Science graduates/year: approximately 300 Estimated number of "ICT" graduates/year: 1000-1800 Estimated number of private education providers for ICT education: approximately 350
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	SFIA	http://www.sfia.org.uk	
Promoted By	Body promoting/advocating the above skills framework.	SMME	http://www.smme.com	SMME is an accredited training provider of IT management and control frameworks in the US, Europe and the Middle East. It focuses on IT process frameworks which organisations use to develop world-class IT services.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring	None		

	and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	ADM Code of Conduct for Information Managers	http://adm.be/downloads/	ADM Code of Conduct for Information Managers. The code is aimed at helping companies to write their own regulations or recommendations.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Vlerick Business School	http://www.vlerick.com/en/programmes/management-programmes/ICT-Business-Process-Management	Various management Programmes in ICT & Business Process Management
		Antwerp Management School	http://www.antwerpmanagementschool.be/en/our-programs/masters-for-professionals.aspx	Various Masters and Executive Masters programmes, e.g. IT Architecture, IT Governance and Assurance, Information Security Management
		Facultés universitaires Notre-Dame de la Paix	http://www.unamur.be/en/teaching	Various Masters programmes including Advanced Masters in the Law of Information Communication Technologies
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry	Dirk Deschoolmeester, Chairman of the Federation of Belgian Informatics Associations (FBVI-FAIB)		

	and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Dirk.Deschoolmeester@ugent.be Frank Robben, Secretary General, SMALS – ICT for Society, https://www.smals.be/fr/contact
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template		COUNTRY	BULGARIA
		POPULATION	7,327,224 (Estimate 2012)

GENERAL/INSTITUTIONAL

Type	Guidance	Name	Website	Specifics
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education, Youth and Science Ministry of Transport, Information Technology and Communications	http://www.mon.bg/en/top_menu/vocational_education/ http://www.mtitc.government.bg	Provides links regarding general, vocational and higher education. Also provides links to documents related to EQF/NQF -- for national qualification framework. The Minister of Transport, Information Technology and Communications implements the state policy in the field of transport, information technology, communications and e-governance. Three directorates are working in the field of ICT: Information Technology (IT) Directorate: Communications Directorate; and E-Governance Directorate. These directorates develop the policy, strategies, programmes and plans in the field of information technologies, communications and e-governance. The IT Directorate is responsible for pursuing the policy in information society development in coordination with other line ministries. It coordinates and monitors the development and implementation of programmes and projects in the IT area, particularly the ICT theme in FP7, the PSP Programme in CIP, the National Broadband Strategy and related projects.

				The Communications Directorate is responsible for pursuing the policy, as well as harmonizing the legal framework in electronic communications and postal services with the acquis communitaire, and for managing of the radio frequency spectrum. The e-Governance Directorate is responsible for developing and implementing the e-governance policy in coordination with the line ministries. It coordinates the implementation of the National e-Governance Strategy and implements a series of e-governance projects funded by the Administrative Capacity Operational Programme. The Ministry works in close cooperation with the ICT sector which is represented by the branch organizations in the Consultancy Board on the issues of electronic communications, postal services, information society and e-Governance.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".			
Professional Bodies/National Computing Associations	Provide names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your	Union of Automation and Informatics (UAI)	http://www.sai.infotel.bg	UAI's objectives are: 1. To join the efforts of its members to take an active part in decision making and activities related to progress in economics, scientific studies and their applications in the country, in the name of national

	country.			prosperity and universal human values. 2. To represent and defend the creative professional interests and the public prestige of its members before state, social and business institutions in the country and abroad. 3. To create conditions for its members to increase constantly their knowledge, qualifications and professional skills. 4. To represent the community of specialists of automation and informatics in similar international and foreign organizations and to assist in making and developing active contacts in international scientific life. UAI is the national representative to and member of CEPIS.
		Bulgarian Academy of Sciences (BAS)	http://www.bas.bg/cgi-bin/e-cms/vis/vis.pl?p=0200	The leading national research center of excellence with several institutes and research units in the informatics field. (Not exactly a "professional society" as many understand the term but certainly a player in informatics related activities).
		Bulgarian Association of Information Technologies (BAIT)	http://www.bait.bg/	The Bulgarian Association of Information Technologies (BAIT) is an organisation in the field of information and communication technologies in Bulgaria. **Established** in 1995 it currently members of 99 companies directly. The association includes companies from all sectors of information and communication technologies - hardware, software, systems integration, networking, telecommunications, Internet service providers and others. A majority of them offer their own solutions, products and services and successfully operate in foreign markets.

Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Federation of Scientific and Technical Unions of Bulgaria (FNTS) Statutes including aims and scope Union of Scientists in Bulgaria Confederation of Independent Trade Unions in Bulgaria Confederation of Labour "Podkrepa"	http://www.fnts.bg/en/about_us_en.php info@fnts-bg.org http://www.fnts.bg/en/doc_en/statute.pdf http://www.usb-bg.org/English/english.htm http://www.knsb-bg.org/ http://www.podkrepa.org/content/	The Federation of scientific and technical unions in Bulgaria /FNTS is a non-profit, non-government, non-political, creative-professional association and is a part of the civil society. The main aim is to assist the advancement of science and higher education in the country, to promote their prestige and contribution to the prosperity of the Republic of Bulgaria. The USB participates as an independent partner and consultant to the Law- and Decision-makers in the elaboration and implementation of the national strategy for the development of science and higher education. The USB voices and protects the rights and interests of its members and assists their innovative and professional activities.

Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Bulgarian Chamber of Commerce and Industry (BCCI) Bulgarian Industrial Association	http://www.bcci.bg/ http://www.bia-bg.com/	The BCCI's mission is to: Preserve the stability of the Bulgarian economy, improve the business conditions and the attractiveness of the economic environment in the Republic of Bulgaria; Curtail the consequences of the world economic and financial crisis for Bulgaria and ensure a speedy economic recovery in its aftermath; Secure the stability of the country's energy system; Improve trilateral cooperation, inclusive of achieving a better balance in the relations between workers/employees and employers, and shared rights and responsibilities for the firm's economic results; Preserve the BCCI's capacity, and optimize and enhance the efficiency, types and quality of the BCCI's services and its role in upholding the business circles' interests.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			

Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	In progress		Working towards EQF
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Certification BureauVeritas ECDL Bulgaria	http://certification.bureauveritas.bg http://www.ecdlbg.org/	They certify organizations in: ISO 9001, ISO 14001, ISO 22000 (HACCP), OHSAS 18001, ISO 27001, ISO 16949, TL 9000, EMAS, BRC / IFS, TAPA, SA 8000. They also have global and network accreditations. They qualify auditors, classify organizations by industrial codes, define the time for audit, etc. ECDL Bulgaria is the certifying authority of the leading international computer skills certification programme – ECDL / ICDL in Bulgaria
Accreditation	Provide list and **brief** summary of Bodies	VET Accreditation	http://www.mon.bg/o	

Bodies	responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.		pencms/export/sites/mon/en/top_menu/vocational_education/presentation_VET-system_BG.pdf	
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	None		
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant			

	jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Union of Scientists in Bulgaria	http://www.usb-bg.org/English/english.htm	This body has an Ethics Committee
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Yoshinov Radoslav, yoshinov@live.com, Union of Automation and Informatics (UAI)		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the			

	landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	CROATIA 4,398,150 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Science, Education and Sports	http://www.vlada.hr/en/naslovnica/o_vladi_rh/ministarstva_djelatnosti/ministarstvo_znanosti_obrazovanja_i_sporta	The Ministry of Science, Education and Sport is in charge of administrative and other activities relating to the following: preschool education, elementary school and secondary education in the country and abroad; curriculum; textbooks, educational standards; development of the educational system; professional education and permanent education of kindergarten and school teachers; student standards; inspection and professional and pedagogic control; establishment of educational institutions and control of their compliance with the laws; securing financial and material conditions for work in education; qualifying the children, youth and adults for acquiring technical knowledge and skills, and activities of various associations in its domain.
		Ministry of Public Administration	http://www.vlada.hr/en/naslovnica/o_vladi_rh/ministarstva_djelatnosti/ministarstvo_uprave_1	The Ministry also performs tasks related to: monitoring and coordination of projects in the ICT field implemented in state administration bodies; participation in the adoption and monitoring of the execution of laws and other regulations in the ICT field in the Republic of Croatia; promotion and systematic improvement of the construction of the internet infrastructure in the Republic of Croatia, public access to Internet services and contents, development of the application of ICT and the

		Ministry of Social Policy and Youth	http://www.vlada.hr/en/naslovnica/o_vladi_rh/ministarstva_djelatnosti/ministarstvo_socijalne_politike_i_mladih	systems of e-Government, e-Education, e-Health and e-Business.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Agency for Vocational Education and Training and Adult Education	http://www.aoo.hr/default.aspx?id=100	Mission: To make education the strongest root of personal growth and success. Strategic Goals: Develop qualifications based on competences and learning outcomes; Continuous alignment of education with Labour Market Needs; Build VET system that enables lifelong learning and mobility; Define roles of teachers in learning outcomes oriented system; Establish quality assurance system.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Croatian Information Technology Association (CITA)	http://www.hiz.hr/	Croatian Information Technology Society is an umbrella association of independent professional institutions and individuals interested in the development, promotion and improvement of the use of information and technology related to the Republic of Croatia is a member of CEPIS , IFIP, IT-old and ECDL Foundation
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Croatian Employers' Association in ICT (CEA – ICT)	http://www.hup.hr/	Croatian Employers' Association (CEA) is a voluntary, non-profitable independent employers' association, founded in 1993. CEA mission is to improve entrepreneurial and investment climate in order to strengthen Croatian economy competitiveness. CEA has 25 industrial associations, with 5,000 members employing 400,000 workers.

		Croatian Chamber of Economy	http://www.hgk.hr	The Croatian Chamber of Economy (CCE) is an independent professional and business organization of all legal entities engaging in business, established in 1852. Every company registered with the Commercial Court is a member of the CCE consists of the Headquarters in Zagreb and 20 county chambers. CCE includes 55 professional associations, 88 groups and 35 affiliations. CCE manages various databases on companies, registered within the Republic of Croatia. There are several databases: Croatian Companies, Import-export companies, Estate Brokers, Real Estate Agents, Register of Direct Sales Exchange of Goods and Services, Movable and Immovable Assets, sold in distrait and bankruptcy proceedings, The single point of contact - Details about all the above services are available on the website of the CCE (www.hgk.hr), from the Business Information Centre (poslovne-informacije@hgk.hr) or on free-of-charge info telephone number 1852.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Union of Autonomous Trade Unions of Croatia (SSSH)	http://www.sssh.hr/hr/	SSSH is recognized as the principal voice of Croatian trade unionism. It was founded in May 1990, and represents around 1/5 of organized workers in the country. It has 18 affiliated industrial unions.
Best Practices	Are there any specific examples of best			

	practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Croatian Qualifications Framework (CROQF)	http://public.mzos.hr/lgs.axd?t=16&id=17399	Croatia adopted its National Qualifications framework Law on 8th of February 2013 and is currently developing secondary legislation in order to the system to be fully functional by the end of 2014. Within its NQF, Croatia will build total of 26 sectors including one for ICT (and electro-technics). The NQF is a voluntary instrument linked to the EQF and covers the whole educational system starting from 1st till 8th level.

Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Croatian Information Technology Association (CITA)	http://www.hiz.hr/	In terms of Croatia's recent entry into the European Union one of the most important activities is the introduction of IT education at all levels of education system. Recommendation of the European Union that all residents must be trained in the use of information technology. Also, concerns about the IT profession and IT professionals are of the utmost importance, which includes the identification of core and specialist knowledge, and educational components in preparation for certification. The goal is to protect IT professionals and to increase their value in the labour market, reduce their disadvantages, and to better regulate the labour market ICT through systematization of professional competence. The Croatian Information Technology Society manages is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Croatia.
		International certification available through providers such as VUE and Prometric		It is possible to get certification for number of ICT areas through existent network of testing centres operated by local providers and being members of VUE or Prometric global networks.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Currently there is no national Accreditation Body relevant to ICT		Within the Croatian Qualifications Framework there is a possibility to set up accreditation and 'Recognition of Prior Learning' validation bodies. It is expected that the Accreditation Body will take the form of national Agency while there will be a number of private validation/certification providers, providing different certificates to citizens and professionals as a result of successful validation/certification process.

Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			Currently no national Skills frameworks but some higher educational institutions and some VET providers used EU E-competence framework 2.0 in order to build their Qualifications.
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any.			None so far but there is an idea to set up ICT Chambers in order to regulate ICT profession and increase both quality and knowledge of professionals.

	Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Croatian Information Technology Association (CITA) Code of Ethics	http://cepis.org/media/Eticki_kodeks_HIZ-a_2012_12_121.pdf	
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			International BoKS are being used in some areas relevant to ICT (like PM BoK for project management), and other in most cases vendor provided references.
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Hrvoje Balen (hrvoje.balen@algebra.hr) Tomislav Vračić (tomislav.vracic@e-hrvatska.hr) Vedran Mornar (vedran.mornar@fer.hr)		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	The NQF and 'Recognition of Prior Learning' validation might be strong points in shaping future qualifications in respect to international frameworks and BoKs. On the other hand if idea of setting up ICT Chambers is implemented, it could positively influence the development of professionalism in ICT.		

Country Profile Template			COUNTRY POPULATION	CYPRUS 862,011 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Department of IT Services	http://www.mof.gov.cy/mof/dits/dits.nsf/index_en/index_en?OpenDocument	Government body responsible for the promotion and application of Information Technology and e-Government in the Public Sector.
		Ministry of Education and Culture of Cyprus	http://www.moec.gov.cy/	Education Web Portal School (DIAS)
		Ministry of Labour and Social Insurance	http://www.mlsi.gov.cy/mlsi/mlsi.nsf/index_gr/index_gr?OpenDocument	Department of Labour, oversees employment and labour market issues
		Ministry of Communications and Works	http://www.mcw.gov.cy/mcw/mcw.nsf/index_gr/index_gr?OpenDocument	
		Pedagogical Institute of Cyprus	www.pi.ac.cy	
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with	Department of Electronic Communications	http://www.mcw.gov.cy/mcw/dec/dec.nsf/dmlindex_gr/dmlindex_gr?OpenDocument	The Department of Electronic Communications (DEC) (formerly Directorate of Telecommunications) of the Ministry of Communications and Works was established in 2003 and it has responsibilities in Radio-communications, Electronic Signatures, Information Society and Space issues

	responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Commissioner of Telecommunications and Postal Regulations	www.ocecpr.org.cy	In the framework of harmonizing the Cyprus law with the European acquis communautaire for the deregulation of the sectors of electronic communications and postal services, Cyprus since 2002 has introduced through the establishment of the Office of the Commissioner of Electronic Communications and Postal Services the regulation of the above named sectors
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Cyprus Computer Society (CCS)	http://www.ccs.org.cy	The Cyprus Computer Society (CCS) was established in 1984 and today it numbers more than 1000 members. CCS is the national member society of CEPIS. As a not-for-profit organization, the CCS is seeking to improve and promote high standards amongst informatics professionals, in recognition of the impact that informatics has on employment, business, society as well as on the quality of life of the citizen. The CCS plays a key role in linking Academia with the Profession through the promotion of key elements of Informatics, in particular in the areas of digital literacy, professional skills, professionalism, education, training and research.
		Cyprus Scientific Technical Chamber	www.etek.org.cy	The Cyprus Scientific and Technical Chamber (ETEK) is the statutory Technical Advisor to the State and is the umbrella organisation for all Cypriot Engineers.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Cyprus IT Enterprises Association	www.citea.net	Involved in closely observing the rapid changes of IT in the global arena with the purpose of introducing and adopting them to the Cyprus market.

Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Pancyprian Workers Federation Cyprus Workers Confederation Democratic Workers Organisation of Cyprus	www.peo.org.cy www.sek.org.cy www.deok.org.cy	These are the local workers union's federations. They are usually represented in various committees and boards of organizations such as the Human Resources Development Authority. Although they didn't demonstrate any serious activity in the ICT field/industry they have been influential with the governments
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Cyprus Chamber of Commerce and Industry Cyprus Employers Federation	http://www.ccci.org.cy/ www.oeb.org.cy	The Cyprus Chamber of Commerce and Industry is a private corporate body functioning under special law and is financially independent, free of any influence by the state. The Chamber is funded by its members' subscription fees and through income generated from a number of services it provides. The Cyprus Employers and Industrialists Federation (OEB) OEB is a pan-Cyprian independent organisation comprising of more than 55 of the main professional/sectoral associations as well as hundreds of companies from the Manufacturing, Services, Commercial, Construction and Agricultural Sectors. In total, OEB has more than 4,500 Member/ Enterprises.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration			

	initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Cyprus Productivity Centre e-Volve Project	http://www.mlsi.gov.cy/mlsi/kepa/kepa_new.nsf/All/1B6806CB0FBF2AC2C2257824004B3B0F	The "e-Volve Project" is implemented by the Cyprus Productivity Centre within the framework of the European Social Fund since March of 2010. For the Period 2010 - 2013 approximately two thousand five hundred SMEs will receive Training and Consultancy Services on E Business issues. During the Implementation of the Project, An E-Business awareness campaign will run in order to promote e-business practices in the business world and to the general public .The campaign will include, among other initiatives, the production of educational films, through which the available e-Government services, e-Banking, e-Learning and other e-Business good practices will be presented and promoted.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Human Resources Development Authority	www.hrdauth.org.cy	HRDA's mission is to create conditions for the planned and systematic training and development of human resources of Cyprus, at all levels and in all sectors, to meet the needs of the economy within the social and economic policies.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	KYSATS: Cyprus Council for the Recognition of Higher Education Qualifications	www.kysats.ac.cy	KY.S.A.T.S. (Council for the Recognition of Higher Education Qualifications) is the Competent Authority for the recognition of Titles (or Degrees) which were awarded from institutions of Higher Education recognized in the country they operate. It serves the role of the National Academic Recognition Information Centre (NARIC) for Cyprus

		ECDL Cyprus	http://ecdl.com.cy/	ECDL Cyprus is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Cyprus
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Cyprus Computer Society	www.ccs.org.cy	
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)		http://www.cystat.gov.cy/mof/cystat/statistics.nsf/index_en/index_en?OpenDocument	There are 3 public universities that offer BSc, MSc and PhD in ICT related programmes. There are 3 private accredited universities that offer BSc, MSc and PhD in ICT related programmes. There are two private universities for which accreditation are still pending. A number of private colleges also offer one or two year programmes in ICT related fields. National statistics in Cyprus are compiled by the Republic of Cyprus Statistical service.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those	ECDL Cyprus	www.ecdl.com.cy	The ECDL - European Computer Driving Licence - is an internationally-recognized standard of competence, a widely acceptable certificate that asserts that the holder has the knowledge and skills

	competencies. Provide name and **brief** details of this framework, if relevant.			needed to use the most common computer applications efficiently and productively in the workplace and at home.
Promoted By	Body promoting/advocating the above skills framework.	Cyprus Computer Society (CCS)	www.ccs.org.cy	The Cyprus Computer Society (CCS) was established in 1984 and today it numbers more than 1000 members. CCS is the national member society of CEPIS. As a not-for-profit organization, the CCS is seeking to improve and promote high standards amongst informatics professionals, in recognition of the impact that informatics has on employment, business, society as well as on the quality of life of the citizen. The CCS plays a key role in linking Academia with the Profession through the promotion of key elements of Informatics, in particular in the areas of digital literacy, professional skills, professionalism, education, training and research.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	ETEK	www.etek.org.cy	The Cyprus Scientific and Technical Chamber (ETEK) is the statutory Technical Advisor to the State and is the umbrella organisation for all Cypriot Engineers. ETEK regulates the qualifications and experience that an engineer (including university graduates in ICT and Computer Science related fields) must have in order to be able to practice the profession. ETEK has strong links with the government and the semi-government sector. They have managed to include in the schemes of service (job descriptions) the

		Cyprus Organization for Standards	www.cys.org.cy	requirement that an engineer must be a member of the ETEK in order to apply for a job that requires engineering related qualification. This is the local standards organization, recently they are getting involved in the promotion of the European e-Competence Framework. They are also active in the area of training in ICT related areas.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	ETEK	www.etek.org.cy	
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts			

	or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template		COUNTRY	CZECH REPUBLIC	
		POPULATION	10,505,445 (Estimate 2012)	
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments:	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas.	No specific department responsible.		
		Ministry of Industry and Trade of the Czech Republic	http://www.mpo.cz/en/e-comm-and-post/	The Ministry of Industry and Trade is a central body of the state administration that is involved in, amongst other areas, technical standardization, industrial research, engineering and technology development, and electronic communication.
		Ministry of Education, Youths and Sports of the Czech Republic	http://www.msmt.cz/index.php?lang=2	The Ministry of Education, Youths and Sports is a central authority of the state administration for pre-school facilities, school facilities, elementary schools, secondary schools and universities, for science policy, research and development including international cooperation in this sphere, for science degrees, for the state policy related to children, youths, sports, tourism and sport representation.
		Ministry of Labour and Social Affairs	http://www.mpsv.cz/en/	The Ministry of Labour and Social Affairs is a authority of the state administration for social and labour relations, safety of labour, employment and retraining, collective bargaining, wages and other remuneration for work, pension security, health insurance, sickness benefits, social care, working conditions of women and youths, legal protection in

				maternity, family and children care, care for citizens with special aid requirements and other wage and social policies.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas.	No specific department responsible. Government Council for Information Society	http://www.vlada.cz/en/ppov/rvis/government-council-for-information-society-74186/	The Government Council for Information Society is an expert advisory body of the government in the field of the information society which is tasked to carry out the coordination role previously held by the now dissolved Ministry of Informatics and to provide the government with input in the area of information society development so that the coordination of departmental and nation-wide projects can be improved.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	The Czech Society for Cybernetics and Informatics (CSKI)	http://www.cski.cz/main.php?id=02.01.01.00	The Czech Society for Cybernetics and Informatics (CSKI) was founded in 1966 as the Czechoslovak Society for Cybernetics. It is the largest society focused on informatics in the Czech Republic. The society objectives centre on support and promotion of cybernetics, informatics and related fields, advancing the professional standing of its members, providing services to its members, and support of conferences, seminars and other activities. The CSKI is the Czech member of CEPIS.
		Association For Information Technologies And Telecommunications – ICT Unie O.S.	http://www.ictu.cz/index.php?id=1165	ICT UNIE is a professional association of enterprises operating in the information and electronic communication technologies sector and other businesses and educational subjects, with the objective of increasing the importance of the introduction and the use of modern technologies in

		CACIO	http://www.cacio.cz/	society, including the creation of the optimal conditions for the development of public telecommunication networks in the Czech Republic, as a necessary precondition for the creation of an information company. The activities of the Association are related to the objectives of the Association for Information Society (SPIS) and the Association of Operators of Public Telecommunication Networks (APVTS). Czech Association of IT Managers assembles the top managers in the area of information technologies. CACIO was founded in 1998 and its members represent the highest IT managers of organizations and companies.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Unknown		
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Czech-Moravian Confederation of Trade Unions	http://www.cmkos.cz/homepage	The Czech-Moravian Confederation of Trade Unions is a voluntary, open, independent, democratic confederation of trade unions protecting wage, working and living conditions and rights of employees. It is an important social partner in tripartite negotiations in the framework of the Council of Economic and Social Agreement of the Czech Republic. It works in the regions of the Czech Republic through Regional Councils of Trade Unions (RROS) and Regional Offices for Legal Assistance (RPP).
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of	Economic Chamber of the Czech Republic	http://www.komoracz.eu/	The Czech Chamber of Commerce (CCC) is an entity representing the entrepreneurial public and became

	the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.			an integral part of the economic life in the Czech Republic. It protects the interests of its members – small, medium and large enterprises associated in a network of regional chambers and trade associations.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Global Grant EDUCA	http://www.czechinvest.org/1globalni-grant-educa	Long-term e-Skills project falling under the Human Resources and Employment OP (HREOP) supported by the European Social Fund.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against	Under development		The development and implementation of the National Qualifications Framework in the Czech Republic is to be carried out during the years 2009-

	various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development			2015. The Ministry of Education, Youth and Sports works together with the National Institute of Technical and Vocational Education on the project, which is co-financed by the European Social Fund and from the Czech Republic state budget. The project will be carried out during the years 2009-2015.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	UNMZ - Czech Office for Standards, Metrology and Testing	http://www.unmz.cz/office/en	The Czech Office for Standards, Metrology and Testing was established by the Czech National Council Act No. 20/1993 on the Organisation of the State Administration in the Field of Standards, Metrology and Testing as the state administration body responsible for such activities. The Office is a budgetary organisation subordinated to the Ministry of Industry and Trade. The Office's mission is to perform tasks set out in Czech legislation on technical standardisation, metrology and testing and tasks related to the harmonisation of Czech technical regulations and standards with the technical regulations of the European Community. Since 2009, the Office has been ensuring development and publication of Czech standards.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	The Czech Accreditation Institute	http://www.cia.cz/default.aspx?id=45	The Czech Accreditation Institute, Public Service Company, National Accreditation Body, was established by the Government of the Czech Republic. It provides services to state and private organisations in all fields of accreditation in conformity with valid legal regulations. The principle of a uniform European accreditation system, formed by national accreditation bodies working in conformity with uniform rules and performing accreditation according to defined internationally recognized standards, is based on the EC position as

		ECDL Czech Republic	http://www.ecdl.cz	defined in the Global Conception of Testing and Certification. ECDL Czech Republic is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in the Czech Republic
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	There is no developed national ICT Skills Framework		
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed			

	international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Code of ethics of the research fellows of the Academy of Sciences of the Czech Republic	http://www.avcr.cz/o_avcr/zakladni_informace/dokumenty/eticky_kodex.html	Based on: - Ethical code framework, Czech Government declaration, August 17, 2005, No. 1005; - European charter for researchers, 2005/251/ES, Official bulletin of the EU, March 22, 2005; - Good Manners in Science; A Set of Principles and Guidelines, Polish Academy of Sciences, Committee for Ethics in Science, Third (amended) edition, Warsaw 2001 - Rules of Good Scientific Practice, adopted by the Senate of the Max Planck Society on 24 November 2000; - Memorandum on Scientific Integrity, All European Academies, Amsterdam, 2003 (On standards for Scientific research and a National Committee for Scientific Integrity, KNAW, NWO, VSNU, 2001).
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3			

	individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY	DENMARK
			POPULATION	5,580,516 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	The Ministry of Science, Innovation and Higher Education	http://fivu.dk/en	The Ministry of Science, Innovation and Higher Education is responsible for the following areas: Research, Innovation, University educations and Internationalisation of education and training in Denmark.
		Ministry of Education	http://www.eng.uvm.dk/	The Department has the overall responsibility for managing the various domains of the Ministry of Education and to ensure the best possible foundation for carrying out the Government's education policy.
		Ministry of Employment	http://uk.bm.dk/	The Ministry of Employment has the overall responsibility for measures in relation to all groups of unemployed persons, i.e. both unemployed persons on social assistance as well as unemployed persons receiving unemployment benefits.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Agency for Higher Education	N/A	Will be formed as of Oct. 1, 2013 as a merger of two former agencies.
		Danish Agency for Universities and Internationalisation	http://en.iu.dk/	The agency's core tasks are to create optimum framework conditions for the Danish university sector and to strengthen Denmark's position in the global community by promoting internationalisation of study programmes, intercultural understanding,

		Danish Agency for Digitisation	http://www.digst.dk/Servicemenu/English	integration and a global outlook. The Agency for Digitisation is an agency of the Ministry of Finance and has been established in 2011 to speed up the digitisation processes required to modernise the Danish welfare society. The Agency is in charge of the digitisation of Denmark and is responsible for the implementation of the government's digital ambitions in the public sector.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	DANSK IT	http://www.dit.dk/	With more than 6,000 members DANSK IT is a leading interest organisation for IT professionals in Denmark. The core activities evolve around member networks, conferences, courses, certification programmes and IT political advice to the DK Government and its agencies. Founded in 1958 DANSK IT is among the first IT societies in the world and is a member of CEPIS.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	LO – The Danish Confederation of Trade Unions	http://www.lo.dk/English%20version/About%20LO.aspx	The Danish Confederation of Trade Unions is the largest national trade union confederation in Denmark and is recognised as the most representative workers' organisation in both the private and the public sector. LO's main objective is to handle employee interests vis-à-vis employers and authorities. Through its cooperation with associations, cartels and other trade union organisations, LO seeks to influence the government and the political parties when it comes to drafting and implementing legislation, especially in relation

				to labour market policies.
		The Danish Society of Engineers, IDA	http://ida.dk/sites/english/Sider/IDA.aspx	The Danish Society of Engineers, IDA is a professional body and trade union for technical and scientific professionals as well as students. IDA has more than 83,000 members, and represents the interests of employees, managers, the self-employed and pensioners within the fields of pay and employment, the labour market, industrial policy, skills, careers and training, the working environment, technology and research.
		PROSA	http://www.prosa.dk/in-english/	With 13,000 members working professionally with IT, PROSA stands out as the leading interest group and labour association for organised IT Professionals in Denmark. PROSA is a democratic and professional association, with no ties to political parties. At the same time it has a strong political engagement in questions related to the implications of IT for the wider society – e.g. privacy issues, digital rights etc.
		SAM-DATA	https://www.sam-data.dk/info/info.asp?id=259&m=5&sprog=uk	SAM-DATA is a trade union for the IT profession. SAM-DATA strives to improve the conditions in the labour market for IT specialists. SAM-DATA offers supplementary training, IT-related events, union experts and legal advice. SAM-DATA constantly strives to improve the conditions for IT specialists.
		Dansk Metal	http://www.danskmetal.dk/Om%20Dansk%20Metal/Hvad%20er%20Metal/English.aspx	The Danish Metalworkers' Union ("Dansk Metal") works professionally to safeguard the rights and interests of its members. Dansk Metal is a politically independent, democratic association, in which the members make the decisions. Dansk Metal has

				136,000 members in the manufacturing, building and construction, IT and telecommunications and service industries, in enterprises throughout Denmark.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	The Danish Chamber of Commerce	http://www.danskerhverv.dk/OmDanskErhverv/Profil/Danish-Chamber-Commerce/Sider/Danish-Chamber-Commerce.aspx	The Danish Chamber of Commerce is the network for Trade, IT, Industry and Service in Denmark.
		Danish IT Industry Association ITB	http://www.itb.dk/site.aspx?p=51	With more than 500 IT-member companies The Danish IT Industry Association (ITB) is the largest and leading independent representative for the IT-business community in Denmark.
		DI ITEK	http://itek.di.dk/special/bundmenu/Pages/English.aspx	DI ITEK is the Danish ICT and electronics federation for IT, Telecommunications, Electronics and Communication enterprises. The 300 members of DI ITEK all have their ties within the IT, Telecommunications, Electronics and Communication business.
		TI – Telecommunications Industry Association in Denmark	http://www.teleindustrien.dk/	TI is a professional association, working to improve the conditions for the Danish telecommunications operators.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries?			

	E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Klar Til Indberetning	www.klar-til-indberetning.dk	Online platform to assist those SMEs who are inexperienced with ICT with electronic reporting to the public sector (e.g. VAT, company registrations, e-invoices).
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Danish Qualification Framework	http://en.iu.dk/transparency/qualifications-frameworks/about-the-qualifications-framework	Denmark has had a national QF since 2003, and this framework has been widely implemented and used by institutions of higher education in the country. However, in order to be in line with the overarching European framework, a revision of the country's existing framework was necessary - a process that started in 2006. The Danish Qualifications Framework for Lifelong Learning is a comprehensive, systematic overview, divided by levels, of qualifications that can be acquired within the Danish education system – from primary and lower secondary to university level and within the area of adult and continuing education and training. The Qualifications Framework has eight levels. Degrees

				and certificates are placed at one of these eight levels on the basis of learning outcomes.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	DANSK IT	http://www.dit.dk/	DANSK IT has undertaken the role of a certifying and accrediting body for IT qualifications – one of many activities aimed at promoting the knowledge and use of Information and Communication Technology into the Danish market. Being an independent interest organisation for nearly 6,000 IT professionals it is also a way for them to gather the community around the development and documentation of qualifications for IT professionals. DANSK IT provides the following Certifications: ITIL V3, ITIL®, ISTQB Software Tester, Lean it-processer, and It-architecture.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	DANSK IT	http://www.dit.dk/	DANSK IT has the role of a certifying and accrediting body for IT qualifications – one of many activities aimed at promoting the knowledge and use of Information and Communication Technology into the Danish market. Being an independent interest organisation for nearly 6,000 IT professionals it is also a way for them to gather the community around the development and documentation of qualifications for IT-professionals.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for			

	ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	There is no developed national skills framework		
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.			
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or			

	referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.			
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template			COUNTRY POPULATION	ESTONIA 1,339,662 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education and Research	http://www.hm.ee/	The main tasks of the Ministry of Education and Research are to guarantee the expedient and effective development of education, research, youth and language policies and the high level and competitiveness of research and development activities.
		Ministry of Economic Affairs and Communications	http://www.mkm.ee/	Ministry of Economic Affairs and Communications, the aim is to create conditions for growth and competitiveness of the Estonian economy, balanced and sustainable economic development through the development, implementation and evaluation of outcomes.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Estonian Information System's Authority	http://www.ria.ee/	Established by the Estonian government to solve the main IT problems common to several state organisations and to arrange the work of the state's information systems. The Estonian Informatics Centre is an implementing body in general coordination of state information policy and public sector IT development (Subdivision of the Ministry of Economic Affairs and Communications).
		Foundation Innove	http://www.innove.ee/en	The main objective of the Foundation is to coordinate the lifelong learning development activities and to implement the relevant programmes and projects and the EU structural aid

		Estonian Qualifications Authority (Kutsekoda) Information Technology Foundation for Education	http://www.kutsekoda.ee/ http://www.eitsa.ee/?url=eitf	in a targeted and efficient manner. The Estonian Qualifications Authority's main aim is to develop and administer the professional qualifications system.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Estonian Trade Union Confederation (EAKL)	http://www.eakl.ee/	The (EAKL) comprises 19 branch unions that represent state and municipal government officials, education workers, health care workers, transport workers (including road, railway, sea and air transport), industrial workers and people employed in the service sector.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Estonian Association of Information Technology and Telecommunications (ITL)	http://www.itl.ee/	Voluntary organisation, whose primary objective is to unite the Estonian information technology and telecommunications companies, to promote their co-operation in Estonia's development towards information society, to represent and protect the interests of its member companies and to express their common positions.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Estonian Trade Union Confederation (EAKL)	http://www.eakl.ee/	The (EAKL) comprises 19 branch unions that represent state and municipal government officials, education workers, health care workers, transport workers (including road, railway, sea and air transport), industrial workers and people employed in the service sector.

		Estonian Employees´ Unions´ Confederation (TALO)	http://www.talo.ee/	TALO is a central union composed of trade unions and the associations of these working throughout Estonia. TALO has been established in order to represent and defend the employees´ work, profession and income-related as well as economic, social, educational and society-related interests and relevant rights through co-operation.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Estonian Chamber of Commerce and Industry (ECCI)	http://www.koda.ee/	The Estonian Chamber of Commerce and Industry (ECCI) is the oldest and largest Estonian representative organization of entrepreneurs and was founded to represent and protect common interests of Estonian merchants, manufacturers, bankers and ship-owners in the year 1925.Today, the ECCI with almost 3,200 members is the largest business representation organization in the country.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Start IT	http://startit.ee/	Online platform aimed at raising awareness of IT and the possibilities IT training and careers can offer young people. Yearly events are held across Estonia. Initiative primarily driven by the Estonian Association of Information Technology and Telecommunications (ITL).
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification,	"Raising Public Awareness about the Information Society" programme	https://www.ria.ee/programme/	6-year programme, funded through EU Structural Funds, aimed at increasing people's awareness about the possibilities of the information society so as to contribute to the development of a society that would support people's life and activities and increase the efficiency of policy formulation in the field of information society through high-quality information and data usage.

	support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Estonian Qualification Authority (QA) (Kutsekoda)	http://www.kutsekoda.ee/et/index	See Government Agencies
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Foundation Innove	http://www.innove.ee/en	The main objective of the Foundation is to coordinate the lifelong learning development activities and to implement the relevant programmes and projects and the EU structural aid in a targeted and efficient manner.
		The Estonian Higher Education Quality Agency (EKKA)	http://ekka.archimedes.ee/	The mission of the Estonian Higher Education Quality Agency (EKKA) is to foster the quality of Estonian higher education, and to promote and disseminate the best quality assurance practices. Upon making assessment decisions, EKKA is independent and sovereign.
		ECDL Estonia	http://www.ecdl.ee	ECDL Estonia is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Estonia
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications	Estonian Qualification Authority (QA)	http://www.kutsekoda.ee/en/index	Official accreditation body. Awards ICT Professional Qualifications in Estonia. The main institution involved in the implementation of the NQF however,

	by determining if a certification scheme conforms to specific standards, if relevant.	(Kutsekoda) BCS Koolitus AS	 http://www.bcs.ee/koolitus	other ministries, institutions (National Examination and Qualification Centre, employers, agencies, etc.) are involved Official ECDL/EUCIP accreditation body
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	Ministry of Education and Research	http://www.hm.ee/index.php?048055	Graduates 2012 - Vocational education 464 - Higher education 565 Vocational education institutions by ownership: State 16 Municipal 1 Private 2
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	"Estonian Information Society Strategy 2013" EUCIP	http://www.riso.ee/en/information-policy/policy-document/Estonian_Information_Society_Strategy_2013 www.eucip.org	Estonian Information Society Strategy 2013, approved by the Order of the Government of the Republic Nr 667 (of 30 November 2006), is a sectoral development plan, setting out the general framework, objectives and respective action fields for the broad employment of ICT in the development of knowledge-based economy and society in Estonia in 2007-2013.
Promoted By	Body promoting/advocating the above	Ministry of Economic	http://www.mkm.ee/	See Government Departments (above).

	skills framework.	Affairs and Communications		
		Technical Education Development Foundation	http://www.tehnikaharidus.ee/	See Professional Bodies (above)
		BCS Koolitus AS	http://www.bcs.ee/koolitus	Awards Professional Qualifications (IT Specialist I, IT Specialist II)
		ECDL Estonia	http://www.ecdl.ee	ECDL Estonia is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Estonia
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Estonian Association of Information Technology and Telecommunications (ITL)	http://itl.ee/?op=body&id=24	ITL has Code of Ethics for ICT companies
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of	Provide list and **brief** summary of Bodies	Estonian	http://www.kutsekoda	Official qualification framework, including ICT

Knowledge (BoKs)	of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Qualifications Framework (EstQF) E-university	.ee/en/kvalifikatsiooniraamistik http://www.e-uni.ee/e-kursused/eucip/	e-learning materials for EUCIP courses in Estonian and Russian
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Ants Sild Ants.Sild@bcs.ee Katrin Kerem Katrin.Kerem@kutsekoda.ee		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template			COUNTRY POPULATION	FINLAND 5,401,267 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	The Ministry of Transport and Communications	http://www.lvm.fi/web/en/home	The Ministry of Transport and Communications is responsible for two broad sectors: transport policy and communications policy. In the communications sector, the Ministry takes care of issues relating to communications networks, information security and data protection, information society policy, the mass media, and postal services.
		The Ministry of Education and Culture	http://www.minedu.fi/OPM/Ministerioe_ja_hallinnonala/?lang=en	Within the Government, the Ministry of Education and Culture is responsible for developing education, science, cultural, sport and youth policies, and international cooperation in these fields. The Ministry develops conditions for education, know-how, lifelong learning, creativity and citizens' social participation and well-being.
		Ministry of Employment and the Economy	http://www.tem.fi/index.phtml?l=en&s=2072	The Ministry of Employment and the Economy (MEE) is responsible for the operating environment underpinning entrepreneurship and innovation activities, securing the functioning of the labour market and workers' employability, as well as for regional development within the global economy.

				The sphere of authority of the Ministry of Employment and the Economy includes: industrial policy and innovation and technology policy, internationalization and technical safety of enterprises, amongst others.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Finnish National Board of Education	http://www.oph.fi/english/about_us	Finnish National Board of Education is the agency responsible for the development of education in Finland. Its administrative sector encompasses pre-school and basic education, upper secondary education, basic vocational training, adult education, and liberal adult education, including folk high schools and adult education centres. It also produces services for polytechnics and universities.
		Public Sector ICT	http://www.vm.fi/vm/en/16_ict/index.jsp	This operational unit is responsible for the overall development of public administration information management, e-Government and corporate data, for information management governance in central government and for the coordination of joint development projects. Public sector ICT promotes information management cooperation between central and local government, formulates joint functional and technical solutions and methods and is in charge of overall development of information security in public administration as well as data security governance in central government.
		KuntienTieraOy	http://www.tiera.fi/yri	Kuntien TIERA Ltd develops and streamlines ICT

			tys	services of the municipal sector in cooperation with municipalities and other public and commercial actors.
		CSC — IT Center for Science Ltd	http://www.csc.fi/english/csc	CSC — IT Center for Science Ltd is administered by the Ministry of Education, Science and Culture. CSC is a non-profit company providing IT support and resources for academia, research institutes and companies: modeling, computing and information services.
		Tekes - the Finnish Funding Agency for Technology and Innovation	http://www.tekes.fi/en/community/Home/351/Home/473	Tekes works with the top innovative companies and research units in Finland. Every year, Tekes finances some 1,500 business research and development projects, and almost 600 public research projects at universities, research institutes and polytechnics.
		Sitra – the Finnish Innovation Fund	http://www.sitra.fi/en/About+Sitra/sitra.htm	Sitra, the Finnish Innovation Fund has the duty to promote stable and balanced development in Finland, the growth of its economy and its international competitiveness and co-operation. Sitra's responsibilities are stipulated in law.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	The Finnish Information Processing Association, FIPA	http://www.ttlry.fi/english	The Finnish Information Processing Association, FIPA, (TietotekniikanLiittory) is an independent association of Finnish ICT professionals and companies that provide ICT products and services or use them. FIPA has currently about 16 000 professionals and more than 500 companies as members. They are organised as 28 individual FIPA

				member associations. FIPA is the national member of CEPIS.
		Tieto-javiestintäteollisuuden tutkimus TIVIT Oy	http://www.tivit.fi/frontpage	TIVIT is committed to ensuring even more rapid development of Finnish ICT know-how. The aim is both to increase the speed with which new innovations reach the market and also to increase the know-how and promote the growth of both companies and research communities.
		The Finnish Software Entrepreneurs Association	http://www.ohjelmistoyrittajat.fi/in-english	The Finnish Software Entrepreneurs Association is a non-aligned association for innovative, professional, growth-driven and entrepreneurial software business executives. Association drives the success of software business as an industry and supports individual software companies in their road to success.
		TIEKE Finnish Information Society Development Centre	http://www.tieke.fi/display/English/Home	TIEKE Finnish Information Society Development Centre has a key networking role as a neutral and non-profit organisation in promoting the efforts of its members, within the public and private sectors alike, with an ultimate goal to create viable tools and expertise for use in the information society.
		Finnish Federation for Communications and Teleinformatics,	http://www.ficom.fi/inbrief/index.html	Finnish Federation for Communications and Teleinformatics, FiCom is a co-operation organisation for the ICT industry in Finland and

		FiCom		looks after its interests.
		Culminatum Innovation Oy Ltd	http://www.culminatum.fi/en/sivu.php?id=3	Culminatum Innovation Oy Ltd is a development company owned by the Uusimaa Regional Council, the cities of Helsinki, Espoo and Vantaa, and the universities, polytechnics, research institutes and the business community of the Helsinki region.
		Electronic Frontier Finland – EFFI ry	http://www.effi.org/index.en.html	Electronic Frontier Finland ry (EFFI) was founded in 2001 to defend active users and citizens of the Finnish society in the electronic frontier. EFFI influences legislative proposals concerning e.g. personal privacy, freedom of speech and user rights in copyright law. EFFI also works in close cooperation with organizations sharing the same goals and values in Europe, the United States and elsewhere. EFFI is a founding member of the European Digital Rights (EDRi).
		COSS	http://www.coss.fi/en/about	COSS (the Finnish Centre for Open Source Solutions), founded in 2003, is a national development agency for the open source business ecosystem in Finland and the number one gateway to Finnish open source. COSS promotes the development and adoption of managed and sustainable open source solutions in various industries and public sector.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their	The Federation of Finnish Technology Industries	http://www.teknologiateollisuus.fi/en/	The mission of the Federation of Finnish Technology Industries is to ensure that the Finnish technology industry has the preconditions for success in the

	work areas, if relevant.			global marketplace.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	The Central Organisation of Finnish Trade Unions – SAK	http://www.sak.fi/english	The Central Organisation of Finnish Trade Unions – SAK is the oldest employee confederation in Finland. Nowadays SAK represents the interests of more than one million members in 21 affiliated trade unions.
		The Finnish Confederation of Professionals STTK	http://www.sttk.fi/en-GB/	The Finnish Confederation of Professionals STTK is one of the three trade union confederations in Finland. STTK was founded in 1946.
		Akava - Confederation of Unions for Professional and Managerial Staff in Finland	http://www.akava.fi/en/	Akava, The Confederation of Unions for Professional and Managerial Staff in Finland, is a trade union confederation for those with university, professional or other high-level education.
		Union of Professional Engineers in Finland	http://www.uil.fi/portal/page?_pageid=157,21298&_dad=portal&_schema=PORTAL	Union of Professional Engineers in Finland (UIL) promotes the interests of engineers, engineering students and other experts of technical field. Through its member organisations, UIL's total membership is approximately 70,000. UIL comprises thirty regional branches and five national branches through which engineers and other experts of technical field belong to the union.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names	Finland Central Chamber of Commerce	http://www.keskuskauppakamari.fi/site_eng/About-us	Finland Chamber of Commerce together with the regional Chambers helps businesses succeed in Finland and in international markets.

	of these Chambers of Commerce and **brief** summary of their work areas, if relevant.			
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	SkillsFinland	www.skillsfinland.fi	Skills Finland is a non-profit organization promoting excellence in skills. The objective is achieved through skills competitions and by training and coaching young professionals, competition specialists and trainers. Skills Finland works in close partnership with all the stakeholders sharing the same objectives and values. The work is mainly done with funding of the European Social Fund (ESF). The funding covers the years 2002-2013. Trainings/competitions include Mech. Eng. CADD; Printing Technology; Print Design; IT / Software Applications; IT PC / Network Support; Web Design.
		MyTech	www.mytech.fi	Online platform for young people showcasing the experience of over 200 young professionals from different fields of technology companies who talk about their work and their workplace. They talk about their own job tasks, skills, working environment. There is also a "Summer jobs" section. This is an initiative driven by the Federation of Finnish Technology Industries.
		IT Barometer	http://www.ttlry.fi/tutkimus/IT-barometri	IT Barometer is a study of the importance of IT for Finnish companies in the business and IT management point of view. The study has been carried out annually by the Finnish Information Processing Association, FIPAsince 2008.
		Mobile Monday	http://www.mobilemo	MobileMonday™ (MoMo) is an open community

			nday.net/	platform of mobile industry visionaries, developers and influential individuals fostering brand neutral cooperation and cross-border P2P business opportunities through live networking events to demo products, share ideas and discuss trends from both local and global markets. Originating in Helsinki in 2000, with activities organized by 300+ volunteers around the world, MoMo has become an industry leading mobile platform.
		Slush	http://2012.slush.fi/en-gb/	Slush is the largest tech, design & start up conference covering Northern Europe and Russia. Slush was founded in 2008 by a small group of Finnish entrepreneurs originating from the Aalto University.
		Startup Sauna	http://startupsauna.com/	Startup Sauna is a non-profit organization for startups and aspiring entrepreneurs in Northern and Eastern Europe and Russia. The aim is to implement a blooming startup ecosystem and a pay-it-forward culture into the region.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development			

	and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	The National Framework for qualifications and other learning in Finland	http://www.oph.fi/mobility/qualifications_frameworks	A committee appointed by the Ministry of Education has completed its proposal for a National Framework for qualifications and other learning. According to the proposal, the National Framework consists of eight levels, similar to the EQF. The Framework describes the competence required by Finnish qualifications in terms of knowledge, skills and competences based on the EQF level descriptions, while further specifying the EQF level descriptions from a national perspective.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	ECDL Finland TIEKE Finnish Information Society Development Centre	http://www.ecdl.fi http://www.tieke.fi/display/English/Home	ECDL Finland is the certifying authority of the leading international computer skills certification programme – ECDL / ICDL in Finland. TIEKE Finnish Information Society Development Centre has a key networking role as a neutral and non-profit organisation in promoting the efforts of its members, within the public and private sectors alike, with an ultimate goal to create viable tools and expertise for use in the information society.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Finnish Software Testing Board FiSTB Finnish Software Measurement	http://www.fistb.fi/ http://www.fisma.fi/in-english/	FiSTB represents ISTQB in Finland. Finnish Software Measurement Association FiSMA is an independent registered association focusing on

		Association FiSMA		better management through improving the quality and measurability of software and systems engineering. FiSMA's membership is intended for all companies, research units, universities and other institutes interested in software measurement.
		FINAS (Finnish Accreditation Service)	http://www.mikes.fi/frameset.aspx?url=finas.aspx%3fcategoryID=2&langID=uk	FINAS (Finnish Accreditation Service) is according to the law (921/2005) a national accreditation body responsible for organising the accreditation activities according to international criteria. FINAS offers accreditation services for testing and calibration laboratories, inspection bodies, certification bodies, providers of proficiency testing, GHG and EMAs verifiers.
		Finnish Standards Association SFS	http://www.sfs.fi/en	The Finnish Standards Association SFS is the central standardization organization that controls and co-ordinates national standardization work in Finland. SFS develops, approves and publishes national SFS standards. It also sells standards and communicates information about the standards and standardization to the public.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for			

	ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	IT Service Management Forum Finland	http://www.itsmf.fi/	itSMF Finland is part of itSMF international. itSMF is a forum for IT Service Management professionals and decision-makers worldwide.
Promoted By	Body promoting/advocating the above skills framework.	The Association of Finnish eLearning Centre	http://www.eoppimiskeskus.fi/en	The Association of Finnish eLearning Centre is an independent national association that promotes sharing of knowledge, best practices and quality in eLearning. The Centre distributes information and acts as a contact surface for partner finding, such as experts and service providers, in the Finnish eLearning market.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide	Code of Ethics (Ethics guidelines v. 3)	These guidelines can be found in Finnish at http://www.ttlry.fi/etii	In late 1993 the Finnish information processing association (FIPA) ethics group was established. Its main purpose was to create a code of ethics for the

	brief synopsis of the areas covered in this code if known, if relevant.		kan-ohjeet-v3	association. This was accomplished in 1995. After getting the first code of ethics ready, the members of the ethics group devoted their attention to teaching about IT and ethics in various educational institutes ranging from FIPA member groups to universities. This is one of the main reasons universities in Finland teach IT and ethics as part of their curriculum in departments of information technology. Members also wrote articles to professional magazines. The code also went under a revision and the new code was ready in 2002. There are no sanction procedures to enforce the current code, nor was there one for the previous code.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your	Mika Helenius, Aalto University, mika.helenius@aalto.fi , +358 50 64432 Jouni Kangasniemi, senior Adviser at Ministry of Education, jouni.kangasniemi@minedu.fi Taru Rastas, senior Adviser at Ministry of Transport and Communication, taru.rastas@mintc.fi		

	country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY	FRANCE
			POPULATION	65,327,724 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministère de l'Economie des Finances et de l'Industrie	http://www.industrie.gouv.fr/, http://www.minefe.gouv.fr/ministere_finances/besson/eric-besson.php	In charge of French economic and industrial policy, including a specific department promoting digital economy
			http://www.telecom.gouv.fr	Governmental initiative to promote ICT
			http://www.gouvernement.fr/gouvernement/societe-de-l-information/liste	All governmental initiatives regarding the Information Society
		Ministère de l'Enseignement Supérieur et de la Recherche	http://www.enseignementsup-recherche.gouv.fr/	In charge of upper education (Universities) and Research
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a	INRIA	http://www.inria.fr/	Research agency specialising in IT
		National Academy of Technologies of	http://www.academie-technologies.fr/en.htm	Public consultancy body aiming to advise political authorities as well opinion leaders. Linked to

	brief summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	France CGIET	l http://www.cgiet.org/	Ministère de l'Enseignement Supérieur et de la Recherche The high council for Industry, energy and technology: provide Public Authorities with elements to assess, prefigure or shape up public policies relative to information and communication technologies, informatics, audio-visual, technologies, space and postal services.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	MEDEF Syntec numérique CIGREF AFDEL Alliance TICS	www.medef.com http://www.syntec-numerique.fr/?TabID=1 http://cigref.typepad.fr/cigref_english/CIGREF_En_December_2008.pdf http://www.afdel.fr/ http://www.alliance-	No specific interest Professional body of SSO's, SW editors and Engineering and innovation consulting companies. It brings together over 1,000 businesses totalling over 380,000 professionals An association of companies founded in 1970, CIGREF brings together 128 French companies and organisations from all sectors. To this end, CIGREF has three aims: 1) To bring together major companies using information systems, 2)To support CIOs and help them develop in the exercise of their profession, 3) To develop a long-term vision of the impact of information systems and technologies on the enterprise, the economy, and society. Another professional body of SW editors totalling 230 companies Alliance TICS Professional Union brings together

			tics.org/	stakeholders from industries of information technology, communications and related services (ICT).
		Club des responsables d'infrastructure et de production (CRiP)	http://www.crip-asso.fr/beecrip/	CRIP is an independent association of users who brings together more than 2000 managers of Production IT Infrastructure. Collectively our members represent an infrastructure and production budget of more than 20 billion euros, more than 100,000 professionals, 3 million jobs and over 300 Petabytes of data.
		Pasc@line	http://www.assopascaline.fr/650_p_32882/accueil.html	Pasc@line aims to: Promote trainings and digital professions among young people. Promote the exchange and cooperation between educational institutions and major digital employers. Develop Pasc@line's contacts and institutional relations network. Conduct discussions in favour of innovative teaching and act on behalf of students and professionals alike.
		L'Association Française de l'Audit et du Conseil Informatiques (French Association of Audit and IT Council)	http://www.afai.fr/	FAFIA is the French chapter of the ISACA and has about 600 members. ISACA is an international association of Audit and IT consultancy and has about 70,000 members. FAFIA organizes events, trainings, conducts research and publishes the results of surveys and studies.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their	Club de la Sécurité de l'Information Français – CLUSIF (French association	http://www.clusif.asso.fr/	CLUSIF's mission is to act in favour of information security. It is open to any business or community. CLUSIF member companies are drawn from the public and administrative sector, banking/finance,

	work areas, if relevant.	for Information Security)		traditional industry, software companies, telecom's operators etc.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	CICF MUNCI	http://www.cicf.fr/cicf-syndicats/cicf-informatique http://munci.org/	Professional body of VSME (< 50 employees) acting as SSO's, SW editors or consulting. 150 companies. Founded in 2003, MUNCI is the professional association which gathers all individual members of any IT branch (Information technology, Web, Telecom and other ICT), of any status (employee, freelancer, unemployed) and of any employer (software based services, software editors, outsourcing and consulting enterprises, others…). In synergy with SPECIS, union partner in the branch – Syntec-CICF - itself affiliated with the UNSA (fourth union confederation in France), MUNCI frequently intervenes in the media, with institutions and public authorities to defend the interests of these professions.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	CCI	http://www.cci.fr	Chamber of Commerce and Industry
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder	CIGREF's HR Nomenclature – Information Systems roles in large companies	http://www.cigref.fr/information-systems-roles-in-large-companies-hr-nomenclature-cigref	The CIGREF Nomenclature of IS roles provide a description of the roles existing in the Information Systems Departments of large companies. As a result of its studies, started in 2002, concerning e-competences and its participation in work conducted at a European level, CIGREF's HR group has decided to incorporate the competences from the e-CF into its nomenclature of roles. This nomenclature had

	partnerships, international collaboration initiatives…			already been formatted to allow this in its 2009 version. In 2010, the role data sheets were thus completed accordingly. The latest available version is the 2011 version.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Le Portail des Métiers de l'Internet	http://www.metiers.internet.gouv.fr/	Online national portal offering training courses in ICT and information on various digital competences through the Ministère de l'Enseignement Supérieur et de la Recherche.
		Certificat Informatique et Internet (C2i)	http://www.c2i.education.fr/	IT certificate called C2i, offering training and certification on basic and professional e-skills level through the Ministère de l'Enseignement Supérieur et de la Recherche.
		EMSI (Ecole de Managment des Systèmes d'Information)/ Grenoble Ecole de Management	http://www.grenoble-em.com/accueil_ecole.aspx?ecole=emsi&lg=fr	Ecole de Management des Systèmes d'information" delivers programs in the field of Management & Information Systems.
		Pasc@line	http://www.assopascaline.fr/650_p_32882/accueil.html	Pasc@line aims to: Promote trainings and digital professions among young people. Promote the exchange and cooperation between educational institutions and major digital employers. Develop Pasc@line's contacts and institutional relations network. Conduct discussions in favour of innovative teaching and act on behalf of students and professionals alike.
		CFA-AFIA apprenticeships	http://www.cfa-afia.com/	The CFA-AFIA is an initiative created in 1992 by a grouping of major corporate ICT players in France

				(Air France, IBM France, Credit Lyonnais, EDF-GDF etc.) the CFA-AFIA offers ICT education through apprenticeships. The CFA-AFIA has 11 partner universities.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	CNCP	http://www.rncp.cncp.gouv.fr/grand-public/qualificationsFramework	Professional certification authority for both initial and vocational education
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	AFPA FAFIEC PCIE (ECDL)	http://www.afpa.fr http://www.fafiec.fr http://www.pcie.tm.fr	National association for professional training The FAFIEC, OPCA Branch of computer science, engineering, consulting…, is to inform and advise businesses, especially SMEs and small businesses, in their efforts to continuing vocational training. European Computer Driving Licence
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	AFNOR Commission des Titres d'Ingénieurs	http://www.afnor.org/en http://www.cti-commission.fr/	National and international operator charted to deliver performance and sustainable development solutions for business and civil society: Standardization, Publishing, Certification, and Training. Accreditation of engineering schools (Grandes Ecoles d'ingénieurs)

		AERES RNCP Ministère de l'éducation nationale	http://www.aeres-evaluation.com/ http://www.rncp.cncp.gouv.fr/ http://www.education.gouv.fr	Evaluation of institutions, research units, doctoral schools and programmes and degrees National inventory of professional certifications Ministry of National Education
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	e-CF CIGREF Portail des métiers de l'Internet	http://ecompetences.eu http://www.cigref.fr http://www.metiers.internet.gouv.fr	Common European framework for ICT Professionals in all industry sectors French IT Job profile framework in user companies (2011 – Information Systems roles in large companies : HR Nomenclature – CIGREF) National inventory of the professions of the Internet

		ROME	http://www2.pole-emploi.fr/espacecandidat/romeligne/RliIndex.do	Operational Directory of Trades and Jobs
Promoted By	Body promoting/advocating the above skills framework.	Pasc@line and CIGREF	http://www.cigref.fr http://www.assopascaline.fr	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	TIC ETHIC ADEME Cercle Ethique des Affaires CNIL	http://www.ticethic.com http://www2.ademe.fr http://www.cercle-ethique.net/ http://www.cnil.fr/english	TIC ETHIC is accompanying implementation strategies respecting the sustainable development (ethics). French Environment and Energy Management Agency Association for Business Ethics CNIL is an independent administrative authority protecting privacy and personal data.
BODIES OF KNOWLEDGE				

Type	Guidance	Name	Website	Specifics
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.			
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			
Country Profile Template			**COUNTRY** **POPULATION**	**GERMANY** **81,843,743 (Estimate 2012)**
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT	Federal Ministry of Economics and Technology	www.bmwi.bund.de	Specific objective for the Ministry in promoting new technologies and innovation to maintain economic competitiveness.

	professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Federal Ministry of Education and Research Federal Ministry for Labour and Social Affairs	www.bmbf.de www.bmas.de	The promotion of education, science and research by the Federal Ministry of Education and Research represents an important contribution to securing the country's prosperity. One of the areas the ministry is responsible for is creating a strong framework for more jobs by focusing on the maintenance & fostering of well-trained and highly-motivated workers in the workforce to enable/ maintain competitive advantage for Germany.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	BIBB Federal Employment Agency	www.bibb.de www.arbeitsagentur.de	Federal Institute for Vocational Education and Training Agency is the operational unit of the Federal Ministry for Labour and Social Affairs. Offers some services on the labour and training market for unemployed citizens.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Gesellschaft für Informatik e.V. (GI) (Society for Computer Science) Informationstechnische Gesellschaft im Verband der Elektrotechnik, Elektronik und	www.gi.de	Motivates & develops the scientific discipline and promotes the impact of informatics on the economy, business and society. GI is a member of CEPIS.

		Informationstechnik (VDE) (Association for Electrical, Electronic & Information Technologies) Professional Association for IT Consultants (Certified)	http://www.vde.com/ http://www.bvsi.de/	VDE, the Association for Electrical, Electronic & Information Technologies is one of the largest technical and scientific associations in Europe with more than 34,000 members. VDE is a member of CEPIS. An organization for Professionals in Computer Science which is targeted at Freelancers in particular. This is one of many organizations of this nature.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	BITKOM	www.bitkom.org	Federal Association for Information Technology, Telecommunications and New Media. Industry counterpart of GI and VDE
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Ver.di GEW IGM	www.verdi.de www.gew.de www.igmetall.de	United Services Union For School and Education workers as well as the admin force in academia. IG Metall – (comprises workers in metalworking and electrical areas including workers in the information technology area).
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	German Chambers of Commerce.	www.dihk.de www.ahk.de	DIHK is the umbrella organization for regional chambers of commerce IHK. The regional IHK provide certifications of IT-related occupations, as well (see below). AHK in partnership with BMWI develops German

				business interests abroad
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Academy Cube	http://academy-cube.eu/	Academy Cube is primarily intended for academics, graduates and job seekers – ideally from the STEM fields (Science, Technology, Engineering and Mathematics). The online platform invites candidates to grow their skillsets via e-learning, reach out to in-demand companies and increase their chances on the job market. The initiative combines the enterprise networks and experience of the following European companies, research institutions and universities: BITKOM (German Association of IT, Telecommunications and New Media), German Federal Employment Agency Central International Placement Office (ZAV), DFKI (German Artificial Intelligence Research Centre), EIT ICT Labs, Festo Didactic GmbH & Co. KG, Gesellschaft für Informatik e.V. (German IT Association), LinkedIn Germany GmbH, Microsoft Deutschland GmbH, Robert Bosch GmbH, SAP AG, Software AG, ThyssenKrupp AG, University of Duisburg-Essen.
		VDE Career Portal	http://karriere.vde.com/career/Seiten/index.aspx	Online career portal with information for young graduates and jobseekers with a background in ICT/engineering.
		IT 50 plus	http://www.it-50plus.org/	IT 50plus is a joint initiative of the Federal Association for Information Technology, Telecommunications and New Media (BITKOM) and the IG Metall trade union (IG Metall).The project objectives are, employment and employability of older workers to improve ,the reintegration of IT professionals to after periods of unemployment easier, the employment-oriented

				skills development of these target groups to make practical and sustainable, the IT training system so as to develop further, that the unemployed can gain recognized qualifications and certificates.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	GQF – German Qualifications Framework (often referred to as DQR) Sectoral qualification framework for engineers and computer science	http://www.deutscher qualifikationsrahmen.de http://www.4ing.net/index.php?id=263	German Qualification Framework including Lifelong Learning. Based on the EQF. A proposal conducted by 4Ing organization (university level)
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	German Chambers of Commerce.	www.dihk.de	DIHK is the umbrella organization for regional chambers of commerce IHK. The regional IHK provide certifications of IT-related occupations. These occupations are at vocational training level and

				require training with a duration of normally 42 months. E.g. - Communication Electronics Technician in… Facility Installation Facility Maintenance - Information and Telecommunication Systems Electronics Technician - Computer Systems Technician - Qualified IT Specialist - IT Clerk - Applied Computer Technician in… Application Development Systems Integration
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	DAkkS	w.dakks.de/ueber_die_dakks	German Accreditation Service (GmbH) includes certification for Management Systems and People
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	Federal Statistical Office	https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/BildungForschungKultur/Hochschulen/Hochschulen.html	Numbers of freshmen, students, and graduates in electrical engineering and computer science (amongst others)

E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	AITTS	www.aitts.de	Advanced IT Training System. With this certification according to ISO 17024, you have expertise in one of the 14 IT Specialists profiles, not only in theory but in practice based on real projects.
Promoted By	Body promoting/advocating the above skills framework.	Gesellschaft für Informatik e.V. (GI) / German Informatics Society (GI)	www.gi.de	Analyses, motivates & develops the scientific discipline and promotes the impact of informatics on government, economy, business and society.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			ICT professionalism on academic level is not regulated in Germany. In comparison to UK, there is no professional body like e.g. the engineering council which is registering engineers or IT professionals. Occupations are given by employers qua academic title and professional experience.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	GI Ethical Guidelines	www.gi.de/wir-ueber-uns/unsere-grundsaetze/ethische-leitlinien.html	
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or			

	referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.			
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template			COUNTRY	GREECE
			POPULATION	11,290,067 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Infrastructure, Transport and Networks	http://www.yme.gr/index.php?getwhat=1&oid=531&id=&tid=531	The mission of the Ministry of Infrastructure, Transport and Networks is to plan and implement national policy and create the appropriate institutional framework at European and international level for the development of top quality transport, mass-transit, telecom and postal services under conditions of healthy competition.
		The Ministry of Development, Competitiveness, Infrastructure, Transport and Networks	http://www.mindev.gov.gr/?page_id=1366	The Ministry of Development, Competitiveness, Infrastructure, Transport and Networks established on 21/06/2012. Among the responsibilities of the Ministry are: a) the services of the former Ministry of Infrastructure, Transport and Networks with the functions, institutions, locations and staff of this Ministry and with their bodies supervised by and b) the services of the former Ministry of Development, Competitiveness and Shipping, the powers, instruments, positions and personnel and supervised by these bodies, other than the services belonging to the Ministry of Shipping,
		Ministry of Education, Lifelong Learning and Religious Affairs	http://www.minedu.gov.gr	Formerly the Ministry for National Education and Religious Affairs, it is responsible for Education, Lifelong Learning policies and Religious Affairs.

		Ministry of Employment and Social Security Ministry of Administrative Reform and e-Governance	http://www.ypakp.gr www.ydmed.gov.gr	Responsible for Employment Policy, Industrial Relations, Social Security, Social Protection, and Health and Safety at Work. The Ministry of Administrative Reform and e-Governance is responsible for organizational, operational and personnel issues in the public sector. Additionally, it is responsible for the coordination of public sector bodies on issues such as the modernization of the organizational structure and function, the general policy agenda housing services and the wage scheme (in cooperation with the Ministry of Finance) and the development of ICT in the public sector. The Ministry is also responsible for the Operational Programme "Information Society" in terms of studies, projects and actions related to e-government.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Technical Chamber of Greece (TEE) Department of Information Technology and Communications of	www.tee.gr http://www.e-tee.gr/index.php?option=com_content&view=frontpage&Itemid=1	The Technical Chamber of Greece aims to promote science in the fields related to the specialization of its members, technique and technology in general and their use for economic, social and cultural development of the country within the principles of sustainability and protection environment. Created in order to effectively promote the institutional role of the Technical Chamber Greece (TEE) as adviser to the Greek State in the area of ICT. The Objective of e-TEE is to contribute decisively in

		the Technical Chamber Greece (e-TEE)		the formulation of effective policies in the area of ICT, in the development and use of ICT induced added-value, as well as in the promotion of the profession of the ICT scientists in Greek society.
		Hellenic Telecommunications and Post Commission (EETT)	http://www.eett.gr/	EETT is the National Regulatory Authority, which supervises and regulates the telecommunications as well as the postal services market. EETT's institutional purpose is to promote the development of the two sectors, to ensure the proper operation of the relevant market in the context of sound competition and to provide for the protection of the interests of the end-users. EETT is an independent self- funded decision-making body.
		Greek Research and Technology Network (GRNET)	www.grnet.gr	The Greek Research and Technology Network (GRNET S.A.) is a state-owned company, operating under the auspices of the Greek Ministry of Education - General Secretariat for Research and Technology. Its mission is to provide high-quality Infrastructure and services to the academic, research and educational community of Greece, and to disseminate ICT to the general public. GRNET is the National Research and Education Network (NREN) provider, operating the Greek Academic network, that connects local universities and research institutions via dark fibre at speeds up to 10Gbps, and offering to the Greek R&E community access to the pan-European GEANT network through 4x10Gbps links.
Professional Bodies/National Computing	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant.	Hellenic Professionals Informatics Society	http://www.hepis.gr/	The Hellenic Professionals Informatics Society (HePIS) is the network that connects all the ICT Professionals in Greece and which aims at meeting

Associations	+ Please estimate the number of members of the main professional ICT body in your country.	(HePIS)		the expectations of both professionals and scientists in the field of Information & Communications Technologies (ICT). HePIS is the only member of CEPIS (Council of European Professionals Informatics Societies) and IFIP (International Federation for Information Processing) in Greece, representing the country's ICT professionals and promoting their interests at a Global level.
		Union of Engineers of Information Technology and Communications of Greece ([EMiPEE])	http://www.computer-engineers.gr/index.php	The Union of Engineers of Information Technology and Communications of Greece exists in order to create the conditions for the promotion of Information technology, developing forces of Computer specialists and satisfying their labour and scientific needs. It represents computer specialists in all fields of their interests.
		ItSMF Hellas	www.itsmf.gr	itSMF Hellas is the Greek chapter of an international forum headquartered in the UK. There are more than 2600 members in Greece, including IT professionals in every industry imaginable. It is a forum in the true sense of the word in that the knowledge comes collectively from the membership and is shared freely amongst members.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	The Federation of Hellenic Information Technology & Communications Enterprises (SEPE)	http://www.sepe.gr/en/AboutSEPE	A non-profit organisation, established in 1995. Over 400 companies are currently members of SEPE and collectively they hold more than 95% of the country's turnover in the Information Technology and Telecommunication Industry. The main objectives of SEPE are to promote Information and

				Communications Technologies (ICT) in Greece and to enlarge ICT Industry's market. SEPE is the national point of contact of e-skills week in Greece.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	The General Confederation of Greek Workers (GSEE) The Civil Servants' Confederation (ADEDY) The All-Workers Militant Front (PAME)	http://www.gsee.gr/ http://www.adedy.gr/adedy/site/home/ws.csp?loc=en_US http://www.pamehellas.gr/main.php?lang=2	The General Confederation of Greek Workers (GSEE) is the highest, tertiary trade union body in Greece. GSEE is made up of 83 worker unions and 74 departmental secondary confederations. Its prime purpose is defending the interests of all workers in Greece, in the private sector. The Civil Servants' Confederation (ADEDY) is a trade union center in Greece. It is affiliated with the European Trade Union Confederation. The All-Workers Militant Front is a coordination center within the Greek trade union movement, founded on the initiative of Communist Party of Greece trade-unionists in April 1999. According to its website, the trade unions that are affiliated in PAME have 415,000 members in total as of 2005. PAME is internationally affiliated with the World Federation of Trade Unions.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	The Athens Chamber of Commerce and Industry (ACCI)	http://www.acci.gr/acci/Home/tabid/28/language/en-US/Default.aspx	ACCI's mission is to assist the Government in the fields of commerce, industry, services and general development policy. Its Department of Information & Communication Technologies is responsible for: 1. Covering ACCI's computer ICT needs in terms of analysis, design, planning, documentation standards and application development. 2. Software, hardware and network maintenance and technical support. 3. Maintenance and operation of ACCI's internet node, EBR network and linkage with external Data Banks to provide information to ACCI's members, aiming at

		The Union of Hellenic Chambers of Commerce and Industry (UHC)	http://www.uhc.gr/newsite/english/index.php?menu=main_menu&page=home	fostering entrepreneurship. 4. Reviewing European and National programmes related to new Information and Communications Technologies to consider possible participation. UHCC members are all 59 Chambers covering the entire country. The Union represents the Chambers at home and abroad and expresses their positions and a component of their views. The UHCC represents our country's entire business world: namely 880 thousand Hellenic enterprises.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	GetBusy.gr	http://getbusy.gr/	Getbusy.gr is a web portal containing comprehensive information and educational material that can be used by young people in Greece in order to empower their skills in accordance with today's modern and very challenging economic environment. Getbusy.gr is addressed to all young people who wish to enrich their knowledge, their Curriculum Vitae as well as their position in the labor market. It is also addressed to those who wish to be entrepreneurs and start their own business. Getbusy.gr, has educational and informational material, divided into four categories: ICT Skills; Personal & Professional Development; Entrepreneurship; and New Technologies and Sustainability. The Getbusy.gr part of the international initiative Microsoft YouthSpark is organized by Microsoft, HEPIS and PeopleCert.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries.			Getbusy.gr was presented during the Grand Coalition for Digital Jobs conference hosted by Jose Manuel Barosso and received a distinction at the European CSR Awards 2013. It is considered as a best practice at EU level and can be implemented in

	E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			other European countries. More information http://www.slideshare.net/athanassiospapadimitriou/getbusy-presentation-23190079
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	The Hellenic Qualifications Framework	http://www.nqf.gov.gr/	The National Qualifications Framework uses 8 levels of reporting, that are based on learning outcomes describing what the individual knows, comprehends and is capable of doing after the completion of the training process.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	PEOPLECERT Info test	http://www.peoplecert.org/en/Pages/peoplecert.aspx http://www.infotest.gr	With more than 3,300,000 certificates issued to date, PEOPLECERT Group offers independent, globally recognized certifications that evaluate competence, know-how and expertise. PEOPLECERT operates worldwide, with 100+ employees and 1,000 associates, through more than 10.000 global examination locations, including the extensive network of Pearson VUE. With internationally recognized brands such as ITIL®, IASSC Lean Six Sigma, ECDL, City & Guilds and a wide portfolio of market driven PEOPLECERT certifications based on specific industry requirements and globally recognized ISO standards. Infotest is active in Greece since 2003 and has exclusivity in the provision of Certiport certifications. It provides the following certifications: Microsoft

				Certified Application Specialist, Microsoft Office Specialist, IC3, Adobe Certified Associate, CompTIA, Infotest Certified Basic User, Infotest Certified CAD Specialist, Infotest Certified Joomla Specialist and @kids.
		I-Skills S.A.	http://www.i-skills.gr/index.php?lang=en	The company I-Skills (Society Anonyme for the Certification of Skills S.A. – I-Skills S.A.) was established in 2007, aiming at providing a thorough range of certification services in the field of education and vocational training for individuals and companies in Greece and neighbouring countries. I-Skills S.A. provides the following Certifications: I-SKILLS Cad 2 Basic; I-SKILLS Network ; I-SKILLS Multimedia Content Authoring; I-SKILLS Project Manager; I-SKILLS ERP FI User; I-SKILLS Web Developer; I-SKILLS DB Admin - SQL Server; I-SKILLS Web Designer; I-SKILLS Network Admin; I-SKILLS System Security
		ICT Europe	http://www.icteurope.gr/index.php	International Computer Technology is a Skills Certification programme for the use and knowledge of Computer and Information Technology at introductory, basic and specialized levels. It has a presence in Greece, in Cyprus and in Albania, since 2004 and provides the following certifications: ICT Intermediate; ICT Foundation; ICT Master In Office; ICT Advanced, and ICT Professional Training
		Aristotle Certification Training & Assessment	http://www.acta.edu.gr/en/acta/index.php	The ACTA Spin off Aristotle University of Thessaloniki, having acquired know-how in certifying computer knowledge offers reliable computer certifications, adopting and implementing reliable

		Vellum	http://www.vellum.org.gr	and fair examination procedures in accordance with the requirements of International Standards ELOT EN ISO / IEC 17024. ACTA provides the following certifications: CTNP, CWNP, CCITEE, CompTIA Strata IT Fundamentals, Certified Computer Programmer (CCP), Certified Java Programmer (CJP), Certified Data Base Designer (CDBD), Certified Information Security Professional (CISP), CELM, Infotest Certified Joomla Specialist, Certified E-commerce Consultant (CEC), and Certified Project Manager in Information Technology (CPMIT). Vellum Educational Services provides solutions to bridge the gap between educational programmes and assessment procedures in Greece, Cyprus and the Balkans. The company has been a Cambridge associate partner since 2OO3. It provides a series of certifications based on the International Diploma in IT skills Standard programme.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	EOPPEP	http://www.eoppep.gr/index.php/en/	EOPPEP is the National Organisation for the Certification of Qualifications and Vocational Guidance**,** an all-encompassing statutory body investing on better quality and more efficient & reliable lifelong learning services in Greece. EOPPEP operates under the supervision of the Minister of Education & Religious Affairs, Culture & Sports and is seated in Athens. It has derived from the amalgamation of three national bodies, all under the supervision of the same Ministry: the National Centre for the Accreditation of Lifelong Learning Providers (EKEPIS), the National Organisation for the

				Certification of Qualifications (EOPP) & the National Centre for Vocational Guidance (EKEP). The newly established national authority, the National Organisation for the Certification of Qualifications and Vocational Guidance (EOPPEP), corresponds to the pressing need of creating and maintaining a holistic and interrelated policy framework for the development of lifelong learning and certification of qualifications in Greece, linking with the open market and responding to the needs of the citizens, a central issue in EU policy.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and	There is no developed national ICT Skills Framework.		The Greek Skills Framework will be provided by EOPPEP in the upcoming months.

	proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.			
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively	Industry: Thanassis Papadimitriou , Senior IT Executive (thanassisp@gmail.com) Organizations/NGOs: Nikos Faldamis, President of HePIS (nikos.faldamis@gmail.com)		

	engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Education: Dr. Panagiotis Georgiadis, Professor in the Department of Informatics and Telecommunications of the University of Athens (p.georgiadis@di.uoa.gr)
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	HUNGARY 9,957,731 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of National Resources – State Secretary for Education	http://www.kormany.hu/hu/nemzeti-eroforras-miniszterium/oktataszert-felelos-allamtitkarsag	
		Ministry of National Development – State Secretary for Info-communication	http://www.kormany.hu/hu/nemzeti-fejlesztesi-miniszterium/infokommunikacioert-felelos-allamtitkarsag	
		Ministry for National Economy – State Secretary for Employment Policy	http://www.kormany.hu/hu/nemzetgazdasagi-miniszterium/foglalkoztataspolitikaert-elelos-allamtitkarsag	
		Educational Authority	http://www.oktatas.hu/	Within the Ministry of National Resources
		Hungarian Institute for Educational	http://www.ofi.hu/english	Within the Ministry of National Resources

		Research and Development Educational Non-profit.	 http://www.educatio.hu	 Within the Ministry of National Development
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Government IT Development Agency National Innovation Agency	http://www.kifu.gov.hu/index.php?lang=eng http://www.nih.gov.hu/english	Within the Ministry of National Development Within the Ministry for National Economy
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	NJSZT IVSZ	http://njszt.hu/en http://ivsz.hu/	John von Neumann Computer Society (Hungary) is the Hungarian CEPIS member. Hungarian Association of IT Companies
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.			No relevant ICT related Trade Union activity.

Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	MKIK AmCham Hungary	http://www.mkik.hu/en http://www.amcham.hu	Hungarian Chamber of Commerce and Industry American Chamber of Commerce in Hungary
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification	National framework against which	National	http://www.oktatas.hu	National training framework system

Framework	qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Qualifications Framework National Qualifications Register	/ http://www.ofi.hu/kiadvanyaink/orszagos-kepesitesi http://www.oktatas.hu/kepesitesek_elismertetese/english/hungarian_eric_naric_office https://www.nive.hu/index.php?option=com_content&view=article&id=297	List of Qualifications register
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	National Institute of Vocational Education Hungarian Institute for Educational Research and Development NJSZT	http://site.nive.hu/okjmodulterkep/ http://www.ofi.hu/appendix-090617-1/description-of-hungarian http://njszt.hu/en	Within the Ministry for National Economy Hungary uses the ISCED Levels to certify all education. (International Standard Classification of Education – maintained by UNESCO) John von Neumann Computer Society (Hungary) is the Hungarian national operator for ECDL Hungary and is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Hungary.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme	Hungarian Accreditation Committee	http://www.mab.hu/web/index.php?lang=en	Independent body responsible for oversight on quality of Higher Education in Hungary

	conforms to specific standards, if relevant.			
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	There is no developed national ICT Skills Framework.		
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT			

	professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	NJSZT	http://njszt.hu/neumann/dokumentumok/njszt-etikai-kodex	John von Neumann Computer Society (Hungary)
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	http://www.kormany.hu/hu/emberi-eroforrasok-miniszteriuma/hatterintezmenyek http://mta.hu/english/		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template		COUNTRY	IRELAND
		POPULATION	4,582,769 (Estimate 2012)
GENERAL/INSTITUTIONAL			
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Department of the Taoiseach	http://www.taoiseach.gov.ie/	Supports Government operations, and leadership, co-ordination and strategic direction of government policy.
		Department of Education and Skills	http://www.education.ie/	Works to provide high-quality education. Promotes equity, inclusion and lifelong learning. Enhances capacity for service delivery, policy formulation, research and evaluation.
		Department of Enterprise, Trade and Innovation	http://www.deti.ie/	Mission is to drive Ireland's competitiveness and productivity.
		Department of Communications, Energy and Natural Resources	http://www.dcenr.gov.ie/	Objectives regarding telecommunications include contributing to macro-economic growth by promoting investment in infrastructures, developing R&D reputation in ICT etc.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Science Foundation of Ireland	http://www.sfi.ie/	SFI invests in academic researchers and research teams who are most likely to generate new knowledge, leading edge technologies and competitive enterprises in the fields of science and engineering
		Discover Science & Engineering	http://www.discover-science.ie/	Developed by the SFI, DSE aims to increase interest in science, technology, engineering and mathematics (STEM) among students, teachers and members of

				the public
		FAS	http://www.fas.ie/	A nationally & funded run training & job placement organization.
		Forfas	http://www.forfas.ie/	Ireland's national training and employment authority. It enhances skills and competencies, provides tailored training and employment programmers.
		Expert Group on Future Skills Needs (EGFSN)	http://www.skillsireland.ie/	Ireland's policy advisory board for enterprise, trade, science, technology and innovation. Provides independent research and support; ensures coherence of policies; and evaluates enterprise policy interventions. Advises the Irish Government on current and future skill needs and other labour market issues.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	The Irish Computer Society (ICS)	http://www.ics.ie/	Founded in 1967, the ICS is the national body for ICT Professionals in Ireland. It is a member of CEPIS and IFIP. The ICS supports a number of related associations including the Health Informatics Society of Ireland, the Business Analysts Association of Ireland, IASA, association of data protection officers. Total membership is approximately 4,500
		Computers in Education Society of Ireland	http://www.cesi.ie/about-cesi	CESI supports the development of methodologies that help to marry new technologies with a sound pedagogy. Organised and driven by practitioners for practitioners, at all three levels of the educational system, CESI promotes the practical implementation of ICTs at school and classroom level.

		Irish Internet Association	http://www.iia.ie/	The Irish Internet Association is the professional body for those conducting business via the internet from Ireland. It has been and remains one of the driving forces behind the adoption of the medium. Established in 1997, the IIA provides leadership to enterprises and society conducting business in Ireland. The IIA has +300 member companies.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	ICT Ireland	http://www.ictireland.ie/Sectors/ICT/ICT.nsf/vPages/Home?OpenDocument	ICT Ireland is the leading representative body for the technology sector in Ireland and is affiliated to the Irish Business and Employers' Confederation (IBEC). Its membership is made up of the leading players in the Irish technology sector, as well as many early stage hi-tech companies and telecommunications companies. The vision of ICT Ireland is to maximise the contribution of these companies to Irish society and the economy.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Irish Congress of Trade Unions (ICTU)	http://www.ictu.ie/	Mission is to achieve economic development, social cohesion and justice through organising workers in unions and engaging with Government, employers, and other groups.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Chambers Ireland Enterprise Boards	http://www.chambers.ie/ http://www.enterpriseboards.ie/index.aspx	Ireland's largest business organisation, with 60 member chambers representing over 13,000 businesses. The 35 CEBs, were established in Ireland in 1993 to provide support for small businesses ('micro-enterprises') with 10 employees or less, at local level.

Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	ICS Skills initiatives: • E-Skills campaigns, • F1 in schools, • Scratch, • ChooseIT, • European Computer Driving License • Computing Curriculum ICS initiatives: • 3rd Level Professionalism	http://www.ics-skills.ie/equalskills/index.php http://www.f1inschools.ie/ http://www.scratch.ie/ http://www.chooseit.ie/public/index.php	These provide basic end user training to the elderly or those from socio-economic deprived backgrounds. This global competition challenges students to design, build & race miniature F1 cars. Students use IT to learn about physics, aerodynamics, teamwork, marketing, & business. Scratch visual programming language is designed to teach students programming & computational thinking. ChooseIT is a uses a website, presentation and school visits by 3rd level students of computing to dispel commonly held misconceptions about IT careers. ECDL is a globally recognised certification that proves the holder has met the recognised international benchmark in end-user computer skills. ICS Skills developed a Computing Curriculum for 2nd level junior cycle students. The course was designed with the assistance of a Syllabus Working Group (SWG) comprised of teachers. ICS travel to universities, colleges & institutes of technology around Ireland presenting research from CEPIS & IVI. Students receive 3 years free ICS

		Programme. • ICS Graduate Development Programme. • ICS Leadership Development Programme. • ICS CPD Programme. • Fastrack to IT (FIT)	http://www.fit.ie/	membership. This 3 year programme develops vocational and leadership skills in computing graduates. Industry has been consulted I the programmes design. Industry has been consulted regards content & delivery. This programme to develop leadership capabilities in senior I professionals. Industry was consulted via creation of the CIO advisory board. ICS schedule several events, training sessions, workshops & conferences yearly to support member's continuous professional development. FIT is an industry-led initiative which works in close collaboration with government departments and national education and training agencies, local development organisations and a host of community based organisations. Our primary partners in education and training include FAS, VECs, Third Level Institutions, Leargas, Leader Companies, Rapid Coordinators, Local Authorities and Employment Pacts. FIT's mission is to promote an inclusive Smart Economy by creating a fast track to marketable technical skills for those at risk of unemployment long term. It is the primary industry skills development initiative facilitating collaboration with government, education & training providers and disadvantaged communities to enable greater access

				to employment for marginalised job seekers. FIT Ltd, a registered charity and not for profit organisation, was established in 1999. The Initiative develops and promotes technology-based programmes and career development opportunities for job seekers who have become detached from the labour market in an increasingly knowledge-based economy. Since it started in Dublin in 1999, FIT has expanded substantially and now operates across the Republic of Ireland. More recently FIT has commenced programmes in Northern Ireland under the banner FIT-NI. To date, over 8,000 job seekers have completed FIT skills development programmes of which over 5,000 progressed into employment. 2,500 job seekers are currently participating in FIT programmes. Recently the EU Commission cited FIT as one of the most effective employability initiatives in Europe.
		WebActivate 2.0	http://www.digitalskillsacademy.com/courses/webactivate/	WebActivate-2.0 is an exciting new online publishing, digital marketing and entrepreneurship programme, that aims to equip participants to be self-employed web publishers and digital marketers servicing local businesses in their area or to start new careers as digitally-skilled employees.
		Log On, Learn	http://www.logonlearn.ie/	Log On, Learn is an easy and friendly way to learn how to use computers (to do the things you want). Log On, Learn is a programme designed to 'buddy up' a participating transition-year student with an older person from their local community to share skills with each other. The one to one nature of learning means that older people can learn about

				what they want to, at their own pace. Lessons usually take place in the school room, where the focus is on fun, sharing skills, stories and learning for life. The course suits older people who want to know more about using computers or who may not have had a chance to use a computer before. The transition year 'teachers' get a lot out of the classes too, mixing with people who have a wealth of knowledge and wisdom, and the time to share it.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Graduate Conversion	http://www.hea.ie/en/funding/institutional-funding/skills-funding http://www.ictskills.ie/AboutUs.aspx	The Graduate Skills Conversion Programme (GSCP) is a joint initiative with the Department of Education and Science and the Higher Education Authority, in response to the Information and Communications Technology (ICT) skills needs, identified by the Expert Group on Future Skills Needs and the mid-term evaluation of the ATS programme. It is funded under the National Development Plan.
		FAS eSkills Certification – ECDL FAS eCollege	http://www.ecollege.ie/site/pages/lol.html	These courses are designed to give a flexible response to the specific skills needs of job ready individuals who require training interventions with certification to assist them to re-enter the labour market. ICS Skills provide ECDL eLearning options to FAS
		Momentum	http://www.momentumskills.ie/	MOMENTUM funds the provision of free education and training projects to allow 6,500 jobseekers to gain skills and to access work opportunities in identified growing sectors.
		Skillnets	http://www.skillnets.ie/	Skilllnets funds and facilitates training through networks of private sector companies, in a range of

				sectors and regions. Each network delivers training that is relevant to specific industry and member company needs.
		Smart Futures	http://smartfutures.ie/	This national campaign promotes careers in science, technology, engineering and maths (STEM) to second-level students in Ireland. It aims to encourage the consideration of the STEM areas, such as technology (e.g. gaming, cloud computing, cyber security), engineering and energy (e.g. green tech), pharma and medical devices as potential career options.
		The Digital Hub	http://www.thedigitalhub.com/about/digital-hub-development-agency/20	The Digital Hub fosters innovation, technological development and creativity in a supportive, entrepreneurial environment. Our resident digital media and technology businesses enjoy excellent infrastructure and support, as well as ample opportunities for collaboration, networking and knowledge-sharing.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its	National Qualification Framework (NQF) referenced to EQF	http://www.nqai.ie/	Irelands NQF launched in 2003, has 10 levels, and now includes the majority of national awards. Ireland was the first EU Member State to reference its NQF to the EQF.

	development			
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	ICS Skills	http://www.ics-skills.ie/	ICS Skills, established in 1997, is the not-for-profit skills division of the ICS. To date, more than 17% of the Irish working population has undertaken an ICS Skills certification.
		National Standards Authority of Ireland	http://www.nsai.ie	NSAI is Ireland's official standards body. It is the national certification authority for CE Marking and provides a certification service to enable business demonstrate that Irish goods and services conform to applicable standards.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Irish National Accreditation Board (INAB)	http://www.inab.ie/	The national body responsible for accrediting laboratories, certification bodies and inspection bodies in Ireland, in accordance with ISO and European standards.
		Quality and Qualifications Ireland	http://www.qqi.ie/Pages/default.aspx	QQI was created by an amalgamation of four awarding and quality bodies in Ireland: FETAC, HETAC, and NQAI & IUQB. QQI has assumed all the functions of the four legacy bodies while also having responsibility for new or newly-statutory responsibilities in particular areas.
		Higher Education and Training Awards Council (HETAC)	http://www.hetac.ie/	The qualifications awarding body for third level institutions outside of the university sector. It awards qualifications, sets standards, accredits programmes, and provides quality assurance.
		Further Education	http://www.fetac.ie/	The statutory awarding body for further education

		and Training Awards Council (FETAC) National Qualifications Authority of Ireland (NQAI) Irish Universities Quality Board (IUQB)	 http://www.nqai.ie/ http://www.iuqb.ie/en/homepage.html	and training. It provides recognition for learning in education/ training centres, the workplace and community.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	The Expert Group on Future Skills Needs	http://www.skillsireland.ie/ http://www.skillsireland.ie/media/15072013-National_Skills_Bulletin_2013-Publication.pdf	EGFSN advises the Irish Government on current and future skills needs of the economy and on other labour market issues that impact on Ireland's enterprise and employment growth. It has a central role in ensuring that labour market needs for skilled workers are anticipated and met. Q4 2011 to Q4 2012, employment increased by 11,000 jobs in ICT. ICT professionals frequently switch jobs. ICT & Cross-disciplinary skills remain difficult to source (e.g. ICT combined with business intelligence and financial applications expertise; engineering combined with science skills).
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and	SFIA as part of Skills Cert programme	http://www.ics.ie/index.php/skills-	Skills Cert is an accreditation framework for IT job skills. Skills Cert uses SFIA in profiling an individual's competency on a range of ICT skills. This assessment

	proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	eCF	certification.html http://www.sfia.org.uk/	is validated internally and certification is awarded following external validation ICS is transitioning from SFIA to eCF. The tool will be promoted to ICS members & related societies.
Promoted By	Body promoting/advocating the above skills framework.	ICS Skills	http://www.ics-skills.ie/	Established by the Irish Computer Society in 1997, ICS Skills provides training, consultancy and professional development solutions for Irish businesses.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	Name	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	None	None	None
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	ICS Professional Code of Conduct	http://www.ics.ie/index.php?option=com_content&view=article&id=441&Itemid=244#ics-code-of-conduct	All ICS members subscribe to a code of conduct which has principles in five specific areas: 1. Protection of Public Interest and Legal Compliance. 2. Responsibility to Employers and Clients. 3. Professional Dignity and Promotion of Professional Aims. 4. Competence, Ethics and Impartiality.
BODIES OF KNOWLEDGE				
Type	**Guidance**	Name	**Website**	**Specifics**
Bodies of	Provide list and **brief** summary of Bodies	Project Management	http://marketplace.pm	

Knowledge (BoKs)	of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Body of Knowledge (PMBOK)	i.org/Pages/ProductDetail.aspx?GMProduct=00101095501	
		Software Engineering Body of Knowledge (SWEBOK)	http://www.computer.org/portal/web/swebok	
		Canada's Association of Information Technology Professionals (CIPS BOK)	http://www.cips.ca/CBOK	
		Information Technology Infrastructure Library (ITIL)	http://www.itil-officialsite.com/Publications/Core.aspx	
		COBIT 4.1	www.itgi.org/cobit	
		ACM/IEEE Computer Science Curriculum	http://www.acm.org/education/curricula/ComputerScience2008.pdf	
		Capability Maturity Model Integrated (CMMI)	http://www.sei.cmu.edu/library/abstracts/cmmi/	

		IT Security Essential Body of Knowledge	http://niccs.us-cert.gov/	
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Tom O'Sullivan - Deputy CEO, Irish Computer Society Robert Farrell - Projects Executive, Irish Computer Society Ted Parslow - Head of the Third Level Computing Forum Bill McCluggage - (NEW) Irish Government CIO at Department of Public Expenditure & Reform Pat O'Connor - Head of the ICT Skills section within the Higher Education Authority. Declan Brady – Vice president (ICS), Honorary Secretary (CEPIS)		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	ICS have recently formed the CIO advisory board comprised of CTOs, CIOs and IT directors from leading national & international firms located in Ireland. This board contributes to improving national levels of IT professionalism. In August, with the support of the CIO board ICS will unveil its CIO conference, Leadership development programme and Professionals website. Industry & academia are currently been consulted and planning is already underway. Coupled with other initiatives, this marks a significant step toward maturing the profession and improving professionalism.		

Country Profile Template			COUNTRY	ITALY
			POPULATION	60,820,696 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry for Education, University and Research	www.istruzione.it	Includes the portfolios of Education, University and Research.
		Ministry for Labour (Letta Governement)	www.lavoro.gov.it	Involved in the NQF initiative (involved with ISFOL).
		Ministry for Economic Development	www.sviluppoeconomico.gov.it/	Includes responsibility for policies for the development of technological innovation, and the area of telecommunications.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Digital Italian Agency-DigitPA	www.digitpa.gov.it/	National Agency for Informatics in Public Administration.
		CNEL	www.cnel.it	Consiglio Nazionale dell'Economia e del lavoro – CNEL is a "constitutional" body, under the auspices of the President of the Republic. CNEL is an independent (from Government) body whose mission is to influence and monitor Governmental actions. It has been active in the fields of Standardisation, e-Competences and e-Certificates.
		ISFOL	www.isfol.it/	Institute for the development of Vocational training (for Workers)
		CLICLavoro	www.cliclavoro.gov.it	New portal for the ministry of labour and social policies (Services and work exchange)

Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	AICA AIPSI FIDA ANIPA	www.aicanet.it/ www.aipsi.org/ www.fidainform.org/ www.anipa.it/	Italian association for Informatics & Automatic Computing (promotes the EDCL and EUCIP ICT Certification programs). Member of CEPIS. Italian association for Security professionals and Italian Chapter of ISSA (Information Systems Security Association). National Federations of Information Management Professional Association. (various regional CTI or CLUB IT are included) National Association of Public Administration (includes job profile definitions and continuous education for people in the IT Industry.)
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	ASSINFORM ASSINTEL CNA Comunicazione	www.assinform.it www.assintel.it www.cna.it	Large and medium offer companies association - Confindustria Digitale Medium and small offer company association - Confcommercio Micro company association - Confederazione Nazionale Artigiani
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	CISL CGIL UIL	www.cisl.it www.cgil.it www.uil.it	Confederation of Trade Unions in Italy Italian General Confederation of Labour Italian Workers Union
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names	Italian Chambers of Commerce.	www.chamberofcommerce.it	Portal for Chambers of Commerce, Industry, Agriculture and Crafts.

	of these Chambers of Commerce and **brief** summary of their work areas, if relevant.			
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Digital Advisory Group CIO AICA Forum-Community of future IT Leaders (selected by IDC Smart 2012/0106, DAE-Engagement for growth and jobs)	http://www.digitaladvisorygroup.it/en/digital-skill-levels.html www.aicanet.it	The DAG is a group of over 30 organizations, private and public companies and universities, willing to foster the development of the digital economy in Italy. To bridge the gap and catch up with the more advanced European countries, Italy will have to overcome five important hurdles, one of which is "Digital Skill Levels" Association of the largest IT demand companies, member of EuroCIO, along with AICA it promotes a one year programme for the future IT Leader: 8 webinars and 4 meetings per year, each one followed by in depth discussions and commenting on a reserved LinkedIn area, assisted by a community manager and a coach
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	AICA-Eucip Core in the Technical School AICA-Build up your future in ICT sector (selected by IDC Smart 2012/0106, DAE-Engagement for growth and jobs) AICA-Re-plan Your	www.aicanet.it www.aicanet.it and www.prospera.it Milan Chapter www.aicanet.it	Started 3 years ago, in 2013 around 100 Technical schools adopted Eucip Core for the 3 year course programme, including final certification; today the focus is on involving another 100 schools A joint initiative of AICA and Prospera, to support the orientation of new ICT graduates in the labour market; providing them with guidelines and personal support to produce their first CVs with relevant ICT competences Support in terms of Job Placements, through Eucip

		Future in ICT (selected by IDC Smart 2012/0106, DAE-Engagement for growth and jobs)	Milan Chapter	assessment and CV re-writing support focusing on highlighting the most interesting competences possessed.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	QTI (Italian Qualifications Framework)	http://www.quadrodeititoli.it	Framework for Qualifications for European Higher Education Area.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	AICA CEPAS EXIN	www.aicanet.it/ www.cepas.it/ www.exin-exams.com/	Italian association for Informatics & Automatic Computing. (Supports and is involved in EUCIP and EDCL). Member of CEPIS. Certification of Professional Training (in the area of ISO/IEC 17024 – Internal and Quality auditing) International Organization involved in distributing Exams to the IT professional (ISO Certified – focus on ITIL, Prince2, ITSM and Information Security)
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	ISFOL UNI ACCREDIA	www.isfol.it/ www.uni.com/ www.accredia.it	Institute for the development of Vocational training Italian Organization for Standardization (includes technological innovation) Italian authority for certification bodies accreditation
Supply estimates	If available, please provide headline			

	statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	e-CF EUCIP Elective Profiles	http://www.ecompetences.eu/ www.eucip.it	The European e-competence framework The CEPIS Competence and Professional Framework, adopted in Italy by PA (Manual 10, by Digit PA)
Promoted By	Body promoting/advocating the above skills framework.	AICA FCD Rete competenze digitali	www.aicanet.it/ www.forumcompetenzedigitali.org www.retecompetenzedigitali.it	Italian Association for Informatics & Automatic Computing Forum Competenze Digitali Federation of industry associations on digital competences referred to e-CF
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant	Digital Agency of Italy (formally approved		This new Digital Agency is trying to define what and how it will operate: its status still has to be

	jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	in February 2012)		approved. The future Digital Agency Director has been nominated: Mr Agostino Ragosa; the referee nominated by Prime Minister is Francesco Caio who in June 2013 will coordinate the activities of 4 Ministers for the Digital Agenda
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	ANIPA	http://www.anipa.it/index.php?option=com_content&view=article&id=16&Itemid=28	Code of Ethics for National Association Public Administration & people who are engaged in IT Industry.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	EUCIP Core	www.eucip.it	Is the only one in Italy; has been adopted by a sub system of Technical Schools with a special arrangement of the 3 modules (Plan, Build, Operate) for the last three classes; at the end of 5th class the certification is proposed.
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national	Agostino Ragosa - Director of Italian Digital Agency Francesco Caio - Prime minister referee for Digital Agency Stefano Parisi - President Confindustria Digitale Marco Ferretti - Responsible for EUCIP promotion in the Universities, as CINI-Consorzio Interuniversitario Nazionale per l'Informatica Fabio Massimo - President of UNI workgroup to adopt e-CF in Italy as Technical Norm		

	Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template		COUNTRY	LATVIA
		POPULATION	2,041,763 (Estimate 2012)
GENERAL/INSTITUTIONAL			
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education and Science Ministry for Economics Ministry of Welfare Ministry of environmental protection and regional development	izm.izm.gov.lv www.em.gov.lv www.lm.gov.lv/ www.varam.gov.lv	Includes portfolios of Education, Sciences, Sport and state languages. Included in portfolio is the medium to long-term vision of the Labour market. Includes the area of Labour Affairs. Ministry is responsible for e-skills development plan and information society development in Latvia.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	AIC AIKNC LIAA NVA VIAA	www.aic.lv/ www.aiknc.lv www.liaa.lv www.nva.gov.lv www.viaa.gov.lv	Academic Information Centre (NCP for EQF) Higher Education Quality Evaluation Centre (referred to HEQEC in English) Latvian Investment and development agency (supports and administers ICT education programmes for SMEs) State employment agency, administers ICT programmes for unemployed and underemployed State Education Development Agency

Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	LIKTA	www.likta.lv/	Latvian Information Technology and Telecommunications Association. The principal objective of LIKTA is to promote and further the development of Information Society in Latvia, so that all citizens may be given the opportunity to benefit from IT and contribute to the Knowledge based economy. LIKTA works toward increasing e-awareness in society by organizing conferences and educational endeavors and takes an active part in preparing professional study programs for IT specialists. LIKTA is the Latvian member of CEPIS.
		LDTA	www.itnet.lv/	Association of Computer Technologies of Latvia (Both are Members of ITTE ALLIANCE – includes LIA (Latvian Internet Association).
		LETERA	www.letera.lv	Latvian Electrical Engineering and Electronics association
		LATA	www.lata.org.lv	Latvian Open Technology Association
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			Please see previous section.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	LBAS	www.lbas.lv/	Free Trade Union Confederation of Latvia (LBAS) – incorporates 21 different braches & trade unions
		LIZDA	www.lizda.lv/	Latvian Trade Union of Education and Science Employees (unites over 34,000 members, active about 20 years)
		LDDK	www.lddk.lv	Employers' Confederation of Latvia: Supports

				definition of e-competences framework and activities initiated by Employers. Social partners to government of Latvia to define employers' needs for education. (LIKTA is a member of LDDK)
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	LCCI	www.chamber.lv	Latvian Chamber of Commerce and Industry.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Baltic Computer Academy (BDA) training getonelineweek/ eSkills Week 2013 Connect Latvia/Pieslēdzies Latvija	http://www.bda.lv/bda4/lv/Home/Pages/apmacibas-darba-mekletajiem http://eprasmes.lv/ http://www.piesledzieslatvija.lv/lv/	Free ICT training to unemployed and job seekers. BCA offers **a free** 16 master training programs will learn not only the theoretical knowledge in the field, but also gain practical skills in the application of information technology tools. E-Skills Week took place throughout Latvia with the involvement of 114 Latvian counties and cities and with more than 42,000 participants. Overall, participants were offered 855 events, along with more than 300 partners, including ministries, government agencies, businesses, banks, schools and universities, libraries, government departments and non-governmental organizations. The Project Connect Latvia, carried out by the company Lattelecom, offers free of charge computer training for people who are older than 50. During the project these people can get training on theoretical and practical skills of how to use compute for job and personal development needs
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be	Local coalition for e-skills and jobs in	http://www.likta.lv/LV/Aktivitates/Documents/E-	A Memorandum of cooperation on "E-skills partnership" was signed in March 2013 by representatives of the governmental sector, non-

	promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Latvia	prasmju%20partneribas%20memorands.PDF	governmental organizations and industry representatives – Latvian Information and Communications Technology Association (LIKTA,) , the Ministry of Environmental Protection and Regional Development, the Ministry of Economics, the Ministry of Education and Science, the Ministry of Welfare, the Latvian Chamber of Commerce and Industry), the Latvian Open Technology Association and the Latvian Internet Association. The cooperation will comply with the priorities defined at European Union level and in Latvian policy development documents such as Latvia 2030, the National Development Plan for Latvia 2014-2020, the Digital Agenda for Europe, the Grand Coalition for Digital Jobs initiative and the LIKTA Charter.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	AIC	www.aic.lv/	Academic Information Centre (NCP for EQF)
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	AIKNC (HEQEC in English) LIKTA	www.aiknc.lv www.likta.lv/	Higher Education Quality Evaluation Centre (referred to HEQEC in English) Latvian Information Technology and Telecommunications Association.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the	VIAA (SEDA in English)	www.viaa.gov.lv	State Education Development Agency – Implement National Policy in relation to EU programmes& policy

	international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.			
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	Number of ICT graduates (higher education level) – 2012 Number of state financed study places for ICT specialities Number of Universities and high schools preparing ICT students Number of ICT certificates issued in 2012 (ICT Industry and ECDL)	1247 3395 16 3600	Data provided by universities having ICT specialities Data provided by LIKTA and BDA
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	AIC	www.aic.lv/	Academic Information Centre (NCP for EQF)

Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	ECDL	www.ecdl.lv	For ECDL certification
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	LIKTA	http://www.likta.lv/LV/par_mums/Lapas/Sekcijas.aspx	Latvian Information Technology and Telecommunications Association.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these	Nadežda Semjonova, CEO, Baltic Computer academy Mara Jakobsone, Vice-president of LIKTA, responsible for ICT skills and information society issues Juris Borzovs, dean of faculty of Computing, University of Latvia		

	individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template		COUNTRY	LITHUANIA	
		POPULATION	3,007,758 (Estimate 2012)	
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education and Science	http://www.smm.lt/en/index.htm	Objectives include implementing the national system of formal and non-formal education, creation of conditions for lifelong learning, and implementation of state policy, administration of education and science, modernisation of national system of research and studies.
		Ministry of Economy	http://www.ukmin.lt/en/About/	Responsible for development of the country's long-term strategy for economic growth, enhanced competitiveness and promoting employment and human capital investment.
		Ministry of Social Security and Labour	http://www.socmin.lt/index.php?-973177706	The key objectives of the Ministry of Social Security and Labour are to implement the national policies on employment relations, remuneration and social partnership, occupational safety and health, labour market and employment, development of human resources and vocational training, etc.
		Science Council of Lithuania	http://www.lmt.lt/	Competitive research funding (distributing funds to researchers), evaluation of research activities in Lithuania, development of scientific resources in Lithuania
		Ministry of Transport and Communications	http://www.sumin.lt/	Oversees telecommunications and Information Society development in Lithuania.

		Ministry of Interior	http://www.vrm.lt	Responsible for training (including e-skills) of state employees
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Administrative Office of Social Care Institutions	http://www.sgiat.lt	State-owned institution under the Ministry of Social Security and Labour. It aims to administer 38 governmental social care enterprises, training and certification of social workers, etc.
		Lithuanian Labour Exchange	http://www.ldb.lt/en/Information/About/Pages/open_for_everyone.aspx	It offers vocational training, public works, works financed from the Employment Fund, starting of one's own business, job clubs, etc.
		Agency for Science, Innovation and Technology (MITA)	http://www.mita.lt/en/istaigos-veiklos-informacija/about-mita/	The main activity is the coordination of national (high-tech, industrial biotechnology) and international programmes (FP7, EUREKA, EUROSTARS, CIP) of research, technological development and innovation and other financial schemes. MITA also promotes business and science cooperation, commercialization of research and protection of intellectual property rights.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Lithuanian Computer Society (LIKS)	http://www.liks.lt/en/modules/tinycontent/?id=1	A voluntary and independently acting social association of computer and software users, specialists and amateurs in informatics and computer science. Since 1998 LIKS is a member of CEPIS. Since 2001, LIKS is a member of IFIP.
		Lithuanian Informatics Teachers Association (LInMA)	http://www.linma.org/	Association for e-skills teachers in secondary schools (with specialist participants from Universities, etc.)

Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Infobalt Association	http://www.infobalt.lt	Infobalt Association unites Lithuanian IT and Telecommunication companies, represents and defends their interests in Lithuania and abroad, and pursues creation of conditions for the growth of the ICT industry.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Lithuanian Trade Union Confederation	http://www.lpsk.lt/en/	Largest Trade Union centre in Lithuania; comprises twenty-six branches. Set up in May 2002. It is a member of International Trade Union Confederation, European Trade Union Confederation and cooperates with the International Labour Organization.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Association of Lithuanian Chambers of Commerce	http://www.tradepartner.eu/commerce/lithuania	It co-ordinates activities of the Chambers in formulating strategy for development of the Chamber system; formulates the overall strategy for international economic co-operation; represents Chambers with foreign entities, in trade fairs, conferences etc.
		Lithuanian Business Employers Confederation	http://www.svv.lt/index.php?language=eng	The largest SME business representation organisation in Lithuania with over 1800 enterprises. It works to create an environment conducive to business development, promoting job creation and initiatives for business investment.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration	e-Guardian	http://www.ecdl.org/programmes/index.jsp?p=771&n=1105	ECDL Foundation endorsed programme, which provides parents/care workers with the necessary knowledge to protect children from the dangers of the Internet and to safeguard their own computers from unwanted access.
		"Libraries for Innovation"	http://www.bibliotekospazangai.lt/en/	1,276 public libraries, branches and subdivisions, about 2,000 libraries' staff participated in the project (financed by Bill & Melinda Gates Foundation and

	initiatives…			Lithuanian Government). The libraries received technical equipment; they were equipped with broadband Internet connection. All libraries were included in the training activities of specialists and visitors, encouraging electronic service usage and consulting. Duration of the project was four and a half years (2008-2012).
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Lithuanian Information Society Development Programme 2011-2019	http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_e?p_id=425996&p_query=&p_tr2=2	Priority 1 of the programme is the "Improvement of Lithuanian Inhabitants Skills to Use ICT". This priority includes actions relating to encouraging Lithuanian residents to gain knowledge and skills required for successful use of the ICTs and to become involved in the information society, to improve their quality of life and to reduce social exclusion and to create the necessary conditions for that.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	National Qualifications Framework (NQF)		Currently being prepared; work commenced in 2006 on its development by the Labour Market Training Authority of Lithuania. Framework has 8 levels.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Lithuanian Standards Board / LST Sert	http://www.lsd.lt/en/	Public certification organisation (LST Sert) established by order of the Lithuanian Standards Board. LST Sert certifies for instance quality management, environmental protection

		Lithuanian Computer Society (LIKS)	http://www.liks.lt/en/modules/tinycontent/?id=1 , http://www.ecdl.lt	management, information security management systems. Lithuanian Computer Society (LIKS) is the Lithuanian national operator for ECDL Lithuania and is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Lithuania.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Lithuanian National Accreditation Bureau Centre for Quality Assessment in Higher Education Public institution "Information Technologies Institute"	http://www.nab.lt/en/?pid=12 http://www.skvc.lt/en/?id=0 http://www.ecdl.lt	Responsible for accrediting testing, calibration laboratories, certification bodies for products, personnel, quality and environmental management systems, among other areas Independent public agency established in 1995. Implements the external quality assurance policy in research and higher education in Lithuania. Founded by the Ministry of Education and Science as an expert institution. Coordinator of ECDL activities and testing centres in Lithuania
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012)	Digital Competence / ICT skills	https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/LT%20internet%20use.pdf (from: https://ec.europa.eu/digital-agenda/sites/digital-	

	Number of private education providers for ICT education (2012)		agenda/files/LT%20internet%20use.pdf)	
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	The General Computer Literacy Programme General Computer Literacy Standard	http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=386105 (in Lithuanian) http://www3.lrs.lt/pls/inter3/dokpaieska.showdoc_l?p_id=248841 (in Lithuanian) http://www.doc88.com/p-665162024175.html (in English)	Stipulates the elaboration of computer literacy programmes complying with the needs of different professional groups and complementing the General Computer Literacy Standard; approved by the Resolution No 1176 of Government of the Republic of Lithuania of 15 September, 2004 (Official Gazette, 2004, No 140-5124) Approved by Minister of Education and Science of the Republic of Lithuania, Order No. ISAK-2016 of 14 December 2004
Promoted By	Body promoting/advocating the above skills framework.	Ministry of Science and Education	http://www.smm.lt	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any.			

	Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	LIKS INFOBALT Association	http://www.liks.lt/en/modules/tinycontent/?id=1 http://www.infobalt.lt	The Lithuanian Computer Society (LIKS) is involved in raising professional ethics of LIKS members. INFOBALT Association of ICT companies has established a Court of Honour
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.			
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template		COUNTRY	LUXEMBOURG	
		POPULATION	524,853 (Estimate 2012)	
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education and Training	http://www.men.public.lu/	The Ministry of Education and Training's mission is essential in planning and administration of all courses offered in Luxembourg, apart from higher education, it is the responsibility of the Ministry of Culture, Higher Education and Research.
		Ministry of Higher Education and Research	http://www.mcesr.public.lu/	Ministry of Higher Education and Research has responsibility for higher education and universities, student life, recognition and approval of academic qualifications as well as international cooperation.
		Ministry of Economy and Foreign Trade	http://www.eco.public.lu/	Responsibilities include general economic policy, company policy, technology and innovation, promotion of foreign trade, quality policy (accreditation, certification, and standardisation), and intellectual property.
		Ministry of Labour and Employment	http://www.mte.public.lu/	Responsible for the policy areas of employment and the field of labour law and industrial relations.
		Government Portal for Media and Communications	http://www.mediacom.public.lu/index.html	

Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	ILNAS	http://www.ilnas.publi c.lu/fr/ilnas/index.html	The Luxembourg Institute of Standardisation – the Accreditation, the Safety and Quality of products and services is a government department under the supervision of the minister in charge of Economics.
		CTE (Centre for Educational Technology)	http://www.cte.lu/	Centre for Educational Technology is a service of the Ministry of Education. Its activities extend to the entire public education in Luxembourg and to all information technology and communication.
		The Employment Administration (ADEM)	http://www.adem.publ ic.lu/	Agency to promote the optimal use of potential work, to recruit workers abroad, to implement legislation on the prevention of unemployment, reduction of unemployment and the granting of full unemployment benefit, to organize and provide career guidance for young adults, to intervene in terms of conversion and reuse of the workforce, to provide training, rehabilitation and professional integration of disabled persons, and to provide direction, training, placement, rehabilitation and outplacement for workers with reduced work capacity.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Association Luxembourgoise des Ingenieurs (ALI)	http://www.ali.lu/	Association of Engineers, Luxembourg (CEPIS Member). ALI's objectives include the contribution to the development of science and technology, to cooperate with domestic and foreign associations, to provide continuing education and vocational training to its members, and to advise official bodies of the challenges the profession is facing.

		Professional Association of Information Security - Association des Professionnels de la Société de l'Information (APSI)	www.apsi.lu	The Association for Professionals in the Information Society (APSI) is a non-profit business association of professionals working in the field of information. The SIPA aims to promote the creation of public and private initiatives in the areas of information society in the Grand Duchy of Luxembourg.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	OGBL	http://www.ogbl.lu/html_fr/qui_sommes_nous/presentation.html	Trade Union Multi-professional Confederation with more than 60,000 members.
		LCGB	http://lcgb.lu/	Trade Union with 40,000 members.
		CGFP	http://www.cgfp.lu/	Trade union representing civil service workers. Comprising of some sixty professional federations and associations of public service, CGFP includes a total of more than 28,000 members, making it the only public service union and a major player in the trade union scene in Luxembourg.
		ALEBA	http://www.aleba.lu/#	Trade Union for Employees in the Banking and Financial Services sector with more than 12,000 members
		FNCTTFEL	http://www.landesverband.lu/	Trade Union Confederation representing Railway employees, Civil Servants, Public and private sector

				employees in the Transport sector in Luxembourg.
		SYPROLUX	http://www.fcpt-syprolux.lu/fcpt_syprolux/fcpt_mission.htm	Trade Union of Transport and Freight sectors.
		FEDIL	http://www.fedil.lu/	Founded in 1918, FEDIL is the Business Federation of Luxembourg.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Chambre des Métiers (GuildChamber of Luxembourg)	http://www.cdm.lu/	The Guild Chamber of Luxembourg is a professional body whose main objective is the interest representation of the Luxembourg craft industry.
		Chambre de Commerce (Chamber of Commerce)	http://www.cc.lu/	Today the Chamber of Commerce has more than 50,000 citizens, occupying 75% of total employment, representing 80% of GDP.
		Agricultural Professional Chamber	http://pro.ovh.net/~produitd/	The Objective of the Agricultural Chamber in Luxembourg is the interest representation for Farmers, Wine-makers and Horticulturists.
		Chambre des Salariés (Chamber of Employees)	http://www.csl.lu/	The Chamber of Employees has more than 400,000 members. All the employees and pensioners, with the exception of civil servants and employees in the public sector, are obligatorily affiliated with the Chamber of Employees, independent of their nationality or their place of residence.
		Chambre des Fonctionnaires et des Employés Publics (Chamber of Civil Servants and	http://www.chfep.lu/	Professional Chambers are public bodies with their main objective being interest representation for their members. The Chamber of Civil Servants and Employees in the public sector was created in 1964 and has fewer than 40,000 members.

		Employees in the public sector)		
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Luxembourg Government ICT program 2009-2014	http://www.gouvernement.lu/gouvernement/programme-2009/programme-2009/01-etat/index.html http://www.mediacom.public.lu/comm_elec/e-Skills/	The plan focuses on, amongst other actions, the development of ICT practitioners' skills and e-Business skills, as well as digital literacy for citizens.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational	NQF coordination by the Ministry of		Outline of a comprehensive NQF was presented to the Council of Ministers in early 2009. Work has

	institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Education		continued on this basis, resulting in the agreement (March/April 2010) of a set of descriptors covering all levels and types of education and training. There is an on-going discussion at Ministerial level for the adoption of the Framework. Work is on-going.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Chambre des Salariés (Chamber of Employees)	http://www.csl.lu/	See above for details – ECDL Certification, CISCO Training and Certification, Pearson VUE Certification accredited Centre
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Ministry of Higher Education and Research	http://www.mcesr.public.lu/	Ministry of Higher Education and Research has responsibility for higher education and universities, student life, recognition and approval of academic qualifications as well as international cooperation.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and	No Skills Framework		

	proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.			
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			

CONTACTS		
Type	**Guidance**	**Specifics**
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	MALTA 417,520 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry for the Economy, Investment and Small Business Ministry for Education and Employment	http://www.meib.gov.mt https://www.education.gov.mt/	The Ministry is responsible for external trade, industry, Investment Promotion, Malta Enterprise, Government Investments, Small Business and the Self-employed, Cooperatives, Trade Services, Ports, Maritime Affairs, Promotion and Financial Services, Information and Communication Strategy and Digital Economy. The Ministry is responsible for Childcare and Early Education, Compulsory Education, Higher Education, Life-long Learning, Examinations, Public Libraries, National Library, National Archives, Employment and Training, Research and Innovation, Science and Technology Policy, Youth, Sport and Sport Complexes
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific	Malta Information Technology Agency (MITA)	www.mita.gov.mt	The Malta Information Technology Agency (MITA) is the central driver of the Government's Information and Communications Technology (ICT) policy, programmes and initiatives in Malta. MITA's role is to deliver and implement the assigned programmes as set out in MITA's Strategic Plan 2009-2012. MITA manages the implementation of IT programmes in Government to enhance public service delivery and provides the infrastructure needed to execute ICT services to Government. MITA is also responsible to

	agency responsible".			propagate further use of ICT in society and economy and to promote and deliver programmes to enhance ICT education and the use of ICT as a learning tool.
		Employment and Training Corporation	www.etc.gov.mt	The Employment and Training Corporation is Malta's Public Employment Service. The Corporation was set up 1990 to: - Provide and maintain an employment service - Find suitable employment and to assist employers to find suitable employees - Provide training service to clients seeking new jobs and to clients already on the job but wanting to improve their knowledge and skills
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Computer Society of Malta	http://www.csm.org.mt	The Computer Society of Malta was founded in 1992, as the national organisation representing Information & Communication Technology professionals in Malta. The Society offers a number of services aimed at promoting the ICT profession and raising the standard of ICT practitioners in Malta. CSM is the Maltese member of CEPIS.
		British Computer Society Malta Section	www.bcs.org.mt	The BCS Malta Section is one of many International sections of the BCS. It was established in Malta in 1997 with the aim of promoting the ideals of the BCS in Malta, facilitating local membership, organising professional activities, and fostering the development of professional standards in the IT industry. The Malta section have been influential in the local scene ,and has been active in organizing

				events, addressed by high-profile persons, for the interest of members and the local IT community in general. The Malta section, in essence, extends to Malta the role the BCS plays internationally, under its guidance and influence.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	e-Skills Alliance Malta	www.mita.gov.mt/Page.aspx?pageid=197	E-Skills Alliance Malta was set up in October 2010 through a multi-stakeholder partnership led by MITA together with other public sector actors, business representative bodies and the private ICT sector. E-Skills Alliance Malta is mainly concerned with ensuring that business gets exactly the skills it needs. Its work and corresponding results are guided by one simple principle - identifying and pursuing the creation of practical and relevant ICT skills. And not just random skills but targeted skills – namely those needed to attract investment and jobs with the best prospects.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	General Workers' Union (GWU)	www.gwu.org.mt	The GWU was founded in 1943 and has been politically identified with the Labour Party (Malta) as the major left-wing trade union in Malta. The two were statutorily fused and continue to share many common objectives. The GWU is the largest trade union movement in Malta and organised in a confederation format of 8 Sections each to an extent autonomous in conducting industrial relations. The 8 Sections of the Union covering most sectors of the economy are: Government and Public Entities; Professional Finance and Services; Chemicals and Energy; Manufacturing; Hospitality and Foods; Maritime and Aviation; Metal and Construction,

				Technology Electronics and Communications.
		Union Haddiema Maghqudin	www.uhm.org.mt	The Union Haddiema Maghqudin (UHM) was founded on 29th September 1966, under the name of the Malta Government Clerical Union (MGCU) with membership restricted to clerical employees in the Public Service. Salvino Spiteri and Maurice Agius respectively were the Union's first President and Secretary General. The main objectives of UHM are: - to unite workers into one strong homogeneous body; - to enhance the dignity of the worker and to improve his conditions of work as well as his economic and social standing; - to gain proper representation on bodies where its presence would further the interests of its members; - to achieve and maintain unity of purpose and action among members; - to foster trade unionism among all workers and at all levels; - to educate workers in those matters that affect them; and - to ascertain a good standard of living for pensioners and those who retire from work.
		The Confederation of Malta Trade Unions (CMTU)	www.cmtu.org.mt	The Confederation of Malta Trade Unions (CMTU) has a membership of 30,000. The CMTU has no political party affiliations, and its constitution, while placing certain obligations on the affiliates of the

				Confederation, leaves the individual organisations free to act as they deem best in the interests of their members. The objectives of the Confederation are to promote the interests of its affiliates and to further the ideals of a democratic trade union movement as well as to improve generally the economic and social conditions of workers.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	The Malta Chamber of Commerce, Enterprise and Industry	www.maltachamber.org.mt	The Malta Chamber of Commerce, Enterprise and Industry shall seek: "To vigorously influence the formation of policy at national and European level towards the development of an enterprise culture, the creation of favourable economic conditions to the advantage of Members and the interests of the wider community."
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Student Placement Programme A brighter Future Initiative	www.mita.gov.mt/spp www.mita.gov.mt/news.aspx?nid=793&catid=37 https://www.mita.gov.mt/page.aspx?pageid=672	The Student Placement Programme provides work experience in an ICT environment for students who are pursuing vocational and academic ICT and ICT-related study paths at MQF Level 4 and higher from both public and private educational institutions and those awaiting results of 'A' or 'Intermediate' level examinations. It is a cost effective way for employers to employ relevant young talent that can be shaped further to better suit their business requirements. The employer benefits from a fresh dose of enthusiasm and creativity that young talent brings while students benefit from applying their academic and vocational knowledge to solve practical problems and gain valuable work experience. A series of initiatives geared towards younger students to entice them to develop into ICT Professionals.

Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	e-Skills Alliance Malta Strategic Plan	https://www.mita.gov.mt/MediaCenter/PDFs/1_eSkills%20Alliance%20Malta%20-%20Strategic%20Plan%202010-2011.pdf	Document outlining the strategic plan, including: Vision - The vision for the Alliance is to be the collective voice and authoritative entity for all stakeholders to work together to ensure that Malta offers the best possible supply of ICT professionals that is required by the international and national ICT industry. Mission - The Mission for the Alliance is to effectively and efficiently gel together the industry, the educational authorities and Government to improve the variety, quality and quantity of ICT competences based on the economic needs of our country. Core Remit - The Alliance will seek to promote the skills requirements of the ICT sector and those required by the ICT-intensive sectors which inevitably contribute to the demand for ICT skills. These include: • ICT consultancy services • ICT outsourcing services • ICT operations including Business Intelligence, Data Management, Security, Service Delivery and Security • Networking and communications, including telecommunications • Emerging trends such as – Gaming and the Creative Arts sector • Business and Financial services sector • Manufacturing sector

EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Malta Qualifications Framework	http://www.ncfhe.org.mt/content/home-malta-qualifications-framework/5963805/	The Malta's Qualifications Framework (MQF) gives a national identity in Malta's educational world as well as provides international recognition within the European Union/Community and beyond. Malta's Qualifications Framework takes the existing qualifications currently being issued by local education and training institutions and references them to the eight different levels of the framework.
		National Commission for Further and Higher Education	http://www.ncfhe.org.mt/	National Commission for Further and Higher Education (NCFHE) was legislated by the revised Education Act which came into force on the 1st August 2012 however; the foundations of this Commission go back to 2005 when the Malta Qualifications Council was set up. The National Commission for Further and Higher Education in fact incorporates both the Malta Qualifications Council (MQC) as well as the National Commission for Higher Education (NCHE). The Commission's remit is the licensing, accreditation and quality assurance of further and higher education. Further education refers to all formal education of persons above the compulsory school age. -
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a			There is not a single national certification body in Malta, but there is a large variety of accredited training providers that enable candidates to obtain professional ICT certifications.

	wide range of ICT certification programmes, if relevant.	ECDL Malta	www.ecdl.com.mt	ECDL Malta manages the ECDL certification programmes on behalf of the Computer Society of Malta (CSM) and accredits local test centres to run ECDL examinations and certifications.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	National Accreditation Board Malta	www.nabmalta.org.mt	The National Accreditation Board - Malta (NAB - MALTA) is operated as a Board under the responsibility of the Parliamentary Secretary for Consumers, Fair Competition, Local Councils and Public Dialogue which falls under the responsibility of the Office of the Prime Minister. NAB-MALTA was established as the single nationally recognized accreditation body in Malta with the authority to give accreditation. In particular, the functions of NAB-MALTA include the following (amongst others): - to accredit certification bodies providing certification of products, - to accredit certification bodies providing certification of management systems such as ISO9001, ISO14001, ISO27001 etc. (ISO17021) and personnel;
		Malta Qualifications Recognition Information Centre - MQRIC	http://www.ncfhe.org.mt/content/home-about-us-malta-qualifications-recognition-information-centre-mqric/5668870/	MQRIC is now part of the National Commission for Further and Higher Education. Established as the official national body to deal with the recognition and comparability of both academic and vocational qualifications MQRIC co-ordinates the different agencies and authorities which are entitled to

				evaluate and award credentials and licenses. MQRIC was set up in 2002 and was established to satisfy the requirements established in Act XVIII of 2002 of the Reciprocal Recognition of Qualifications, as well as the convention on the recognition of qualifications related to Higher Education in Europe.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	National Statistics Office	http://www.nso.gov.mt	The National Statistics Office (NSO) is the executive arm of the Malta Statistics Authority. It is responsible for the collection, compilation, analysis and publication of a wide range of statistical information and related matters. This does not prevent other government departments or institutions from collecting their own statistical data for internal purposes. Statistical reports published include information about ICT usage by households and industry and Adult learning.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related	Skills Framework in development		A local Skills Framework is currently in development and will be mapped to the European e-CF.

	to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.	e-Skills Alliance Malta	http://www.eskillsalliance.com	E-Skills Alliance Malta was set up in October 2010 through a multi-stakeholder partnership led by MITA together with other public sector actors, business representative bodies and the private ICT sector. E-Skills Alliance Malta is mainly concerned with ensuring that business gets exactly the skills it needs. Its work and corresponding results are guided by one simple principle - identifying and pursuing the creation of practical and relevant ICT skills. And not just random skills but targeted skills – namely those needed to attract investment and jobs with the best prospects.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	Malta Communications Authority	www.mca.org.mt	The MCA is the national regulatory authority of the communications sector in Malta. The authority regulates electronic communications, e-Commerce and postal sector, and is also responsible for elements of the national ICT such as e-Inclusion, Internet safety and Internet governance.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify	Computer Society of Malta Code of Conduct	http://www.csm.org.mt/category/content/about-us	The Code of Conduct of the Computer Society of Malta is based on the guidelines issued by CEPIS and covers the following four principal areas: 1.

	principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.			Protection of Public Interest and Legal Compliance; 2. Responsibility to Employers and Clients; 3. Professional Dignity and Promotion of Professional Aims; 4. Competence, Ethics and Impartiality.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			ITIL Prince 2 COBIT ISO 27000 E-Competence Framework
CONTACTS				
Type	**Guidance**	**Specifics**		

Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Mr John Ambrogio – Chairman, eSkills Alliance Malta
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	On the 30th May 2103, the Government of Malta appointed Mr Godfrey Vella as Malta's new Digital Champion. Mr Vella is a board member of the Malta Communications Authority. http://gov.mt/en/Government/Press%20Releases/Press%20Photos/Pages/2013/May/Government-of-Malta-appoints-Mr-Godfrey-Vella-as-Malta%E2%80%99s-new-digital-champion.aspx

Country Profile Template			COUNTRY	NETHERLANDS
			POPULATION	16,730,348 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry for Education, Culture and Science Ministry for Economic Affairs, Agriculture and Innovation Ministry for Social Affairs and Employment	www.minocw.nl/ www.minlnv.nl/portal/page?_pageid=116,1640354&_dad=portal&_schema=PORTAL www.szw.nl/	
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	WRR AWT WTR	www.wrr.nl/ www.awt.nl/?id=16 www.surfsites.nl/wtr/	Advises government about future developments – bridge between academia and policy The Advisory Council for Science and Technology Policy - advises the Dutch government on policy in the areas of scientific research, technological development and innovation. The Scientific Technical Council (WTR) is an independent advisory body of SURF
Professional Bodies/National	Provides names of National computing or informatics societies or bodies, and their	Nederlands Genootschap voor	www.ngi.nl	NGI is the Dutch professional association of and for IT professionals and managers, an independent

Computing Associations	key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Informatica (NGI)		platform where over 3,000 members deepen their knowledge and their networks. NGI exists since 1959. NGI is a member of CEPIS.
		Vereniging van Register Informatica (VRI)	www.vri.nl	VRI is an Association of Registered Information Scientists. VRI is a member of CEPIS. The VRI is one of the oldest ICT professional organizations in the Netherlands, and is focused on promoting skilled, professional and socially responsible Information Scientists. VRI connects experienced professionals, organizes interesting meetings and facilitates networks across business, government and education.
		SNIR	www.snir.nl/	Dutch Foundation for registered informatics – monitors qualifications and professionalism of ICT members.
		SURF	www.surf.nl	A cooperative organization in which universities and research institutes work together on ground breaking ICT innovations.
		NGN	www.ngn.nl/	IT professionals, mostly managers of computer networks.
		GIA	http://www.gia.nl/	Society for Information Architects
		ISOC	http://isoc.nl/organisatie/	Internet Society Netherlands is the national chapter of the multi-national operating Internet Society.

		CIO platform	www.cio-platform.nl/	Independent association of CIOs and IT directors of private and public organizations in the Netherlands.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	ECP.NL	www.ecp.nl	Knowledge platform where government and industry can exchange their knowledge & experience.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	CNV FNV MHP	www.cnv.nl/ www.fnv.nl www.vakcentralemhp.nl/home.asp	National Federation of Christian Trade Unions Federation Dutch Labour Movement Federation of Managerial and Professional Staff Unions
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Dutch Chambers of Commerce	www.kvk.nl	
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Ctrl Alt Delete: Lost productivity due to IT problems and inadequate computer skills in the workplace Digivaardig action	http://www.ecdl.org/media/ControlAltDelete_LostProductivityLackofICTSkills_UniverstiyofTwente1.pdf http://www.digivaardi	Commissioned by the European Computer Driving Licence, "Ctrl Alt Delete: Productivity Loss Due to IT Problems" stresses the scale of the problem affecting the Netherlands, and highlights a lack of awareness at both management and employee level. Recommendations include establishing more structured IT training and education, as well as expanding the role of helpdesks, and formalising ad-hoc assistance provided by tech-savvy colleagues in the workplace. Online multi-stakeholder resource platforms for

		programme on e-skills and competences Kennisnet	gdigiveilig.nl/ http://www.kennisnet.nl/	"digital skills" and "digital safety". The platform is supported by corporates, the Dutch government as well as the European Commission. Online platform for all aspects of ICT skills in education
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Government actions related to e-Skills and ICT Competences	http://www.rijksoverheid.nl/onderwerpen/ict/ict-en-ondernemers/ict-kennis-en-digivaardigheden	Part of the Dutch Government's 'Digital Agenda'
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	NVAO	www.nvao.com/	As list below under Accreditation Bodies
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	ECDL EXIN	www.ecdl.nl/ www.exin-	The internationally recognized European Computer Driving Licence, which indicates the level of knowledge in computer skills. EXIN International – Distribute Exams for IT

			exams.com/NL/en/home/	Professionals
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	NVAO HobéonGroep Certiked NQA	www.nvao.com/ www.hobeon.nl www.certiked-vbi.nl www.nqa.nl	Organization that independently ensures the quality of higher education in Flanders and the Netherlands. Officially recognized Assessing Agency. Officially recognized Assessing Agency. Netherlands Quality Agency B.V. assesses study programmes and offers advisory services to educational authorities in matters of internal and external quality assurance. In this way NQA contributes to the continuous improvement of the quality of education of secondary schools, schools of senior secondary vocational education, universities of professional education (hogescholen), universities and in-company training courses.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	Nederland ICT	www.nederlandict.nl	Nederland ICT is the trade association for more than 550 IT, Telecom, internet and office companies in the Netherlands. Nederland ICT represents a business community with a turnover of almost €30 billion and over 250000 employees, making IT the foremost advocate and representative of the Dutch ICT sector.

E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	NVAO	www.nvao.com/	As above under Accreditation Bodies.
Promoted By	Body promoting/advocating the above skills framework.	Ngi, Dutch computer society NEN- Normalisation institute Netherlands	http://www.ngi.nl http://www.e-cf.nl/	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	VRI	www.vri.nl	VRI is an Association of Registered Information Scientists. VRI is a member of CEPIS. The VRI is one of the oldest ICT professional organizations in the Netherlands, and is focused on promoting skilled, professional and socially responsible Information Scientists. VRI connects experienced professionals, organizes interesting meetings and facilitates networks across business, government and education.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Dutch professional association for ICT Vereniging van Register Informatica	http://www.ngi.nl http://www.vri.nl	Dutch professional association for ICT, NGI is a member of CEPIS VRI is an Association of Registered Information Scientists. VRI is a member of CEPIS.

		(VRI) NOREA	 http://www.norea.nl/	Professional association for IT-auditors in the Netherlands
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	NGI	www.ngi.nl	NGI is the Dutch professional association of and for IT professionals and managers, an independent platform where over 3,000 members deepen their knowledge and their networks. NGI exists since 1959. NGI is a member of CEPIS.
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Government: Maarten Hillenaar CIO at the central government Education: Hans Frederik president of NIOC (National education congress within ICT) The NIOC foundation is established in 1990 to realise congresses to promote and disseminate knowledge and innovation on the field of IT education and training for all educational levels. The realisation of these two-yearly events is always in full cooperation with institutes for IT education (in particular from universities for professional education (polytechnics) and full universities). On this website the archive of all nine realised events is accessible and contributions can be searched. Besides that, the NIOC foundation supports activities relating to the quality of IT education in general and the professionalism of the IT employee. Education & Certification: Anneke Hacquebard Industry: Arjan van Dijk (Ambassador of the NGI)		

ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY	POLAND
			POPULATION	38,538,447 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of National Education Ministry of Science and Higher Education Ministry of Infrastructure Ministry of Administration and Digitization	www.men.gov.pl/ www.nauka.gov.pl/home www.en.mi.gov.pl/ https://mac.gov.pl/eng/	Education portfolio. Science & Higher education portfolio – Research is also included in the portfolio. Part of governmental administration which includes communications portfolio. Oversees actions related to the Information Society in Poland
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	IBE (Educational Research Institute)	www.ibe.edu.pl	Conducts both general and applied educational research, drafts expert opinions for the purpose of educational policy and practice, and fulfils advisory functions – on behalf of the Ministry of National Education.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl	The Polish Information Processing Society was established in 1981 as professional organization representing IT professionals. From its beginning the PIPS has fostered links between experts from

	of the main professional ICT body in your country.	Polish Academy of Sciences	www.pan.pl	industry, academia and business promoting education, knowledge sharing, and codes of conduct and skills frameworks. It voices the member's opinions, needs, interests, and rights in relations with the general public, local and central government and with other associations in Poland and abroad. In 1992 PIPS was the first organisation from the post-communist countries to become a member of the Council of European Professional Information Societies (CEPIS). State scientific institution within which operates The Committee on Informatics.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Commission for the information technology, telecommunications and the information society	http://www.bcc.org.pl/About-us-English.4389.0.html	The Commission for information technology, telecommunications and the information society is affiliated to the Business Centre Club – the biggest private employer organization in Poland. The Commission's objective is to create a platform for dialogue, cooperation and collaboration of individuals, organizations and companies from the ICT industry.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	NSZZ OPZZ FZZ	www.solidarnosc.org.pl/en/ www.opzz.org.pl www.fzz.home.pl	NSZZ Solidarność All-Poland Alliance of Trade Unions Forum of Trade Unions Very few ICT professionals are union members and unions don't bring up issues relevant to the ICT industry
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of	Polish Chamber of Information	www.piit.og.pl	Very actively involved in evaluation of regulations related to business in the sectors of information

	the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Technology & Telecommunications Poland Import/Export Chambers of Commerce	www.chamberofcommerce.pl	technology and telecommunication, combined with provision of information about their effects to members of the Chamber. Polish Import/Export chamber of commerce.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	PARP HR eSkills Manager	http://www.eskills.pl/?gclid=CJOkhdT_rrkCFcJc3god_1AA4Q	PARP HR eSkills Manager is the network-based ICT skills management tool for employees of Polish SMEs. It has been developed under the supervision of the Polish Agency for Enterprise Development (PARP) and operates in a cloud using centralized database of ICT training courses and social features.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Cyfrowa Polska (Digital Poland) Operational Program	http://www.mrr.gov.pl/aktualnosci/fundusze_europejskie_2014_2020/Strony/ProgramPolskaCyfrowa2014_2020_praceprzygotowawcze.aspx	Government programme focusing on four priority axes: broadband networks, effective administration and open government education and digital integration of society's e-economy. It includes a number of initiatives relating to e-skills.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**

Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Polish National Qualification Framework (PNQF)	www.krk.org.pl/en/About_project	Developing an expert model of Polish National Qualifications Framework (PNQF) for lifelong learning and its implementation. (Carried out by the Ministry for National Education).
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl	Supports & Certifies ECDL and EUCIP in Poland.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Polish Information Processing Society(PIPS/PTI)	www.pti.org.pl www.ecdl.pl	The Polish body authorized to provide the ECDL programme at national level in Poland.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			About 16 000 computer science and engineering graduates in 2012. ICT education is provided at 220 state and private universities and colleges.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help	Polish National Qualifications	www.krk.org.pl/en/About_project	Developing an expert model of Polish National Qualification Framework (PNQF) for lifelong learning

	result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	Framework (PNQF)		and its implementation. (Carried out by the Ministry for National Education).
Promoted By	Body promoting/advocating the above skills framework.	Ministry of National Education	www.men.gov.pl/	Education Ministry
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	Polish Information Processing Society (Polskie Towarzystwo Informatyczne)	http://www.pti.org.pl/index.php/corporate/node_2890	Code of ethics developed by the Polish Information Processing Society sets rules for behaviour of ICT professionals in Poland. PIPS is also country operator of the European Certification of Informatics Professionals (EUCIP) certification programme (http://www.eucip.pl/).
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Polish Information Processing Society(PIPS/PTI)	http://www.pti.org.pl	Code of professional ethics From top menu select "Dla czlonkow" and then „Kodeks zawodowy informatyków"
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Project Management Body of Knowledge (PMBOK)	http://www.pmi.org.pl/	PMI Poland Chapter

CONTACTS		
Type	**Guidance**	**Specifics**
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Dr Wlodzimierz Marcinski, Ministries of Administration and Digitization commissioner for the development of digital skills in the administration, Wlodzimierz.Marcinski@mac.gov.pl Prof. Cezary Orlowski, Gdansk University of Technology, cor@zie.pg.gda.pl Prof. Zdzislaw Szyjewski , University of Szczecin, zszyjew@wneiz.pl
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	PORTUGAL 10,541,840 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Economy and Labour	http://www.portugal.gov.pt/pt/os-ministerios/ministerio-da-economia-e-do-emprego.aspx	The Ministry of Economy and Labour implements national policy regarding employment (mobility and occupational training); innovation and competitive advantage; tourism; internationalization; Consumer Protection; transport and communications.
		Ministry of Education and Science	http://www.portugal.gov.pt/pt/os-ministerios/ministerio-da-educacao-e-ciencia.aspx	The Ministry of Education and Science is responsible for Education, Higher Education, Science and Evaluation (people and institutions). The goal of the ministry is to create a culture of rigor and evaluation, provide more autonomy to schools, increase the quality and success of students, optimize the school network and the quality of courses, and support excellence in science activities.
		Ministry for Social Solidarity and Social Security	http://www.portugal.gov.pt/pt/os-ministerios/ministerio-da-solidariedade-e-seguranca-social.aspx	The Ministry of Social Solidarity and Social Security defines, promotes, implements and executes policies in the fields of: solidarity and social security; the fight against poverty and social exclusion; support for the family and having children, children and young persons at risk, the elderly and the inclusion of persons with disabilities; the promotion of volunteering; and active cooperation and the sharing of responsibilities with institutions in the social

				sector.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Centre for training and Technological Innovation Institute of Employment and Vocational Training (IEFP) AMA - Agency for Administrative Modernisation	www.inovinter.pt www.iefp.pt www.ama.pt	Promotes the activity of Professional training. The national employment service promotes the creation and quality of employment through the implementation of active employment policies and training. AMA's mission is to develop, coordinate and evaluate measures, programmes and projects in the areas of modernisation and simplification of administrative and regulatory processes, the management and distribution of electronic public services, within the framework of the policies defined by the Government. The Agency coordinates the inter-ministerial network for Information Technology and Communication.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Ordem dos Engenheiros (OE) Association of Computer Professionals ANPRI - National Association of Teachers of Informatics	www.ordemengenheiros.pt/pt/ www.apdsi.pt www.anpri.pt	Includes Informatics & Computer Engineers courses accredited by OE. Professional association in the area of information technologies and communication technologies and associated knowledge areas, including cultural, scientific, technical and vocational education. ANPRI's mission is to promote ideas and practices to deepen the pedagogical and technological diversity of its members. The association is a platform for the dissemination of pluralistic initiatives that facilitates the dissemination of projects, opportunities and challenges to the formation of each of its members.

Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	ANETIE - National Association of Information Technology and Electronics. APDC - Association of the Information and Communication Technologies	www.anetie.pt www.apdc.pt	The mission of ANETIE is to defend the interests of the business sector of Information Technology and Electronics and promote its sustainable growth. Its specialities are: the Internationalization of Portuguese companies, Training and Certification Applications for Incentive Systems, Disclosure of Public Procurement, Participation in International Consortia, Sector Studies, Market Barometers APDC is the Association of the Information and Communication Technologies (ICT) and New Media Sector. The ambition of the APDC is to be the 'network' of the ICT and New Media sector, making the national and international agenda, anticipating, identifying, debating and promoting current issues and future trends. Interacting transversally with the ICT sector, with civil society, with similar associations, with the Government and with the European Union, the APDC is an integrating and strategic platform of knowledge and collaboration
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	CGTP-IN UGT	www.cgtp.pt www.ugt.pt	Confederation of Portuguese Workers General Workers Union.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Portuguese Chamber of Commerce	www.port-chambers.com	Lisbon Trade Association / Portuguese Chamber of Commerce

Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Portugal Digital Agenda website +e+I (Entrepreneurship& Innovation) Programme	www.portugaldigital.pt www.ei.gov.pt/	One area of digital agenda is "Improving Literacy Skills and Digital Inclusion" Professional training courses at polytechnics and universities: CET–Technology Specialization Courses, level 4 and 5 post-secondary education w/ professional certification. Professional Training: the Portuguese Employment and Professional Training Institute include a common module on ICT and e-Skills in the training courses of all specializations.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	National Qualification Agency FHEQ (included in MEC Ministry)	www.en.anqep.gov.pt N/A	Coordinates the implementation of policies regarding vocational education and training, ensures the development and management of the System of Recognition, Validation and Certification of Competences. Framework for Higher Education Qualification in Portugal

		DGES (General Directorate of Higher Education)	www.dges.mec.pt/en/	General Directorate of Higher Education
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Peoplecert International DGES (General Directorate of Higher Education)	http://www.ecdl.pt www.dges.mec.pt/en/	Peoplecert International is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Portugal Direction comes from MCES (Higher education policy)
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	A3ES (Agency for Assessment and Accreditation of Higher Education)	www.a3es.pt/en	Promotes improvement of performance of HE Institutions in Portugal (including substantiating accreditations).
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and	National Qualification Agency	www.en.anqep.gov.pt	Coordinates the implementation of policies regarding vocational education and training, ensures the development and management of the System of

	proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			Recognition, Validation and Certification of Competences.
Promoted By	Body promoting/advocating the above skills framework.	Portuguese Association for Information Society Portugal Digital Agenda	www.apdsi.pt www.portugaldigital.pt	Main aim is to promote and develop the Information Society and Knowledge in Portugal. Governmental National program for the development and control of ICT Skills in the general population
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	ANACOM - National Authority for Communications	www.anacom.pt	ANACOM is the regulator, supervisor and representative of the communications sector in Portugal.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Portuguese Association for Information Society	http://www.apdsi.pt/	Professional association in the area of information technologies and communication technologies and associated knowledge areas, including cultural, scientific, technical and vocational education.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			

CONTACTS		
Type	**Guidance**	**Specifics**
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	ROMANIA 21,355,849 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education	http://www.edu.ro	Ministry of Education, Youth and Sports, with consultation of other interested ministries and institutions, design and implement the global strategy based on education, setting out the objectives of the education system as a whole, and educational objectives of education levels and profiles (Art. 12 (1) Education Law 84/1995 with subsequent amendments).
		Special Telecommunication Service	http://www.stsnet.ro/	The Special Telecommunications Service is the central specialized structure, with legal status, which organizes and coordinates the activities in the special telecommunications field for the Romanian public authorities and other users as provided for by the law. The institution has a military organization and is part of the national defence system.
		Ministry of Information Society (MCIS)	http://www.mcsi.ro	The mission of the Ministry of Information Society (MCIS) is to create sustainable premises transition to the Information Society in Romania. In this respect, it envisages a unified vision for developing a coherent and integrated national system for online public services dedicated citizens and businesses.
		IT&C Commission Chamber of Deputies	http://www.cdep.ro/	The chamber is a parliamentary commission whose objective is to launch legislative initiatives in the field

		(Lower House)		of technology of information and communications, advance specific technologies in the field, and bring them into line with international regulations, respective standards, and intellectual property
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	National Authority for Communications (ANCOM)	http://www.anrcti.ro/	The ANC was established in September 2008 by Government emergency ordinance (no. 106/200) through the reorganisation of both the National Regulatory Authority for Communications and Information Technology (ANRCTI – which was dissolved) and the National Institute of Research and Development in Informatics (ICI). ANCOM is the institution that sets the rules in the Romanian communications market and monitors the enforcement of these rules.
		Agency for Information Society Services (ASSI)	http://www.cnmsi.ro/	The Agency for Information Society Services (ASSI) was established in April 2007, according to the Government Emergency Decision No. 25/2007 on the implementation of some reorganising measures of the Government. The agency is subordinated to the Ministry of Communications and Information Technology and overtakes the attributions of the former General Inspectorate for Communications and Information Technology (IGCTI) in the area of eGovernment. The organization is in charge of running IT systems for the central governmental bodies offering electronic services to the public
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Asociatia pentru Tehnologia Informatiei si Comunicatii (ATIC)	http://www.atic.org.ro/	CEPIS Member society for Romania. Association for Information Technology and Communications of Romania (ATIC) organizes and promotes the exchange of information, collaboration and cooperation among members.

		Aries (Romanian Association for Electronic and Software Industry) Employers' Association of the Software Industry and Services (ANIS)	http://www.aries.ro/ http://www.anis.ro/	Aries is the association of electronics and software companies of Romania and aims at promoting and protecting the Romanian IT and electronic business environment, as well as the professional and commercial interests of its members. The Employers Association of the Software and Services Industry – ANIS upholds the interests of Romanian software producers and service providers.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	NTUC "Cartel ALFA" C.N.S.C.A. - Confederatia Nationala Sindicala Cartel Alfa C.N.S.L.R. - Confederatia Nationala a Sindicatelor Libere din Romania - Fratia; B.N.S. - Blocul National Sindical;	http://www.cartel-alfa.ro/ www.cnslr-fratia.ro www.bns.ro	National Trade Union Confederation "Cartel ALFA" was founded in 1990 with the purpose of establishing a real and authentic representation of the Romanian workers. NBS was founded in 1993 members – 40 trade federations 42 district branches NBS was founded in November 1991 members – 39 trade federations 36 district branches
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names	Chamber of Commerce and Industry of Romania	http://www.ccir.ro/	Chamber of Commerce and Industry of Romania (CCIR) is the most powerful business association in Romania, bringing together its entire network

	of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	(CCIR)		among the 42 county chambers of commerce and industry, bilateral chambers of commerce and professional associations.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Timisoara Mobile Development Group	http://www.meetup.com/TiMoDev/	Facilitate the contacts between teams and individuals now unknown to each other but all working in this cutting edge field. Establish and support regular learning and networking events.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge,	Ministry of Education, Research, Youth and Sports - National	http://www.cnfpa.ro/ http://www.acpart.ro/	In development

	skills and competence levels. Provide name and state of progression of its development	Qualifications Authority		
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Microsoft	http://www.microsoft.com/ro/ro/	Provides training and certification in Microsoft technology on three levels: for users, for developers and for IT professionals
		CISCO	http://www.infoacademy.net/	Provides training and certification in Networking, Security, VoIP, Wireless LAN's, Linux Unix, Java Database, Java and middleware, Applications, Server and Storage Systems and Partner Certifications
		Oracle	http://www.oracle.com/ro/index.html and http://education.oracle.com/pls/web_prod-plq-dad/db_pages.getpage?page_id=39&p_org_id=54&lang=RO	Provides training and certification in: - Software (Clarity, Cognos, DB2, Information Management, Java, Object Oriented, C, Lotus, Rational, Telelogic, Tivoli, WebSphere) - Hardware (Storage and Storage Networking, System i and OS/400, System p, VMware) - Business and professional (Project Management, Project Management Certification)
		IBM	http://www-304.ibm.com/jct03001c/services/learning/ites.wss/ro/ro?pageType=page&c=a0005268	
		IT Academy	http://www.itacademy.ro/	Provides training and certification in MSP, Prince2 and ITIL Foundation V3
		ECDL Romania	http://www.ecdl.org.ro/	Association for Information Technology and Communications of Romania (ATIC Romania) a

				member of the Council of European Professional Informatics Societies (CEPIS), was awarded the ECDL License for Romania. The administration and the practice of these rights are done exclusively through ECDL ROMANIA SA, the only entity authorized by ECDL Foundation and ATIC to promote and develop the ECDL concept in Romania.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Romanian National Authority of Qualifications	http://www.cnfpa.ro/ http://www.acpart.ro/	Body made up of the National Adult Training Board and the National Agency for Qualifications in Higher Education and Partnership with Economic and Social. Currently reorganising the National Adult Training Board and creating the National Qualifications' Authority by reunion of NATB and Agency for Qualifications in Higher Education (Education Law 2011, Government Ordinance 74 and 132/2010, Government Decisions 885/2010, 1368/2011)
		National Council for Adult Training	http://www.cnfpa.ro/	National Council for Adult Training - nationally coordinate and control the following activities: - approval of training providers by authorizing county commissions and Bucharest; - the development of occupational standards; - evaluation and certification of professional competences acquired by adults through continuous training.
		National Agency for Higher Education Qualifications and Partnership with the Social and Economic Environment	http://docis.acpart.ro/index.php?page=acpart	ACPART is the national authority for establishing and periodic updating of the national qualifications framework in higher education, a specialized body with a legal personality, within the Ministry of Education, Research and Innovation. Established by Government Decision no. 1357
Supply estimates	If available, please provide headline			Number of Computer Science graduates

	statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			(2012)=8000
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	European e-Competence Framework		ATIC are actively supporting e-CF in Romania.
Promoted By	Body promoting/advocating the above skills framework.	Romanian National Authority of Qualifications	http://www.cnfpa.ro/ http://www.acpart.ro/	Going forward, the Romanian National Authority of Qualifications looks like being the most likely agency to promote any framework of this nature.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			

Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Asociatia pentru Tehnologia Informatiei si Comunicatii (ATIC)	http://www.atic.org.ro/	Reference to compliance with code of ethics and professional conduct in the organization statutes.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Prof. Dr. Vasile BALTAC – President of ATIC Prof. Constantin GALATAN - leads the team of teachers which train the Romanian teams participating in international contests in informatics. Matei DIMITRIU – General Director of ECDL Romania		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template			COUNTRY POPULATION	SLOVAKIA 5,404,322 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Finance	www.informatizacia.sk	Central governmental body responsible for Information Society development (strategic documents) and e-Government
		Ministry for Education, Science, Research and Sport	www.minedu.sk	Education, science and research portfolios
		Ministry for Labour, Family & Social Affairs.	www.employment.gov.sk	Involved in the coordination of the employment strategy and labour market policy
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Digital Champion	http://www.digitalchampion.sk	Improving citizens' life through ICT
		The Slovak Government Office for Information Society	www.informatizacia.gov.sk	Coordination of projects supporting Information Society development and e-Government activities
		National Labour Office	www.employment.gov.sk	Implements policies regarding employment and training for the unemployed. Part of the Ministry of

		K.A.B.A. Slovakia	www.kabask.sk	Labour portfolio K.A.B.A. Slovakia - adult education and career counselling, and employment programmes for the unemployed.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Slovak Society for Computer Science	www.informatika.sk	The mission of the Slovak Society for Computer Science is to foster the necessary conditions for the development of informatics and information technology in Slovakia. It represents the ICT community, and is a member of CEPIS and IFIP
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Confederation of Slovakian Trade Unions	www.kozsr.sk/	Umbrella Organization for majority of the Slovakian Trade unions.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	SCCI	web.scci.sk/	Slovak Chambers of Commerce and Industry
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and	eSkills 2013	http://www.eskills.sk/	

	other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Slovak National Agency of Lifelong Learning Programme	www.saaic.sk	Ministry for Education – Life Long Learning Department is the NCP for EQF (WIP)
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Slovak Society for Computer Science Leading ICT companies	www.informatika.sk	Certification body for the ECDL programme Specialized vendor-oriented certificates (Microsoft, Oracle, Cisco, etc.)

Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Accreditation Commission in Ministry for Education	www.minedu.sk	Accreditation Commission - Counselling body of the Government of the Slovak Republic – in the Ministry for Education, Science, Research and Sport. Concerns accreditation of educational programs and courses.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed			

	international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Slovak Society for Computer Science	www.informatika.sk	Represents the ICT community at CEPIS and IFIP level.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Prof. RNDr. Branislav Rovan, PhD., Comenius University Prof. Ing. Maria Bielikova, PhD., Slovak University of Technology		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		

National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	SLOVENIA 2,055,496 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education and Sport Ministry of Higher Education, Science and Technology Ministry of Labour, Home Family, and Social Affairs Ministry of Interior Affairs	www.mss.gov.si/en/ www.mvzt.gov.si/ www.mddsz@gov.si www.mnz@gov.si	Includes e-government initiative
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Centre for Vocational Education and Training Slovenian Institute for Adult Education CEAE National Education	www.cpi.si www.siae.acs.si www.mss.gov.si www.zrss.si/	CPI is the National Institute for Vocational Education and Training – it is the Slovenian central institution for research and development and consultancy in the field of vocational education and training. National institution for development, research and counselling in the field of adult education Council of Experts of the Republic of Slovenia for Adult Education – Part of the Ministry for Education and Sport Involved in external assessment of Students –

		Institute National Examination Center	 http://www.ric.si/	maturity exams mainly. The activities of the National Examination Centre (Rica) are closely related to its role as the central institution for external examinations in Slovenia. RICA prepares, organises and conducts examinations.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Slovenian Society INFORMATIKA	www.drustvo-www.drustvo-informatika.si	Slovenian Society Informatika is a non-profit association of professionals working in various fields of information science and information technology companies, universities and public administration. Founded in 1972, it today has about 390 members and publishes a professional journal called Applied informatics and a scientific journal called Informatica. The Slovenian Computer Society is the national CEPIS member.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Chamber of Commerce of Slovenia	www.gzs.si	Association of business entities which provides support to their members in relations with social partners and government, provides information services, and represents their members.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Association of Free Trade Unions of Slovenia Confederation of Trade Unions of Slovenia PERGAM	www.sindikat-zsss.si www.sindikat-pergam.si	AFTUS voluntary and democratic organization, independent of political parties, parliament, the government and religious communities. It brings together 22 trade unions from various sectors across Slovenia. Nowadays we have more than 300 000 members from both the private and public sectors. The Confederation of Trade Unions of Slovenia PERGAM, the abbreviated name of the KSS Pergam, was founded 15 June 1991 at the inaugural meeting on the basis of resolutions of the general unions.

		Confederation of New Trade Unions of Slovenia	www.knssneodvisnost.si	KNSS - Independence is an independent, democratically organized trade union confederation of trade unions, which are organized on the territory of the Republic of Slovenia. KNSS - Independence was founded on 30 March 1990, the first democratic trade union federations, which, as such, also paved the way trade union pluralism and democracy.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Chamber of Commerce and Industry of Slovenia Chamber of Craft and Small Business in Slovenia	www.eng.gzs.si/slo/ www.ozs.si/eng/prispevek.asp?IDpm=19	NOTE: Co-founder of Slovenian Institute for Vocational Education and Training NOTE: Co-founder of Slovenian Institute for Vocational Education and Training
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	simbioz@	http://simbioza.eu/	Online platform aimed at intergenerational collaboration to provide computer literacy for the elderly in Slovenia. In the week from 21 to 25 October 2013, the young people in the workshops, which will be held in libraries, schools and nursing homes across Slovenia, will teach the elderly computer skills.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development			

	and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development			
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	ECDL Slovenia National Examination Centre	http://www.ecdl.si/ http://www.ric.si/	ECDL Slovenia is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Slovenia Some involvement in certification of exams.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Slovenian Accreditation Body	http://www.sa.gov.si	Included in its scope are certification bodies and management systems
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012)			

	Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			No national professional competence framework has been adopted as yet.
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			There is no national body to monitor professional ethics; SSI has a code of ethics which obliges its constituency; several professional associations (journalists', barristers', physicians' etc.) have adopted their specific codes of conduct/ethics.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Slovenian Society Informatika	http://www.ecdl.org/media/Slovenia_SSICodeofEthics.11.pdf	Slovenian Computer Society Code of Ethics
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of	Provide list and **brief** summary of Bodies			There is no such national standard; professionals

Knowledge (BoKs)	of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			refer to their educational curricula.
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Dr. Marjan Krisper, University of Ljubljana, Faculty of Computing and Informatics Dr. József Györkös, University of Maribor, Faculty of Electrical Engineering, Computing and Informatics		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template			COUNTRY	SPAIN
			POPULATION	46,196,276 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Education	www.educacion.gob.es	Education Portfolio.
		Ministry of Economy and Competiveness. State Secretary for Research, Development and Innovation	www.idi.mineco.gob.es/portal/site/MICINN/	Includes Research & Development policies as well as innovation.
		Ministry of Industry, Energy and Tourism	www.minetur.gob.es/	Responsible for government policy in many areas including industrial development and innovation, telecommunications and the Information Society.
		Ministry for Finances and Public Administrations	www.mpt.gob.es/en/ministerio.html	Includes all initiatives and agencies relating to the e-Government initiative
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	E-Government Portal	http://administracionelectronica.gob.es/	E-Government Initiative for Spain
		Institute of Education Technology	www.ite.educacion.es/	Unit of Ministry of Education – responsible for integration of ICT into Vocational and general education system (Except universities)
		Red.es	www.red.es	Red.es is the public corporate entity attached to the Ministry of Industry, Energy and Tourism (MINETUR) which is responsible for promoting the development

		INTECO	www.inteco.es	of the Information Society in Spain. INTECO is an entity within Ministry of Industry, Energy and Tourism working as development centre of public interest, aimed at adding value to the industry, by disseminating knowledge of ICT sector in Spain, according to the European guidelines.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	ATI	www.ati.es	Asociación de Técnicos de Informatica is an association open to all technicians and IT professionals and is established throughout the country through Regional Chapters exist in various autonomous communities. Established in 1967, is currently the most dynamic association of the largest existing Spanish Computer Sector, based in Barcelona (general headquarters), Madrid, Seville, Valencia. ATI is a founding member of CEPIS and the Spanish member of IFIP and CLEI and national point of contact of ECWT.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	AMETIC	www.ametic.es	AMETIC, the Multi-sectorial Trade Association for Electronics, Information and Communications Technologies, Telecommunications and Digital Content Industries
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	COMFIA UGT CCOO	www.comfia.net/ www.ugt.es www.ccoo.es	Branch of CCOO trade union specifically oriented to activities in financial services, ICT sector, administrative services, etc. (founder of EUCIP Spain Foundation along with ATI and e-logos)General Union of Workers Trade Union Workers commission Trade Union
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of	High Council of Chambers of	www.camaras.org/	Incorporates Chambers of Commerce, Industry and Navigation, High Council Chambers and Regional

	the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Commerce, Industry and Navigation of Spain		Chambers of Commerce.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	National Point of Contact of ECWT	www.ati.es/spip.php?rubrique374	National point of Contact of the European Centre for Women and Technology: a multi-stakeholder unit coordinated by ATI to promote the presence of women in ICT profession and entrepreneurship
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Red.es	www.red.es/redes/	Red.es is an Entity within Ministry of Industry, Energy and Tourism, responsible for consolidating the development of the Information Society in Spain. In addition, we have the mission of executing projects related to information technology and communication (ICT) according to the strategic priorities of the Secretariat of State for Telecommunications and the Information Society (SETSI), in collaboration with communities' autonomous councils and town councils, local authorities and the private sector. Our objectives: Job creation and promotion of entrepreneurship (through programs that boost the ICT sector). Increased productivity and competitiveness in business. Savings and efficiency in public spending.
		Inteco.es	www.inteco.es	Entity within Ministry of Industry, Energy and Tourism created as reference centre for cyber security and digital trustworthiness working in different levels or issues related to security,

				accessibility and software quality.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	INCUAL CGFP SNCFP	www.educacion.gob.es/educa/incual/ice_incual_ing.html www.educacion.gob.es/educa/incual/ice_consejoGeneral_ing.html www.educacion.gob.es/educa/incual/ice_ncfp_ing.html	National Institute of Qualifications - Supports council for Vocational training to achieve the objectives of the NQF. General Council for vocational education and training National System for Qualification and vocational education and training
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	ECDL Spain EUCIP Foundation Spain	www.ecdl.es www.eucip.es	ECDL Spain is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Spain EUCIP Foundation Spain is the certifying entity for E the ICT professional certification programme EUCIP in Spain
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	ENAC AENOR	www.enac.es/ www.aenor.es	Official National Accreditation Board responsible for accreditation of organisms which evaluate conformance in any sector Private non-profit association for standardization and certification (Spanish member of ISO). It is legally responsible for developing and disseminating technical standards in Spain.

				As Spain has 17 regions with regulation autonomy for certain activities (e.g. education, training for unemployed people, etc.), there are specific entities created by regional authorities which are working in the topics covered by the study. These may vary from region to region.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	INE	www.ine.es/	Official governmental institute for statistics.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	INCUAL	www.educacion.gob.es/educa/incual/ice_incual_ing.html	National Institute of Qualifications - Supports council for Vocational training to achieve the objectives of the NQF.
Promoted By	Body promoting/advocating the above skills framework.	ATI	www.ati.es/	Association of IT Professionals
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed	N/A	N/A	

	international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	ATI	http://www.ati.es/spip.php?rubrique19	Code of Conduct for ATI Members, they include aspects of professional ethics.

BODIES OF KNOWLEDGE

Type	Guidance	Name	Website	Specifics
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Libro blanco de los grados de ingeniería informática	www.aneca.es/Documentos-y-publicaciones/Otros-documentos-de-interes/Libros-Blancos	White book published in 2005 by a network of representatives of the different universities for defining a recommended body of knowledge for degrees in IT/Computing engineering (general degrees on IT/Computing). It was developed at request of Ministry of Education as a guideline for adaptation of Spanish University system to the European Higher Education Area (Bologna process). No further efforts for updating or reviewing. There is also a white book for telecommunications degrees, only useful for the specific area of communications infrastructure and some issues in electronics.

CONTACTS

Type	Guidance	Specifics
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively	Luis Fernández, ATI Silvia Leal, Instituto de Empresa Pedro Martín Jurado, observatorio ONTSI de Red.es

	engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY	SWEDEN
			POPULATION	9,482,855 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Enterprise, Energy and Communications	http://www.sweden.gov.se/sb/d/2067	The Ministry of Enterprise, Energy and Communications is responsible for handling government business in the following areas: Electronic communications – Issues concerning electronic communications; ICT Policy – Infrastructure and responsibility for coordination on issues relating to the use of information technology.
		Ministry of Education and Research	http://www.sweden.gov.se/sb/d/2063/a/21953	The Ministry of Education and Research addresses the following areas: The pre-school system; School-age childcare; The pre-school class; Compulsory school and other compulsory types of school; Upper secondary school; Study financing; Universities and other higher education institutions; Research; Formal and liberal adult education; Gender equality; Policy for civil society; and Youth policy.
		Ministry of Employment	http://www.sweden.gov.se/sb/d/8281	Labour market policy; Working life policy; Integration policy; Discrimination; Human rights at national level; Swedish citizenship; and National minorities.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas.	Swedish Governmental Agency for Innovations Systems (Verket för	http://www.vinnova.se/en/	VINNOVA, Swedish Governmental Agency for Innovation Systems, integrates research and development in technology, transport and working life. VINNOVA´s mission is to promote sustainable growth by financing RTD and developing effective

	If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	innovationssystem, VINNOVA) National Post and Telecom Agency (Post- och telestyrelsen, PTS) Högskoleverket (Swedish National Agency for Higher Education)	 http://www.pts.se/en-gb/ http://www.hsv.se/aboutus.4.28afa2dc11bdcdc557480001978.html	innovation systems. The National Post and Telecom Agency, PTS, is the authority that monitors the electronic communications and post sectors. The term electronic communication includes the telecommunications, IT and radio sectors. Högskoleverket (Swedish National Agency for Higher Education) was established in 1995. It reviews the quality of higher education, ensures HEIs comply with relevant legislation and regulations, monitors trends and developments in higher education, provides information about higher education, and recognises qualifications from abroad.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Dataföreningen i Sverige (The Swedish Computer Society)	http://www.dfs.se/	Dataföreningen i Sverige (The Swedish Computer Society) is the independent body for ICT (Information and Communications Technology) professionals in Sweden. The association has members with local representation in all parts of the country, and is the Swedish member of CEPIS. As well as providing an extensive events programme for their members, they work with the government, the industry and the community on issues such as enhancing digital literacy.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			

Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Landsorganisationen i Sverige LO - The Swedish Trade Union Confederation	http://www.lo.se/home/lo/home.nsf/unidview/E2A56001E93D5F3EC1256E760040952D	LO is the central organisation for 14 affiliates which organise workers within both the private and the public sectors. The 14 affiliates together have about 1,700,000 members of whom about 770,000 are women. The 14 affiliates of LO have independent status, and LO is primarily an organisation for co-ordination, research, signing labour market insurance schemes and creating public opinion at central and regional levels. Contacts with the Social Democratic Party are frequent and LO has a representative on the party's executive committee elected by the Party Congress.
		Saco - The Swedish Confederation of Professional Associations	http://www.saco.se/templates/LandingPage.aspx?id=36&epslanguage=EN	Saco is a trade union confederation of 23 affiliated associations which together have over 600,000 members. Members are university graduates or professionals with a college degree. The members include employees, students, researchers, self-employed people and retired professionals. Members include economists, lawyers, physiotherapists, graduate engineers, doctors, teachers and members of many other professions.
		TCO (The Swedish Confederation for Professional Employees)	http://www.tco.se/Templates/Page2____2319.aspx	TCO (The Swedish Confederation for Professional Employees) comprises 15 affiliated trade unions. The 1.2 million members of these unions are professional and qualified employees who share a major responsibility for important functions in society, although in a wide variety of occupations. They work in all parts of the labour market, for example in the schools, healthcare, trade, the media, the police, industry, IT and telecom. Over 60 per cent of the

				members are women. Approximately half of the members work in the private sector and half in the public sector.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	The Swedish Chambers	http://www.swedishchambers.se/home-2/about-us-1.aspx	The Swedish Chambers offer contacts, knowledge and capacity to exporters from developing countries within the Trade Promotion Programme. The programme is carried out in cooperation with SIDA (Swedish International Development Cooperation Agency). It focuses on business contacts, market information, training and extended contacts in order to promote exports from developing countries.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Välj IT (Choose IT)	http://www.valjit.se/website1/1.0.1.0/292/1/	Välj IT is aimed at getting more young people to study and work in the IT field. It is not just the IT industry, but also other businesses and the public sector. The project has the following objectives to be achieved by 2015: At least two applicants per university place. On average, at least 40 per cent of the applicants are women. At least 50 per cent of students in grades nine (of which at least 40 per cent girls) should specify that an IT professional is something they can identify with. Behind the project is the trade organization IT & Telecom Industries. The project also involved a large number of stakeholders from universities and companies both inside and outside the IT industry.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification,	ICT for everyone – A digital agenda for Sweden	http://www.government.se/sb/d/2025/a/181914	To meet the challenges that exist both internationally and nationally, the Swedish Government wishes to make use of the opportunities offered by digitisation, and has therefore taken a decision on ICT for Everyone - A Digital Agenda for Sweden and proposed a new goal for ICT policy, that Sweden should become the best in the world exploiting the opportunities of

	support systems for career development and lifelong learning, creation and delivery of training…	Digidel 2013	http://www.digidel.se/eng/	digitisation. The campaign Digidel promotes an increased digital participation in Sweden. We want everyone to be daring, willing and able to access the Internet. The campaign's goal is to join forces to get at least another 500,000 Swedes to start using the Internet before the end of 2013. We also want to help those who are already online are better at exploiting the opportunities offered by the Internet to facilitate everyday tasks, participate in social development, better health care, greater access to employment opportunities and a better education. The campaign's motto: Digital inclusion is a requirement for a well-functioning democracy. All residents in Sweden should have the opportunity to be involved digitally Knowledge of how to do it is important for digital inclusion. Usability and accessibility for all are important factors for digital inclusion Many can help many to become digitally involved Digital inclusion is a concern for everyone in the community. The campaign Digidel 2013 will support collaboration at national and regional level by disseminating best practices from the field, provide educational materials and involve multiple actors. Everyone who participates in the campaign contributing their best efforts and with their own resources.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification	National framework against which	NQF to be developed	http://www.hsv.se/hig	In Sweden, the Swedish National Agency for Higher

Framework	qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development		hereducationinsweden/nationalqualificationsframework.4.5dc5cfca11dd92979c480001476.html	Vocational Education has been tasked with developing a proposal for a Swedish framework for qualifications (National Qualifications Framework, NQF). The agency has submitted its proposal to the Government. The decision to adopt a national framework is expected to be taken in 2011. Swedish qualifications will be set at the most appropriate level in the national framework, and this will in turn be linked to the European reference framework, EQF. The Swedish National Agency for Higher Vocational Education is the national coordinating point for the European reference framework for lifelong learning, the European Qualification Framework (EQF).
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	ECDL Sweden DF Certifiering AB	http://www.ecdl.se http://www.dfcertifiering.se/	ECDL Sweden is the certifying authority of the leading international computer skills certification programme– ECDL / ICDL in Sweden. DF Certifiering AB (DFC) is a wholly owned subsidiary to Dataföreningen i Sverige, the Swedish Computer Society. DFC's role is to give accreditation to training providers and certify IT. DFC also provides products in the field of Information Security and self-assessing tests for e-Citizens.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	DF Certifiering AB	http://www.dfcertifiering.se/	DF Certifiering AB (DFC) is a wholly owned subsidiary to Dataföreningen i Sverige, the Swedish Computer Society. DFC's role is to give accreditation to training providers and certify IT. DFC also provides products in the field of Information Security and self-assessing tests for e-Citizens.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example,			

	such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			

Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	SUNET	http://basun.sunet.se/html_docs/info_sunet/rules.html	Acceptable Use of Policy of the Swedish University Computer Network (SUNET) and Ethical Rules for SUNET
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Erik Hult, erik.hult@dfs.se, DF Dataforeningen i Sverige (Swedish Information Processing Society)		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template			COUNTRY	UNITED KINGDOM
			POPULATION	62,989,551 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	BIS (Department of Business, Innovation and Skills)	www.bis.gov.uk/	BIS is the UK Government department for economic growth. The department invests in skills and education to promote trade, boost innovation and help people to start and grow a business. It is supported by supported by 48 agencies and public bodies notably: • Technology Strategy Board • Skills Funding Agency • UK Commission for Employment and Skills
		DfE (Department of Education)	www.education.gov.uk	Department of Education is responsible for education and children's services. It is supported by 3 Executive agencies including: the Education Funding Agency
		Cabinet Office (CO)	www.cabinetoffice.gov.uk	The CO ensures the effective running of government and is also the corporate headquarters for government, in partnership with HM Treasury, taking the lead in certain critical policy areas including national security. The CO is supported by 20 agencies and public bodies including: The Government Procurement Service (GPS). Provides advice and assistance on the security of

				communications and electronic data
		DCMS (department for Media, Culture and Sport)	www.culture.gov.uk	DCMS's remit is to protect and promote the UK cultural and artistic heritage and help businesses and communities to grow by investing in innovation it is supported by 44 agencies and public bodies notably the Government Equalities Office (GEO).
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Technology Strategy Board (TSB)	https://www.gov.uk/government/organisations/technology-strategy-board	TSB: supports the development of innovative technologies and products. It offers a range of funding programmes and works with businesses of every size, universities and other organisations
		Skills Funding Agency (SFA)	https://www.gov.uk/government/organisations/skills-funding-agency	SFA - funds and promotes adult further education and skills training in England (excluding higher education).
		UK Commission for Employment and Skills (UKCES)	https://www.gov.uk/government/organisations/uk-commission-for-employment-and-skills	UKCES is a social partnership of commissioners that include CEOs and representatives from trade unions and the voluntary sector. The commission helps to raise skill levels to create more and better jobs and stimulate economic growth.
		Council for Science and technology (CES)	https://www.gov.uk/government/organisations/uk-commission-for-employment-and-skill s	CES - We advise the government on developing science, technology, engineering and mathematics (STEM) in the UK, improving STEM education and making more effective use of research and scientific advice.

		The Government Procurement Service (GPS)	https://www.gov.uk/government/organisations/government-procurement-service	GPS- saves money for the public sector by improving supplier management, and is responsible for agreeing centralised contracts for government departments.
		The Education Funding Agency (EFA)	http://www.education.gov.uk/aboutdfe/executiveagencies/efa	EFA provides revenue and capital funding for education for learners between the ages of 3 and 19, or the ages of 3 and 25 for those with learning difficulties and disabilities.
		Government Equalities Office (GEO)	https://www.gov.uk/government/organisations/government-equalities-office	GEO is responsible for equality strategy and legislation across government which includes a focus on getting more women and girls to choose Science, Technology, Engineering and Maths (STEM) subjects and careers.
		CESG - National Technical Authority for Information Assurance (IA) - .	www.cesg.gov.uk	CESG protects the vital interests of the UK by providing policy and assistance on the security of communications and electronic data, working in partnership with industry and academia.
		National Apprenticeship Service (NAS)	www.apprenticeships.org.uk/types-of-apprenticeships/information-and-communication-technology.aspx	NAS supports, funds and co-ordinates the delivery of Apprenticeships throughout England across all sectors including IT specialists (this area includes provides the apprentice with the competence, skills and knowledge to work effectively and efficiently with IT systems, communication and productivity tools and software applications) and IT, Software, Web and Telecoms Professionals (which covers work in a broad range of digital technologies).

Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	BCS, The Chartered Institute for IT	www.bcs.org/	Champions the global IT profession and the interests of individuals engaged in that profession for the benefit of all. BCS is the regulatory body for the Chartered IT professional standard and maintains and publishes the register of Chartered IT Professionals (CITPs). The Institute licenses other membership bodies to award CITP status to suitably qualified members and accredits third party certifications that satisfy criteria towards for award of CITP status. BCS is the national member of CEPIS and a member of the SFIA Foundation.
		IET	www.theiet.org/	The IET mission is to build an open, flexible and global knowledge network supported by individuals, companies and institutions and facilitated by the IET and its members. IET is licensed to award CITP status by BCS and is a member of the SFIA Foundation.
		itSMF UK	www.itsmf.co.uk	itSMF is the independent and internationally recognised forum for IT Service Management professionals to exchange views, share experiences and participate in continuous development and promotion of best practice and standards. itSMF UK is a member of the SFIA Foundation.
		The Institute of Information Security Professionals (IISP)	www.iisp.org/imis15/iisp	The principle objective of IISP is to advance the professionalism of information security practitioners and thereby the professionalism of the industry

		Council of Professors and Heads of Computing (CPHC) Information Assurance Advisory Council (IAAC)	www.cphc.ac.uk www.iaac.org.uk/	CPHC exists to promote public education in Computing and its applications and to provide a forum for those responsible for management and research in university computing departments. IAAC is a partnership bringing together corporate leaders, public policy makers, law enforcement and the research community to address the challenges of managing risks to information.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Intellect e-Skills UK	www.intellectuk.org http://www.e-skills.com/	Trade Association for Technology supply companies/organisations. e-Skills UK is the sector skills council for Technology and Telecommunications. It is an employer led organisation responsible for developing and maintaining the National Occupational Standards (NOS) for IT & Telecoms professionals and the NOS for IT users. -
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	TUC	www.tuc.org.uk	Trade Union Congress – with 54 affiliated unions the TUC campaigns for a fair deal at work and for social justice at home and abroad and negotiates in Europe, and at home to build links with political parties, business, local communities and wider society.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	BCC (British Chambers of Commerce)	www.britishchambers.org.uk/	Network of accredited Chambers of Commerce across UK BCC is a dynamic, high-profile and independent business network, with Chambers across the UK. Its mission is to make the Chamber network an

				essential part of growing business; by sharing opportunities, knowledge and expertise Local Chambers work with businesses of all sizes, and represent all sectors.
	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	BCSrecruit	www.bcsrecruit.com	BCSrecruit.com is the BCS' recruitment site where you'll find jobs advertised by IT employers. There are also hints and tips to help secure.
		Computer Clubs for Girls (CC4G)	www.cc4g.net/	CC4G is an eSkills UK initiative designed to encourage girls to stay engaged in IT. It supports girls' learning in IT and across the curriculum, and benefits their confidence and self-esteem.
		BCS Academy of Computing.	http://academy.bcs.org	The BCS Academy of Computing is a learned society dedicated to advancing computing as an academic discipline. Its mission is to advance the creation, study and application of knowledge in computing for the benefit of society.
		Computing at School (CAS) Working Group	www.computingatschool.org.uk/	Computing at School (CAS) is a collaborative partner with the BCS through the BCS Academy of Computing, and has formal support from other industry partners. It aims to promote the teaching of computer science at school. With support from the DfE a Network of Excellence is providing funding to support recruitment and training of 400 CAS Master Teachers over the next two years.

		BCS CESG Certified Professional Scheme BCS Personal Development Plan (PDP)	http://certifications.bcs.org/category/15865 www.bcs.org/pdp	BCS CESG Certified Professional Scheme - provides a means of independent assessment and verification for those working in Information Assurance (IA) BCS has created the BCS Personal Development Plan to enable individuals to record career development objectives and the activities undertaken to achieve those Development Goals It is available to anyone who works in the IT profession.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	National Career Service	https://nationalcareersservice.direct.gov.uk/Pages/Home.aspx	The National Careers Service provides information, advice and guidance to help individuals make decisions on learning, training and work opportunities.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge,	OFQUAL	http://ofqual.gov.uk/qualifications-and-assessments/qualificati	Office Of Qualifications & Examinations regulation - National Qualifications Framework.

	skills and competence levels. Provide name and state of progression of its development		on-frameworks/	
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	BCS , The Chartered Institute for IT	www.bcs.org/certifications	BCS provides a range of professional certifications across the full breadth of the IT profession as defined by the SFIA framework. These are delivered via a network of accredited training and examination providers
		The Open Group	www.opengroup.org/certifications	Open Group Professional Certifications: • The Open Group Certified Architect (Open CA) Program - formerly ITAC • The Open Group Certified IT Specialist (Open CITS) program - formerly ITSC • ArchiMate® Certification Program • TOGAF® 9 Certification Program
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	UKAS (UK Accreditation Service)	www.ukas.com	UK sole national accreditation body recognised by government to assess, against internationally agreed standards, organisations that provide certification, testing, inspection and calibration services.
		OFQUAL	www.ofqual.gov.uk/	Office Of Qualifications & Examinations Regulation regulates through a system of monitoring awarding organisations and qualifications to make sure that standards are maintained.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include:	Higher Education Statistics Agency (HESA)	www.hesa.ac.uk/content/view/1897/239/	HESA- the official agency for the collection, analysis and dissemination of quantitative information about higher education

	Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			HE graduates in Computer Science as a first degree 2011/12 - 10815
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	SFIA SFIAplus	www.sfia-online.org/ www.bcs.org/content/conCertification/101	The Skills Framework for the Information Age (SFIA) is the high level UK Government backed competency framework describing the roles within IT and the skills needed to fulfill them. It is constructed as a two dimensional matrix. SFIAplus is a BCS product based on the SFIA framework of IT skills plus detailed training and development resources to provide the most established and widely adopted IT skills, training and development model reflecting current industry needs. For each SFIA skill, SFIAplus contains EIGHT additional skill resources. For each SFIA task, SFIAplus includes SIX additional task components. The additional training and development detail for all 96 skills and 344 tasks makes SFIAplus a three dimensional model.
Promoted By	Body promoting/advocating the above skills framework.	SFIA Foundation BCS, The Chartered Institute for IT	www.sfia-online.org/ www.bcs.org/content/conCertification/101	

REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	NONE	NONE	NONE
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	BCS, The Chartered Institute for IT	www.bcs.org/	All members agree to abide by a code of conduct enforced through disciplinary regulations as a condition of membership. Obligations covered include: Public interest, professional competence, and integrity i.e. Duty to the relevant authority.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoK)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	BCS Breadth of Knowledge syllabus	www.bcs.org/upload/pdf/citp-bok-test-syllabus-v2.pdf	The BCS Breadth of Knowledge syllabus forms the basis for the test taken by all applicants (both BCS members and members of other organisations licensed to award CITP status) as part of the assessment for award of CITP status. The syllabus is designed to apply internationally as well as in the UK.
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3	Adam Thilthorpe, BCS Director for Professionalism, Policy and Public Affairs		

	individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	In 2006 BCS initiated a programme to promote IT professionalism to individuals and raise levels of professionalism in the IT industry. The long term objective is to establish a mature IT profession respected and valued for its contribution to society on a par with other established professions. In 2009 BCS completed a review of its Chartered IT Professional standard. The criteria for award were enhanced by a breadth of knowledge test and compulsory peer review interview. Successful applicants are also awarded a Certificate of Current Competence valid for five years which they are encouraged to revalidate as assurance to employers that their skills remain up to date.

Non-European Country Profiles

Country Profile Template			COUNTRY	AUSTRALIA
			POPULATION	22,945,735 (Estimate 2013)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Department of Communications	http://www.communications.gov.au/	The department has four main areas of focus: Transforming the structure of telecommunications, Switchover to digital television and enhancing the broadcasting sector, Realising the digital economy, Enabling a good consumer experience.
		Department of Education	http://www.education.gov.au/	The Australian Government Department of Education is responsible for national policies and programmes that help Australians access quality and affordable childcare; early childhood education, school education, post-school, higher education, international education and academic research.
		Department of Employment	http://www.employment.gov.au/	The Australian Government Department of Employment is responsible for national policies and programmes that help Australians find and keep employment and work in safe, fair and productive workplaces.
		Department of Industry	http://www.innovation.gov.au/Pages/default.aspx	The Department of Industry helps shape Australia's future economy through skills, learning, discovery and innovation. Together with the wider portfolio, we are working to accelerate productivity growth

				and secure Australia's prosperity in a competitive low carbon global economy. Collaboration, education and a strong science and research base are keys to success. We engage with business, research bodies, tertiary education sectors, government and the broader community to create and build economic and social benefits. Our focus is on promoting innovation across the economy and shaping the businesses, industries and workforce to turn these opportunities into outcomes.
		The Attorney General's Department	http://www.ag.gov.au/Pages/default.aspx	The Attorney-General's Department is responsible for: law and justice, national security, emergency management, natural disaster relief, cultural affairs, including movable cultural heritage and support for the arts, the management of government records. Our department is the central policy and coordinating element of the Attorney-General's portfolio, for which the Attorney-General and Minister for the Arts; and the Minister for Justice are responsible

Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Australian Skills Quality Authority (ASQA)	http://www.asqa.gov.au/	The national regulator for Australia's vocational education and training sector; regulates courses and training providers to ensure nationally approved quality standards are met.
		Office for Learning and Teaching (OLT)	http://www.olt.gov.au/	Responsibilities include commissioning work on issues of strategic significance to the higher education sector to inform policy development and practice in relation to learning and teaching
		Australian Institute for Teaching and School Leadership (aitsl)	http://www.aitsl.edu.au/	AITSL has responsibility for rigorous Australian professional standards, fostering and driving high quality professional development for teachers and school leaders, working collaboratively across jurisdictions and engaging with key professional bodies.
		Austrade	http://www.austrade.gov.au/	The Australian Trade Commission – Austrade – is the Australian Government's trade, investment and education promotion agency. Through a global network of offices, Austrade assists Australian companies to grow their international business, attracts productive foreign direct investment into Australia and promotes Australia's education sector internationally.
		Australian Bureau of Statistics	http://www.abs.gov.au/	The ABS assists and encourages informed decision making, research and discussion within governments and the community, by leading a high quality, objective and responsive national statistical service.
		ASIO	http://www.asio.gov.au/	ASIO was established in 1949 as Australia's ASIO is Australia's national security intelligence service.

				ASIO operates under the direction of the Director-General of Security who is responsible to the Attorney-General.
		Australian Strategic Policy Institute	http://www.aspi.org.au/	ASPI is an independent, non-partisan policy institute. It has been set up by the government to provide fresh ideas on Australia's defence and strategic policy choices.
		CSIRO	http://www.csiro.au/	CSIRO, the Commonwealth Scientific and Industrial Research Organisation, is Australia's national science agency and one of the largest and most diverse research agencies in the world.
		IP Australia	http://www.ipaustralia.gov.au/	IP Australia is the Australian Government agency that administers intellectual property (IP) rights and legislation relating to patents, trademarks, designs and plant breeder's rights.
		National e-Health Transition Agency	http://www.nehta.gov.au/	Our purpose is to lead the uptake of eHealth systems of national significance and to coordinate the progression and adoption of eHealth by delivering urgently needed integration infrastructure and standards.
		NBN Co	http://www.nbnco.com.au/	NBN Co was created on 9 August, 2009 to construct and manage Australia’s fibre to the home broadband network.
		Office of the Australian Information Commissioner	http://www.oaic.gov.au/	The OAIC has three primary functions: Privacy functions, conferred by the Privacy Act 1988 (Privacy Act) and other laws, freedom of information functions, in particular, oversight of the

				operation of the Freedom of Information Act 1982 (FOI Act) and review of decisions made by agencies and ministers under that Act, government information policy functions, conferred on the Australian Information Commissioner under the Australian Information Commissioner Act 2010.
		TEQSA	http://www.teqsa.gov.au/	The Tertiary Education Quality and Standards Agency (TEQSA) is Australia's independent national regulator of the higher education sector.
		AWPA	http://www.awpa.gov.au/about-us/Pages/default.aspx	The Australian Workforce and Productivity Agency (AWPA) is an independent statutory body which provides advice to the Federal Minister for Employment, Skills, Training and Higher Education on Australia's current, emerging and future skills and workforce development needs.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Australian Computer Society (ACS)	www.acs.org.au/	The association for Australia's information and communications technology (ICT) profession represent all ICT practitioners in business, government and education.
		Information Technology Contract & Recruitment Association (ITCRA)	http://www.itcra.com/	ITCRA represents IT recruitment agencies throughout Australia and New Zealand.
		Engineers Australia	https://www.engineersaustralia.org.au/	Engineers Australia is the national forum for the advancement of engineering and the professional development of our members. With over 100,000

				members embracing all disciplines of the engineering team, Engineers Australia is the largest and most diverse professional body for engineers in Australia.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Australian Information Industry Association (AIIA)	http://www.aiia.com.au/	AIIA is Australia's peak ICT industry representative body and advocacy group. For over 30 years it has been our mission to advocate, promote, represent and grow the ICT industry in Australia.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Australian Services Union (ASU) Australian Council of Trade Unions (ACTU) Association of Professional Engineers, Scientists and Managers, Australia (APESMA)	http://www.asu.asn.au/infotech http://www.actu.org.au/ http://www.apesma.com.au/page/277/History-of-APESMA	The ASU looks after workers in the information technology, business and office equipment industries The Australian Council of Trade Unions (ACTU) is the largest peak body representing workers in Australia. It is a national trade union centre of 46 affiliated unions. We represent professionals from a wide variety of disciplines including engineering, science, IT, pharmacy, management, translators and interpreters, architecture, surveying and many more. We were originally registered as the Association of Professional Engineers, Australia (APEA) - in September 1946.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Australian Chamber of Commerce and Industry (ACCI)	http://www.acci.asn.au/	Australia's largest and most representative business association, ACCI speaks at a national and international level on behalf of the nation's peak State and Territory Chambers of Commerce and Industry and National Industry Associations from all sectors of the economy.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT	Information Technology Contract	http://www.itcra.com/industryinsight/skillsm	ITCRA quarterly report captures an overview of the market from a skills perspective, utilising data from

	professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	& Recruitment Association (ITCRA) SkillsMatch Dashboard & Trends Report	atch-dashboard-trends-report	ITCRA's SkillsMatch Database - a unique source of real time placement data from ICT recruitment agencies in Australia measuring the supply and demand for ICT skills in the Australian labour force.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	AWPA ICT Workforce Report	http://www.awpa.gov.au/our-work/sector-specific-skill-needs/Pages/Professional,-Scientific-and-Technical-Services.aspx	The report examines challenges for ICT skills development including outdated perceptions of ICT careers that are often reinforced by poor ICT education in schools, low numbers of female and mature-aged workers in the ICT workforce, industry views that tertiary graduates are not work ready, and low investment by industry in skills development for the existing ICT workforce.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development			
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT	ACS & SFIA Certification	http://www.acs.org.au/sfia-certification/acs-certification	

	certification programmes, if relevant.			
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	ACS	http://acs.org.au/careers-and-employment/accredited-courses/conditions-of-accreditation	The ACS accredits all Australian University undergraduate courses in ICT
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	ACS Statistical Compendium	http://acs.org.au/__data/assets/pdf_file/0014/13541/2012_Statcompendium_final_web.pdf	The annual Statistical Compendium published by the ACS includes data on graduates per year, lists education providers across Higher Education and Vocational Training.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	Skills Framework for the Information Age (SFIA)	http://www.acs.org.au/sfia-certification/mysfia	SFIA is a common framework which allows an international understanding of what an ICT role actually involves and identifies the skills required.
Promoted By	Body promoting/advocating the above skills framework.	Australian Computer Society (ACS)	www.acs.org.au/	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed			

	international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	ACS Code of Ethics ACS Code of Professional Conduct	http://www.acs.org.au/__data/assets/pdf_file/0005/7835/Code-of-Ethics_Final_12.6.12.pdf http://www.acs.org.au/__data/assets/pdf_file/0014/4901/Code-of-Professional-Conduct.pdf	
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	ACS CBOK	http://acs.org.au/__data/assets/pdf_file/0007/7792/The-ICT-Profession-Body-of-Knowledge.pdf	The ACS Core Body of Knowledge for ICT
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these	Keith Besgrove, First Assistant Secretary, Digital Services Department of Communications Ian Oppermann, Director, Digital Productivity and Services Flagship, CSIRO Nick Tate, President, ACS		

	individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	BRAZIL 193,946,886 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Science, Technology and Innovation (MCTI)	http://mct.gov.br/	MCTI covers the following subjects: national policy for scientific research, technology and innovation, planning, coordinating, supervising and controlling the activities of science and technology policy development and automation; national policy biosecurity, space policy, nuclear policy and control the export of sensitive goods and services. Key departments include: SEPIN - Department of Informatics Policy and SETEC - Department of Development and Technological Innovation
		Ministry of Communications	http://www.mc.gov.br/	Areas of competence include broadcasting services, postal and telecommunications. The Ministry is also responsible for formulating and proposing national policies for these areas, as well as the national policy for digital inclusion.
		Ministry of Labour and Employment	http://portal.mte.gov.br/portal-mte/	The Ministry covers the following competence areas: I - policy and guidelines for the generation of employment and income; II - policy and guidelines for the modernization of labour relations; III – work relation's surveillance; IV - wage policy; V - training and professional development; VI - safety and health at work; VII - immigration policy, and VIII - urban cooperatives and associations.

		Ministry of Education) (MEC)	https://portal.mec.gov.br	MEC is responsible for national education policy, including early childhood education, primary education, secondary education, higher education, vocational education, and e-learning.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Brazilian Institute of Information in Science and Technology (IBICT)	http://mct.gov.br/index.php/content/view/63704/IBICT__Instituto_Brasileiro_de_Informacao_em_Ciencia_e_Tecnologia.html	Promotes competence, resource development and information infrastructure in science and technology for the production, socialization and integration of scientific and technological knowledge.
		National Council for Scientific and Technological Development (CNPq)	www.cnpq.br	CNPq aims to encourage research in Brazil. It is also responsible for financing scientific and technological research in diverse areas of knowledge through grants and scholarships, especially for individuals who want to attend Masters and Doctorate, whether in Brazil or abroad. CNPq is attached to the Ministry of Science and Technology.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your	Brazilian Computer Society (SBC)	http://www.sbc.org.br/index.php?language=2	SBC is a scientific society that brings together Brazilian students, teachers and professionals of Computing. SBC`s main objective of this institution is to promote research and education in computing.

	country.			SBC has approximately 4,000 members, including professionals in the field of Computing, professors, and graduate and post-graduate students. It also has about 230 universities, research centers, enterprises and business associations as members or institutional subscribers.
		Brazilian Institute of Informatics- Universidade Federal do Rio Grande do Sul (UFRGS)	http://www.inf.ufrgs.br/en/	The Institute of Informatics (Instituto de Informática) is a world-class centre of excellence in Computer Science and Computer Engineering research, teaching, and innovation. The Institute has 75 faculty members, which makes it one of the largest Computer Science and Computer Engineering groups in the country. One of its main characteristics is a strong connection between hardware- and software-oriented research.
		Brazilian Association of Information Technology and Communication Companies (BRASSCOM)	http://www.brasscom.org.br/brasscom/Ingles/index.php	Brasscom represents some of the most important and influential companies in the Brazilian ICT industry, and has over the past few years served as a link between the private and public sectors. Remit covers five areas - Institutional, Market Development, Education and Human Resources, Infrastructure and Digital Convergence, and Regulatory.
		The Association for Promotion of Brazilian Software Excellence (Softex)	www.softex.br	Softex has initiatives to support the development of the Brazilian Industry of Software and IT Services. It maintains projects in different areas: quality, investment, internationalization, intelligence and innovation. Softex was designated by the Ministry of

				Science, Technology and Innovation (MCTI) to act as manager of the Program for Promotion of Brazilian Software Excellence - SOFTEX Program. The organization benefits more than 2,000 companies nationwide through a network formed by 20 regional agents.
		The Brazilian Association of Software Companies (ABES)	www.abessoftware.com.br	ABES works with the government, regulatory agencies, entities linked to the software and IT services industry, media and society in general. It performs proposition and policy guidance aimed at strengthening the value chain of the Brazilian Industry of Software and Services. It defends intellectual property and combats piracy of national and international software. ABES also supports initiatives that foster expertise, research, development and innovation of domestic software. It has about 1,500 members (software and services companies).
		The Brazilian Association of Information Technology (Assespro)	http://assespro.org.br	Assespro defends the interests of national computer companies. Today Assespro comprises over 1,400 software companies and IT services attached to it through thirteen regional units. The universe of companies is composed of national private enterprises of data processing segment. Assespro´s strategy consists of two lines of action: expanding the domestic market and increase exports.
		The Brazilian Association of Electrical and Electronics Industry (Abinee)	www.abinee.org.br	Abinee is a nonprofit organization that represents the electrical and electronic sectors. It has as associates domestic and foreign companies operating throughout the country.

		Telebrasil	www.telebrasil.org.br	Telebrasil seeks cooperation among affiliated entities - public and private telecom companies - for the development of the National Telecommunications Policy. The organization was born in the nationalization cycle and remained active after the privatization of telecommunications in Brazil.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	National Apprenticeship Service (SENAI).	www.portaldaindustria.com.br/senai	SENAI is a Brazilian private institution of public interest. Its main goal is to support 28 industrial areas (including automation, electronics, and information technology) through training of human resources. It also provides technological services - advisory, consulting, applied research, design, and laboratory service.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Central Única dos Trabalhadores (CUT) Confederação Geral dos Trabalhadores (CGT)	http://www.cut.org.br/ http://www.cgtb.org.br/	CUT is the largest and most important trade union federation in Brazil, representing over 7.4 million workers in all productive areas. CGT is the second-largest federation of labour unions in Brazil.
		FENADADOS	www.fenadados.org.br	Fenadados is the national federation of employees working in public and private enterprises focused on data processing services, and computer and related activities. Fenadados was formed for the purpose of study, organization, coordination, protection and legal representation of the category of employees occupied in the mentioned activities.

		FENAINFO		Fenainfo is the federation of computer companies. Currently Fenainfo integrates 14 unions in the following states: Bahia, Ceará, Goiás, Paraná (two unions), Pernambuco, Rio de Janeiro, Rio Grande do Sul, São Paulo, Santa Catarina (three unions) and Sergipe, which together represent more than 121,000 small, medium and large computer companies. Since its creation, Fenainfo aims to defend the interests of computer companies, foster the creation of company unions in states where don`t exist representative bodies and strength the existing unions.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Câmara Brasileira de Comércio Eletrônico (Camara-e.net)	http://www.camara-e.net/	Camara-e is the main entity related to the Digital Economy in Brazil and Latin America and has 160 affiliated members represent leading companies from different sectors.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	MPS.br	www.softex.br	MPS.BR Program aims to improve the ability of software development and services in Brazilian companies. Considered a landmark that represents the evolution of software quality in the country, MPS.BR brought proven competitiveness gains for the domestic software industry.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and	Brasil Mais TI	www.brasilmaisti.com.br	Brasil Mais TI (Brazil More IT) is a free e-learning platform available in the internet offering IT professional courses. Besides, netizens can do aptitude tests to meet their professional profile and build their own portfolio of learning. See more at http://www.brasilmaisti.com.br/o-projeto/ #

	policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			sthash.w4anksMR.dpuf. Brasil Mais TI is an initiative of the Brazilian Ministry of Science, Technology and Innovation (MCTI).
		National Program for Access to Vocational and Technical Education and Employment (Pronatec)	http://pronatec.mec.gov.br	Pronatec was created by the federal government in 2011 with the aim of expanding the provision of vocational and technical education. Objectives: to expand the offer of technical high school education; build, renovate and expand public schools that offer vocational and technological education; increase educational opportunities for workers through courses of initial and continuing education or professional qualification; increase the amount of teaching resources to support the provision of vocational and technical education, improving the quality of secondary education. ICT courses are among the courses offered by Pronatec.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Plataforma Lattes	http://lattes.cnpq.br/	Plataforma Lattes is the CNPq experience in integrating databases of resumes, research groups and institutions into a single Information System. . The Lattes Resumes database became a national standard in recording the early and current life of researchers in the country. For its wealth of information and its increasing reliability and scope,

				has become indispensable and compulsory in the analysis of merit and competence of claims for funding in the area of science and technology. The Directory of Research Groups database contains information about the research groups active in the country.
		The National System of Higher Education Assessment (Sinaes) – Ministry of Education		Sinaes was established by Federal Law in 2004, in order to ensure national process evaluation of institutions of higher education. It consists of three main components: the assessment of institutions, courses and student performance. Sinaes evaluates all aspects revolving around these three areas: teaching, research, extension, social responsibility, student performance, the management of the institution, faculty, facilities etc.
		Evaluation System of Postgraduate Programs - Coordination of Improvement of Higher Education Personnel (Capes)/Ministry of Education	www.capes.gov.br	The Evaluation System of Postgraduate Programs was implemented by Capes in 1976 and since then has been fulfilling the role of fundamental importance for the development of postgraduate studies and scientific and technological research in Brazil, in compliance with the following objectives : • establish the quality standards required of master's and doctoral`s courses and identify those that meet this standard; • drive the evolution of the entire National System of Postgraduate and each particular program; • provide the country with an efficient database on the status and evolution of the graduates; The evaluation system includes two processes conducted by committees of consultants of the highest level , from institutions in different regions

				of the country: Evaluation of Postgraduate Programs and Evaluation of Proposals for Postgraduate New Courses.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	CERTICS	www.certics.cti.gov.br	CERTICS is a methodology to be applied in companies seeking to qualify for preference in procurement. It`s intended for software development organizations installed in the country of different sizes, market niches and business models. Certification is voluntary. The Ministry of Science, Technology and Innovation (MCTI) issues certification through the Department of Informatics Policy (SEPIN).
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	RFID Coe/ HP	http://fit-tecnologia.org.br	RFID CoE HP is dedicated to the research and development of RFID technology. In 2009, RFID CoE became the first laboratory in the world accredited by EPCglobal in simultaneous scopes: Dynamic Portal Door, Conveyor Portal Dynamic and Static Test Method.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			**Composition of the workforce - ICT Sector, Brazil, 2010** ICT services: 922,417 - IT services: 518,755 - Telecommunications: 300,775 - Repair and maintenance of computer and communication equipment: 53,156 - Information services: 4,731 ICT Trade: 143,185 ICT Manufacture: 107,227 - Manufacture of communication equipment and

				apparatus for the reception, recording and amplification of audio and video – 71,926 - Manufacture of electronic components -19,596 - Manufacture of computer equipment and peripherals -15,706 Total: 1,172,829 **Percentage with at least a university education**: 27,5% **Number of ICT experts (inside and outside ICT sector) - Brazil 2010** Managerial level: 80,834 Upper level: 410,805 Vocational technical level: 704,542 Total: 1,196,181 **Number of ICT experts (inside ICT sector):** 515,312 **Enrollments in courses - computing and informatics area – Brazil, 2010** Upper level: 265,943 Vocational technical level: 139,125 Total: 405,068 Source: Observatório Softex.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals'	The Brazilian	www.mtecbo.gov.br	The CBO, established by Ministerial Decree no. 397

	competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	Classification of Occupations (CBO)		of 9 October 2002, aims to identify the occupations in the labor market, for classification purposes with the administrative and household records. The CBO is based on the International Classification of Occupations proposed by the International Labour Organisation.
Promoted By	Body promoting/advocating the above skills framework.	Ministry of Labour and Employment (MTE)	www.mte.gov.br	The MTE uses the Brazilian Classification of Occupations as a basis for the generation of statistics on the labour market at national and local level. Through the data collected by the, it is possible to know the number of people employed by occupation and also monitor admissions and dismissals by occupation.
		Brazilian Institute of Geography and Statistics (IBGE)	www.ibge.gov.br	IBGE uses CBO as a basis for the survey of occupations held in Census and their economic and household surveys.
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	The Federal Council of Engineering and Agronomy (Confea)		Confea is a professional oversight board responsible for regulating and final judgment in Brazil of professional activities related to the following categories: Engineering, Agronomy, bachelors of Geography, Geology and Meteorology. Electronic engineers, electrical engineers and computer engineers have the support of the Council. No professional supervisory board for other ICT professionals (e.g. computer scientists, programmers, web designers, systems analysts, etc.)
Professional Body's Code of	Names of the Codes of Ethics/Conduct of national computing society that specify			

Ethics/Conduct	principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.			
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	**Silvio Meira** is a Brazilian researcher in the field of Software Engineering. Degree in Electronic Engineering (1977), specialized in Computer Science, pursuing a master's degree in computer science (1981) and PhD in computing (1985). Author of about one hundred of scientific and technological papers published in conferences and journals and more than two hundred of texts on Information Technology and its impact on the society. He supervised (from 1985) over forty theses and doctoral dissertations and master's degrees in computing. Silvio Meira was a researcher of CNPq for over 15 years, designed and coordinated the multi-institutional thematic program in computer science (Protem - cc) of CNPq. He created and coordinated the doctoral program in computer science from the Federal University of Pernambuco, was advisor to the secretary of computer policy of the Ministry of Science and Technology, a member of the first steering committee of the Internet/br, and president of the Brazilian computer Society. He also was a consultant to the World Bank and the United Nations Program for Development.		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template		COUNTRY	CANADA
		POPULATION	33,476,688 (Census 2011)
GENERAL/INSTITUTIONAL			
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Industry Canada	http://www.ic.gc.ca/eic/site/icgc.nsf/eng/home	Industry Canada works with Canadians in all areas of the economy and in all parts of the country to improve conditions for investment, enhance Canada's innovation performance, increase Canada's share of global trade and build a fair, efficient and competitive marketplace.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Information and Communications Technology Council (ICTC)	http://www.ictc-ctic.ca/	The Information and Communications Technology Council (ICTC) is a centre of expertise in Information and Communications Technology (ICT) research, policy development and workforce solutions. ICTC enables industries to maintain a competitive advantage in a global market and develop Canada's future skilled and innovative talent.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Canada's Association of I.T. Professionals (CIPS) Canadian Computer	http://www.cips.ca/ http://cancomputes.co	Since 1958, CIPS has helped strengthen the Canadian IT industry by establishing standards and sharing best practices for the benefit of individual IT professionals and the sector as a whole. CIPS represents thousands of members across the country. The Canadian Computer Society (CCS) is a division of

		Society (CCS)	m/home	the Ontario Centre for Management Studies (OCMS).
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Canadian Coalition for Tomorrow's ICT Skills (CCICT)	http://ccict.ca/	The Canadian Coalition for Tomorrow's Information and Communications Technology (ICT) Skills (CCICT) was founded in 2007 by a group of visionary organizations seeking to proactively address the long term talent/skills requirements of Canadian businesses, government and organizations.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Canadian Labour Congress (CLC)	http://www.clc-ctc.ca/	The Canadian Labour Congress, or CLC is a national trade union centre, the central labour body in English Canada to which most Canadian labour unions are affiliated.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Canadian Chamber of Commerce	http://www.chamber.ca/	As Canada's largest and most influential business association, the Canadian Chamber of Commerce is the primary and vital connection between business and the federal government. It continually demonstrates impact on public policy and decision-making to the benefit of businesses, communities and families across Canada.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	CareerMash by the Canadian Coalition for Tomorrow's ICT Skills (CCICT)	http://careermash.ca/	CareerMash spreads the word about the endless possibilities of today's tech careers. CareerMash is becoming the go-to resource for young career choosers, providing: inspiring career descriptions and real people profiles; enticing descriptions of workplaces; helpful details on education opportunities engaging social media pages on Facebook, YouTube, Twitter & LinkedIn; informative daily news; and events and blogs.
Policy initiatives	Cite any specific examples of policy	Information and	http://www.ictc-	Canada Readiness Tool: bilingual, ICT competency-

	initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	Communications Technology Council (ICTC) tools and resources	ctic.ca/?page_id=1758	based, online self-assessment tool. Online: an e-learning tool that provides essential knowledge about working in Canada, including the process of coming to Canada; what Canadian ICT employers need; and resources available to develop technical, business, language, and workplace communication competencies. ICT Employer Directory: online searchable directory that houses a list of ICT organizations in Canada. ICTC Competency Profiles: provides ICT stakeholders the ability to customize ICT job profiles based on the national standards of knowledge, skills and abilities within 36 ICT work streams in Canada.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	Canadian Degree Qualifications Framework	http://www.cicic.ca/714/qualifications-frameworks.canada	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Canada's Association of I.T. Professionals (CIPS)	http://www.cips.ca/certification	CIPS Certification recognizes leaders within the IT Profession, both in Canada and abroad. Canada's only legally recognized designation for IT professionals, I.S.P. (Information Systems Professional) status provides clients and employers with trusted assurance of an IT professional's knowledge and technical background. I.S.P. standing

				has been granted in Canada since 1989, and is legislated as a self-regulating designation in six provinces, with other provinces working toward similar legislation. Introduced in 2008, the ITCP (Information Technology Certified Professional) certification is intended for senior IT workers and academics who have demonstrated an ability to apply their organizational experience to tough problems and achieve ambitious goals. Accredited by the International Professional Practice Partnership (IP3, www.ipthree.org), ITCP certification is internationally recognized as a sign of professional excellence.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Canada's Association of I.T. Professionals (CIPS)	http://www.cips.ca/accreditation	CIPS has many responsibilities under its mandate. One is to develop and maintain standards in educational qualifications that provide an appropriate foundation for those who wish to follow a career in computing or information systems. As part of this responsibility, CIPS undertakes a program of visits to universities and college/technical institute to review computing, information technology and business technology management program.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012)			

	Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	Skills Framework for the Information Age (SFIA) Information and Communications Technology Council (ICTC) ICTC's Competency Profiles	http://www.cips.ca/certification http://www.ictc-ctic.ca/?page_id=1791	SFIA is a common framework which allows an international understanding of what an ICT role actually involves and identifies the skills required. Use ICTC's online tool to develop customized job descriptions, assessment tests, performance appraisals and people development plans. Educators establish and review course curricula based on ICTC's competency profiles, ensuring digitally savvy graduates ready to join the workforce.
Promoted By	Body promoting/advocating the above skills framework.	Canada's Association of I.T. Professionals (CIPS) Information and Communications Technology Council (ICTC)	http://www.cips.ca/ http://www.ictc-ctic.ca/	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing			

	scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Canada's Association of I.T. Professionals (CIPS) code of ethics	http://www.cips.ca/ethics	
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Canada's Association of I.T. Professionals (CIPS) Common Body of Knowledge for Computing and IT (CBOK)	http://www.cips.ca/cbok	
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.			
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.			

Country Profile Template		COUNTRY	CHINA
		POPULATION	1,353,821,000 (Estimate 2012)
GENERAL/INSTITUTIONAL			
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Industry and Information Technology (MIIT)	http://www.miit.gov.cn/n11293472/index.html	Established in March 2008, it is the state agency of China responsible for regulation and development of the postal service, Internet, wireless, broadcasting, communications, production of electronic and information goods, software industry and the promotion of the national knowledge economy.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	No specific agency responsible	No specific agency responsible	No specific agency responsible
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Chinese Institute of Electronics (CIE)	http://www.cie-info.org.cn/	CIE is a nongovernmental, engineering and academic organization composed of professional and regional societies. The aim of the CIE is to promote electronic science and technology by stimulating and encouraging the development and application of electronic science and technology; strengthening the co-operation in electronics with scholars of all countries; popularizing electronic science and

		China Computer Federation (CCF)	http://www.ccf.org.cn/sites/ccf/	technology; and encouraging education and training for engineers.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	China Electronics Enterprises Association (CEEA)	http://www.ceea.org.cn/ http://www.china-cic.org.cn/	China Electronics Enterprises Association (CEEA) is a non-profitable social and economic organization registered with the Ministry of Civil Affairs. CEEA is a nationwide organization for enterprises engaged in research, development, production, sales and provision of services, involving different areas, departments and ownerships. All the positions for deputy chairpersons and trustees are filled by the principals of groups or renowned entrepreneurs in related sectors. This ensures that the activities of CEEA are organized as required and as expected by the enterprises with a focus on "Protecting interests and promoting the development of the enterprises". Facing the same future with the electronics enterprises, CEEA will work hard to build itself into a "Big Community" for all related companies and entrepreneurs. Presently, CEEA has over 2,700 members including the manufacturers of consumer electronic products, electronic elements & equipment, Telecommunications, Information Technology, Broadcasting, IT, etc. within the Chinese information industry.

Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	All-China Federation of Trade Unions (ACFTU)	http://www.acftu.org.cn/	ACFTU is the nationalised federation of workers organisations of the People's Republic of China. It is the largest trade union in the world with 134 million members in 1,713,000 primary trade union organizations.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	All-China Federation of Industry & Commerce	http://www.chinachamber.org.cn	Established in 1953 and under the leadership of CPC, the All-China Federation of Industry and Commerce, is a people's group and a chamber of commerce with the enterprises and personages of the non-public economic sector as its main component, a channel for the CPC and the government to liaise with the personages of the non-public sector, an aide to the government in administering and serving the non-public economy. ACFIC's work is a key component of the CPC's united front and economic work.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	N/A	N/A	N/A
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries.	N/A	N/A	N/A

	E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	N/A	N/A	N/A
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	China Higher Education Student Information and Career Center	http://www.chsi.com.cn/xlrz/	China Higher Education Student Information and Career Centre (abbreviated as CHESICC in the following) is an authoritative institution directly under the Chinese Ministry of Education. Founded in 1991, CHESICC specialises in information service and career guidance for students of higher education institutions. Its primary business includes higher education enrolment, issues related to the management of students and as well as graduate employment. Meanwhile, it provides technical and informational service to students and higher education institutions, and enterprises and society. Based on the higher education student information database, CHESICC has established two platforms since 2001;

				the China Higher-education Student Information Website (www.chsi.com.cn) and the China New Career Service Website (www.ncss.org.cn), on which more than 20 E-government platforms and social service platforms are built and operated. The core of these platforms is four pillars relates to student records and qualifications, college entrance examinations, postgraduate enrolment and graduate's employment. In 2011, the China Higher-Education Student Information Website was visited nearly 900 million times. CHESICC is the only body designated by the Ministry of Education for HEQC inquiries, the designated website to publish recruitment information of higher institutions nationwide, and the only website to handle entrance exams for postgraduate schools. And it's also the only MOE-authorized specialized organization for the verification of HEQC.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Gcvaic-MIIT	http://www.gcvaic.org/ http://www.miitec.org.cn/	
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates	N/A	N/A	N/A

	(2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	CETTIC	http://www.cettic.gov.cn/zxjs/index.html http://edu.mohrss.gov.cn/Default.aspx	Founded in 1998, CETTIC handles its official affairs jointly with the Occupational Skill Testing Authority (OSTA). It is one of the public institutions directly under the Ministry of Human Resources and Social Security. It is responsible for providing technical guidance in the fields of employment and vocational training work nationally, and organizing occupational skill testing all over the country.
Promoted By	Body promoting/advocating the above skills framework.		http://www.zhongguozhixie.com.cn/	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?		http://txs.miit.gov.cn/n11293472/n11295244/index.html	
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide	N/A	N/A	N/A

	brief synopsis of the areas covered in this code if known, if relevant.			
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	ETIRI	http://www.etiri.com.cn/	
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Fuqing YANG, Chairman, Beida Jade Bird Group Yangyuan WANG. Co-founder, Beida Jade Bird Group (http://www.jadebird.com.cn/index.htm)		
ADDITIONAL INFORMATION				
Type	**Guidance**	**Specifics**		
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	N/A		

Country Profile Template			COUNTRY POPULATION	INDIA 1,210,193,422 (Census 2011)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Information & Broadcasting	http://www.mib.gov.in/	The Ministry of Information and Broadcasting is a branch of the Government of India is the apex body for formulation and administration of the rules and regulations and laws relating to information, broadcasting, the press and films in India.
		Ministry of Human Resource Development	http://mhrd.gov.in/	The ministry is divided into two departments: the Department of School Education and Literacy, which deals with primary and secondary education, adult education and literacy, and the Department of Higher Education, which deals with university education, technical education, scholarship etc.
		Department of Electronics and Information Technology	http://deity.gov.in/	Objective of the Department of Electronics and Information Technology: e-Government: Providing e-infrastructure for delivery of e-services; e-Industry: Promotion of electronics hardware manufacturing and IT-ITeS industry; e-Innovation / R & D: Providing Support for creation of Innovation Infrastructure in emerging areas of technology; e-Education: Providing support for development of e-Skills and Knowledge network; and e-Security: Securing India's cyber space.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that	National Informatics Centre (NIC)	http://www.nic.in/	National Informatics Centre (NIC) is a premier S & T institution of the Government of India, established in 1976, for providing e-Government / e- Governance

	are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".			Solutions adopting best practices, integrated services and global solutions in Government Sector.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Computer Society of India (CSI)	http://www.csi-india.org/	Formed in 1965, the CSI has been instrumental in guiding the Indian IT industry down the right path since its formative years. Today, the CSI has 70 chapters all over India, 418 student branches, and more than 90000 members including India's most famous IT industry leaders, brilliant scientists and dedicated academicians.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	ilearniwork (India learn, India work)	http://www.e-skills.in/	
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Indian National Trade Union Congress (INTUC)	http://www.intuc.net/	Indian National Trade Union Congress (INTUC) is the trade union wing of the Indian National Congress. It was founded May 3, 1947, and is affiliated with the International Trade Union Confederation. According to provisional statistics from the Ministry of Labour, INTUC had a membership of 3,892,011 in 2002.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Associated Chambers of Commerce and Industry of India	http://www.assocham.org	The Associated Chambers of Commerce and Industry of India (ASSOCHAM), India's premier peak chamber covers a membership of over 400,000 companies and professionals across the country. It was established in 1920 by promoter chambers, representing all regions of India.
Best Practices	Are there any specific examples of best	N/A	N/A	N/A

	practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	N/A	N/A	N/A
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	N/A	N/A	N/A
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications	Computer Society of India (CSI)	http://www.csi-india.org/	Since 1979, CSI has been offering certifications in programming languages, office automation, system

	and providing a wide range of ICT certification programmes, if relevant.			analysis and design, Data structure through C language, Data communication and networks, information systems control and audit, web programming, extensible mark-up language, object oriented analysis and design with C++, Linux, Java programming, embedded systems, information security, service oriented architecture and software testing. CSI prescribes the curriculum for each topic and ties up with training organizations, who train and field candidates. Qualifying examinations are periodically conducted by CSI to award certification to successful candidates.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	N/A	N/A	N/A
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	N/A	N/A	N/A
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals'	N/A	N/A	N/A

	competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.	N/A	N/A	N/A
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	N/A	N/A	N/A
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Computer Society of India (CSI) code of ethics	http://www.csi-india.org/web/guest/code-of-ethics	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	N/A	N/A	N/A
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3	N/A		

	individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	N/A

Country Profile Template			COUNTRY	JAPAN
			POPULATION	126,659,683 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	IT Strategic Headquarters	http://www.kantei.go.jp/foreign/policy/it/index_e.html	In light of the urgency to adapt ourselves to the world's rapid and drastic changes in the socio-economic structure caused by the utilization of information and telecommunications technology, in order to promote measures for forming an advanced information and telecommunications network society expeditiously and intensively, the Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society (IT Strategic Headquarters) was established within the Cabinet in January 2001.
		Ministry of Economy, Trade and Industry (METI)	http://www.meti.go.jp/english/policy/index_information_policy.html	METI has jurisdiction over a broad policy area in ICT in Japan, containing IT use and utilization, promotion of open data, information security policies, IT human resources development, etc.
		Ministry of Education, Culture, Sports, Science and Technology (MEXT)	http://www.mext.go.jp/english/	MEXT has jurisdiction over the education system in Japan. MEXT also administers the Professional Engineer systems as the jurisdiction in accordance with the PE Act (Law No.25/1983).
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas.	Information-technology Promotion Agency, Japan (IPA)	http://www.ipa.go.jp/index-e.html	Information-technology Promotion Agency, Japan (IPA) is a government agency administrated by METI. Its role is to solve diverse IT issues and create an IT-based society where people can live their lives feeling secure. IPA's slogan, "Invigorating Japan

	If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state “No specific agency responsible”.			through IT", embodies this objective. IPA's activities are aimed at fulfilling three missions: (1) Assuring the security and reliability of social IT services and systems (2) Strengthening international competitiveness (3) Cultivating highly skilled world-class IT human resources
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Information Processing Society of Japan (IPSJ) Technical Discipline of Information Engineering, Institution of Professional Engineers, Japan (IPEJ)	http://www.ipsj.or.jp/english/index.html https://www.engineer.or.jp/sub09/	Since its establishment in 1960, the Information Processing Society of Japan (IPSJ) plays a key role for realizing the information society of the 21st century through its academic, cultural and industrial activities. IPSJ has 16,566 members and is the largest and leading society in the information technology in Japan. IPEJ is a non-profit institution and manages Exanimation and Registration of the Professional Engineers as the organization designated by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Professional Engineers majored in ICT are managed by the technical discipline of information engineering.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	Japan Information Technology Services Industry Association (JISA) Japan Users Association of Information Systems (JUAS)	http://www.jisa.or.jp/Portals/0/resource/e/ http://www.juas.or.jp/en/	JISA was founded in 1984 and its member include leading system integrators, computer system designers, development & related service providers, data processing service providers, and systems operation and management services vendors. JUAS was founded in 1962 for the purpose of looking at the increasing centrality of information from the viewpoint of companies that use IT (information systems) and pursuing IT that is integrated with

				corporate management.
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Japanese Trade Union Confederation (RENGO)	http://www.jtuc-rengo.org/	Rengo is the largest national trade union centre in Japan, with over six million members as of 2011. It was founded in 1989 as a result of the merger of the Japan Confederation of Labor (Domei) and the Federation of Independent Labor Unions (Churitsu Roren).
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Japan Business Federation (KEIDANREN)	http://www.keidanren.or.jp/en/	Japan Business Federation (KEIDANREN) is a comprehensive economic organization with a membership composed of 1,300 representative companies of Japan, 121 nationwide industrial associations and 47 regional economic organizations (as of July 1, 2013). Their mission as a comprehensive economic organization is to draw upon the vitality of corporations, individuals and local communities to support corporate activities which contribute to the self-sustaining development of the Japanese economy and improvement in the quality of life for the Japanese people.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	Asian Common Skill Standard Initiative for IT Engineer	http://www.ipa.go.jp/english/humandev/mutualrecognition.html http://www.ipa.go.jp/jinzai/asia/index.html (in Japanese)	This initiative was proposed by Japan at the Meeting of the ASEAN Economic Ministers and the Ministers of People's Republic of China, Japan and Republic of Korea in 2000 and then the initiative was adopted as a project. The purpose of the initiative is: a) to establish common skill standards for IT engineers & professionals; b) to assist the mobility of IT engineers across the

				border; c) to facilitate the cooperation among IT businesses. Under the initiative, IPA has signed mutual recognition agreements regarding IT engineers examination with 11 countries/regions. Philippines, Thailand, Vietnam, Myanmar, Malaysia and Mongolia formed ITPEC (IT Professionals Examination Council) and started a common examination based on Japan's ITEE.
		Exploratory IT Human Resources Project	http://www.ipa.go.jp/jinzai/mitou/index.html (in Japanese)	In addition, IPA continues to discover and cultivate outstanding Human Resources through "Exploratory IT Human Resources Project (The MITOH program) and The Security Camp. (1) The exploratory IT Human Resources Project (The MITOH program) aims to discover and develop young human resources with the creativity and capability to create new IT markets. (2) The Security Camp is Camp-style training program for students under 22 years old, started in 2004 as an annual event and has produced about 400 young students with a specific level of IT knowledge and skill participated in total (2004-2012).
		IT Forum	http://www.ipsj.or.jp/it-forum/index.html (in Japanese)	IPSJ provides a framework to develop a professional community on a specific topic such as big data, IT human resource development, service science,

				diversity. IT forums are currently running (July 2013). IPSJ promotes there IT forums through an annual convention named Software Japan.
		Journal of Digital Practices (DP)	http://www.ipsj.or.jp/dp/dp-index.html (in Japanese)	IPSJ runs a peer-reviewed journal, named Digital Practices (DP), for IT professionals to share various ideas and/or experiences to utilize IT at the real world. DP is published quarterly.
		Center for Future ICT Leaders (CeFIL)	http://www.cefil.jp/ (in Japanese)	KEIDANREN created a non-profit organization named CeFIL in order to promote cooperation between industry and academia to develop highly skilled IT students. CeFIL provides 1-2 months internship program for graduate students, and various contents for practical education.
		Innovation Management College of Japan (IMCJ)	http://imc-j.jp/ (in Japanese)	JUAS provides a CIO training program named Innovation Management College of Japan (IMCJ). IMCJ is composed of 2-week seminar with extensive lecture and discussion together with virtual community of the participants.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	IPA	http://www.ipa.go.jp/jinzai/itss/csfv1.html#section7 (in Japanese)	Information-technology Promotion Agency, Japan (IPA) has established the Common Career/Skill Framework (CCSF) to serve as a reference model for three skill standards (ITSS, ETSS and UISS). This framework serves as the foundation for developing highly skilled IT professionals.
			http://www.ipa.go.jp/jinzai/itss/ccsf/download.html (in Japanese)	CCSF is provided as a reference model for three skill standards shown below: (1)Skill Standards for IT Professionals (ITSS) (2)Embedded Technology Skill Standards (ETSS) (3)Users' Information Systems Skill Standards (UISS)

				In addition, IPA provides a template of Business applications services as an example for practical use of CCSF. It could be a concrete example for Managements of SMEs who perform business innovation.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	The National IT engineers examination (ITEE)	http://www.jitec.ipa.go.jp/index-e.html http://www.jitec.ipa.go.jp/ (in Japanese)	The National IT engineers examination (ITEE) has been conducted by IPA since 1969: a) to stimulate IT engineers to raise technical ability by showing the goal; b) to contribute to set up education and training programs in academic institution, vocational school and in-house school by showing the level of ability required for IT engineers; c) to provide objective evaluation criteria that is used when companies and public offices employ IT engineers and then establish the social status of IT engineers. The ITEE consists of 12 examination categorises aligned with 4 levels defined in the CCSF (Common Career Skills Framework, see Skills Framework section). Level 1: able to perform tasks under guidance • IT Passport Examination Level 2: able to perform part of the required tasks on their own • Fundamental IT Engineer Examination Level 3: able to perform all required tasks on their own

		Professional Engineer Japan (P.E. Jp)	https://www.engineer.or.jp/sub09/	• Applied IT Engineer Examination Level 4: professionals with advanced knowledge and skills • IT Strategist Examination • System Architect Examination • Project Manager Examination • Network Specialist Examination • Database Specialist Examination • Embedded Systems Specialist Examination • Information Security Specialist Examination • IT Service Manager Examination • Systems Auditor Examination The certificate is issued with the signature of the Minister of Economy, Trade and Industry. The examination system has been constantly updated by the change of IT environment and the major change has been performed by the recommendations from the committee in the Industrial Structure Council in METI (Ministry of Economy Trade and Industry). The examination is well accepted and supported by the industry and academia. For example, many IT companies recommend their employees to take this qualification in their human resource development system and 118 universities use this qualification for their credit system. Recently, IPSJ announced to start IT professional certification system and use this qualification as the requirement (see Certification Bodies section). Professional Engineer Japan (P.E. Jp) is the national

				qualification stipulated by the Professional Engineer Act. A Professional Engineer is defined as an engineer engaged in the professional practice (except for cases where such practice is prohibited under other laws) of rendering services for science and technology in planning, research, design, analysis, testing, evaluation, and training in such work, which requires application of extensive scientific and technical expertise. The Enforcement Regulation of the Professional Engineer Act specifies 21 technical disciplines, in each of which a Professional Engineer is qualified. Professional Engineers in ICT are managed by the technical discipline of information engineering. P.E.Jp qualification can be upgraded to international certification such as APEC Engineer and EMF Engineer with extra requirements including CPD and periodical renewal.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Information Professing Society of Japan (IPSJ)	http://www.ipsj.or.jp/english/index.html	IPSJ announced the proposal of the advanced certification system for IT engineers in June 2013. The certification system conforms to international standards such as ISO/IEC 17024 and 24773. It also references CCSF/ITSS which is widely adopted among IT industries in Japan. Among the seven levels defined in CCSF/ITSS, the certification is intended for advanced IT engineers of level 4 and above, where ITSS level 4 is compatible with SFIA level 5. IPSJ is currently running a trial evaluation and is planning to start the actual certification from 2014.
Accreditation	Provide list and **brief** summary of Bodies	Japanese	http://www.ipsj.or.jp/	JABEE was established in 1999 for the purpose to

Bodies	responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Accreditation Board for Engineering Education (JABEE)	english/index.html	promote professional education and to support fostering international professionals. JABEE accredits professional education programs in higher education institutions fostering professionals with benchmarks required by the society by JABEE Accreditation Criteria which is internationally equivalent such as Seoul Accord which covers computing and IT-related disciplines. Graduates of the education program accredited by JABEE are exempted from the first stage examination for Professional Engineer.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	Ministry of Education, Culture, Sports, Science and Technology (MEXT) JABEE The National IT engineers examination (ITEE) Technical Discipline of Information Engineering, P.E. Jp	 http://www.ipsj.or.jp/english/index.html http://www.jitec.ipa.go.jp/index-e.html http://www.jitec.ipa.go.jp/ (in Japanese) https://www.engineer.or.jp/sub09/	The number of ICT graduates (undergraduate level) is estimated 34,239 in 2013. The number of ICT graduates (master level) is estimated 10,328 in 2013. The number of ICT departments in science and/or engineering is about 150. (July 2013) Japanese Accreditation Board for Engineering Education (JABEE) has accredited 30 computing programs (undergraduate level) up to May 2013. 17,290,133 engineers have applied and 2,125,249 engineers have passed the ITEE (up to June 2013). The number of ITEE applicants in 2012 was 488,879, which is the largest national examination in Japan. 1836 engineers have passed the Professional Engineering (P.E. Jp) qualification in the technical discipline of Information Engineering (up to March 2013).

E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	Information-technology Promotion Agency, Japan (IPA)	http://www.ipa.go.jp/english/humandev/forth.html	**Skill Standards for IT Professionals (ITSS)** ITSS is a set of systematic indices that clarify and systemize the skills needed for people working in the IT services industry. ITSS is utilized as a tool for developing professional human resources to implement corporate strategies. Organized into a career framework, ITSS classifies the information services industry into 11 job categories and 35 specialty fields. In each field, there are seven levels based on individual experience and results. One appealing feature of ITSS is that this standard allows engineers to draw roadmaps for their own futures and career advancement (Career Path). **Embedded Technology Skill Standards (ETSS)** In working to strengthen development capabilities for embedded software, IPA is formulating and promoting the Embedded Technology Skill Standards (ETSS) as guidelines for the effective development and deployment of human resources. **Users' Information Systems Skill Standards (UISS)** UISS serves as metrics for use in the optimal placement of corporate information systems and the identification and proper training of necessary human resources. With the aim of bolstering corporate competitiveness, this standard exhaustively and systematically arranges and lists the skills and knowledge required for organizations and people.
Promoted By	Body promoting/advocating the above	Center for Human	http://www.ipa.go.jp/a	Same as above

	skills framework.	Resources Development Initiative, IT Human Resources Development HQ, IPA	bout/ipajoho/gaiyo.html#section3 (in Japanese)	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	Professional Engineer Act	http://eiyaku.hounavi.jp/taiyaku/s58a02501.php	The PE Act specifies qualification of professional engineer • Such behaviours that lose confidence on P.E.Jp are prohibited. • Confidentiality • Securing of Public Interest • Continuing Professional Development (CPD) • Indication of Title as P.E.Jp
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	IPSJ IPEJ	http://www.ipsj.or.jp/english/ipsjcode_e.html http://www.engineer.or.jp/c_topics/000/000025.html (in Japanese)	Information Processing Society of Japan (IPSJ) has code of ethics and rule of conduct as member of society, as ICT professional, and as organizational leaders. The Institute of Professional Engineers, Japan (IPEJ) has code of ethics composed of priority of public interest, sustainability, capability, truth, justice, confidentiality, trust, cooperation, compliance, and continuing professional development.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of	Provide list and **brief** summary of Bodies	Information-	http://www.ipa.go.jp/ji	IPA provides Bodies of Knowledge (BoKs) which has

Knowledge (BoKs)	of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	technology Promotion Agency, Japan (IPA)	nzai/itss/csfv1.html (in Japanese)	been made by organizing knowledge required in Common Career/Skill Framework (CCSF) level 1 to 4. The BoKs has consistency with Information Technology Engineers Examination (ITEE), and this is one of the reasons why ITEE could be very useful for human resources development.
		ITEE Syllabus	http://www.jitec.ipa.go.jp/1_04hanni_sukiru/_index_hanni_skill.html (in Japanese) http://www.ipa.go.jp/files/000027072.pdf (partially in English)	In addition, ITEE Syllabus was developed for ITEE (see Qualification Framework section). This syllabus is used for the curriculum development at 109 universities.
		J07-BOK • J07-CSBOK • J07-CEBOK • J07-SEBOK • J07-ISBOK • J07-ITBOK • J07-GEBOK	http://www.ipsj.or.jp/annai/committee/education/j07/ed_j07.html (in Japanese)	Information Processing Society of Japan (IPSJ) provides the computing curriculum standard J07 and corresponding BOKs for each J07 domain for undergraduate level ICT education. J07 is composed of the following six domains and is widely utilized at many ICT departments in Japan. • CS (Computer Science) • CE (Computer Engineering) • SE (Software Engineering) • IS (Information System) • IT (Information Technology) • GE (General Education) GE is a curriculum standard for general ICT education for non-ICT students. Other five domains correspond to CC2005 domains with some modification to adopt teaching environment at Japanese universities.

CONTACTS		
Type	**Guidance**	**Specifics**
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	• Hirokazu Akimoto (IPA) • Kenji Ogawa (IPA) • Katsuhiko Kakehi (Waseda University and IPSJ) • Hiroharu Asahi (Hitachi Ltd. and IPSJ) • Tetsuro Kakeshita (Saga University and IPSJ)
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY	RUSSIA
			POPULATION	143,300,000 (Estimate 2012)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Ministry of Communications and Mass Media (MinComSvyaz Rossii)	http://minsvyaz.ru/ru/	The ministry is responsible for drafting and implementing national policy and legal regulation in: information technology, including the creation of government information resources and the promotion of access to such resources; telecommunications, including the allocation and conversion of the radio frequency spectrum, and postal communications; mass communications and the media, including the electronic media, the development of the Internet, television and radio broadcasting, and related technology; publishing and printing; and personal data processing.
		Ministry of Education and Science	http://eng.mon.gov.ru/	The ministry carries out functions on elaborating state policy and normative-lawful regulation in the sphere of education, scientific, scientific-technical and innovative activity, nanotechnologies, intellectual property, and also in the sphere of upbringing, social support and social protection of schoolchildren and pupils of educational institutions.
		Ministry of Industry and Trade (Minpromtorg)	http://www.minpromtorg.gov.ru/eng	The ministry is a federal executive body with policy-making and regulatory functions in civil and defence industries, as well as in aviation technology development, technical regulation and standardization, science and technology for national

				defence and security, foreign and domestic trade.
		Ministry of Economic Development	http://www.economy.gov.ru/	The ministry has a large number of functions, including support and coordination of Presidential Programs in business education and of post-graduate engineering retraining.
		Ministry of Labour and Social Protection (Mintrud)	http://www.rosmintrud.ru/eng http://profstandart.rosmintrud.ru http://www.niitruda.ru/	The ministry is responsible for the development and implementation of 800 new Professional Standards (including 30 ICT Professional Standards) in 2012-2015. Mintrud supports web-portals for Professional Standards and has a Labour Research Institut which provides training programs for experts, who develop Professional Standards.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	Agency Development of ICT-Education (АРИТО)	http://minsvyaz.ru/ru	New agency which was founded by the Ministry of Communications and Mass Media and the Ministry of Education and Science for a special purpose: to implement the ICT Workforce Development Strategy.
		Agency for Strategic Initiatives (ASI)	http://www.asi.ru/en/	The agency was established by the President of RF for the coordination of strategic projects. ASI has a branch 'Young professionals' which coordinates the activities of several ministries on fulfilling orders of the President RF "to create and modernize 25 million of high-efficiency work places". The roadmap includes: support of professional associations; distribution of best practices of modern education and HR management; raising the prestige of

				workers' professions etc.
		Federal Agency on Technical Regulating and Metrology (Rosstandard)	http://www.gost.ru/wps/portal/pages.en.Main	Rosstandard consists of the system of federal executive bodies (including Technical Committees 'Information Technology') and is under jurisdiction of the Ministry of Industry and Trade of the Russian Federation. Rosstandard tasks include also: harmonization of national standards of the Russian Federation, rules and procedures of conformity, assurance of products and services to specified requirements of internationally recognized standards, rules and procedures etc.
		National Agency for Qualifications Development (NARK)	http://www.nark-rspp.ru/	NARK promotes the development of quality of workforce, Life Long Learning and a National Qualifications System; coordinates actions of business community organizations and interaction of business and state bodies; distributes information and knowledge, consultation and organization of learning in the field of making of the National Qualifications System; support of organizations participating in the development of workforce quality; assessment of education results, training and labour skills etc.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your	Russian Information & Computer Technologies Industry Association (AP KIT)	http://www.apkit.ru/	In terms of its membership, AP KIT is the most representative non-commercial association in the Russian IT Industry. Association members have earned acclaim as leading Russian and international businesses, distributors, system integrators, vendors

	country.			and developers. By many accounts, AP KIT members control up to 70% of the official market. AP KIT unites associations representing individual market segments as well as regional unions. Among the AP KIT members are sub industry and niche associations. APKIT includes a specialized Committee for IT-education, which is the main industrial organization responsible for the support of IT-education (organization of the major industrial conference on IT-education, providing regular dialogue on behalf of the ICT Industry with all related ministries on IT-education issues).
		Russian Software Developers Association (RUSSOFT)	http://www.russoft.org	RUSSOFT is a nationwide association of the most technically competent software developing companies in Russia. Presently RUSSOFT unites more than 70 companies with more than 23000 highly qualified programmers and software engineers with advanced graduate level degrees in Technology & Computer Science.
		Russian Union of CIO (RUCIO)	http://www.rucio.org/main/	RUCIO is an interregional organization, uniting managers of IT-services of commercial enterprises and state establishments, as well as other IT-experts, participating in activities of professional communities. Being a professional association, RUCIO sees its aim in providing interaction between IT-professionals at the interregional level, in increasing CIOs' status in society due to their active participation in the branch development and in the state policy of building the information society through development of programs, recommendations and standards. RUCIO strives to

		The IT Service Management Forum Expert Council on Professional Standards	http://www.itsmforum.ru/ http://www.rosmintrud.ru/eng	form a professional community of managers of IT-services within the territory of Russia. RUCIO includes more than 30 CIO regional clubs. The Forum is a community of professionals in the area of ICT-service management and integrates about 300 members who are: individual experts, representatives of companies and ICT vendors. Main educational activities of the Forum include: Analytic & Research; organization of ICT Education conferences; translation ITIL and ITSM; developing Curriculums for HE on the base of ITIL and ITSM. The Council was established by the Ministry of Labour and Social Protection. The Council reviews and approves all the Professional Standards, including ICT Professional Standards. There is no special Council for ICT Professional Standards in RF.
Industry Association	Cite any national industry association focusing **specifically** on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			There are no any national industry association focusing **specifically** on e-skills IT/ICT in RF
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.			There are no trade unions of IT/ICT staff in Russia.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names	Chamber of Commerce and Industry of the	http://www.tpprf.ru/en/	The TPPRF is a non-governmental, non-profit organization uniting its members for meeting the tasks and objectives set out in the Russian

	of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	Russian Federation (TPPRF)		Federation Law on Chambers of Commerce and Industry in the Russian Federation and the Chamber's own Charter. It represents the interests of small, medium and big business and encompasses all business sectors – manufacturing, domestic and foreign trade, agriculture, the finance system and services. It promotes the growth of the Russian economy and its integration into the world economic system and provides favourable conditions for the advancement of all business sectors.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…	National System of Research and Education Centers on Supercomputing Technologies in Federal Districts of Russia	http://hpc.msu.ru/?q=node/138	The National System of Research and Education Centers on Supercomputing Technologies integers more than 600 people from 75 universities of Federal Districts of Russia (budget $8M); 8 centers were established in 7 federal districts.
		Russian Software Developers Association (RUSSOFT)	http://www.russoft.org	RUSSOFT has initiated ITAPO (Network-Academy for Industrial Post-graduate IT-education) in St Petersburg where 10 training centres of major software companies offer coordinated retraining services for IT-professionals.
		Multivendor and Academic ICT Consortium (MAC ICT)	http://facebook.com/MAC.ICT	MAC ICT experts develop methodology and practical recommendations for the integration of vendor-based and traditional academic education systems using educational and methodical materials based upon the competency approach, National and Sectorial ICT Qualification Framework and Professional standards (job profiles). Developed educational modules (TOP-curriculums) have been implemented in 50+ leading technical universities in

				Russia. For two years it has trained more than 10,000 students and hundreds of teachers. These courses are an education for IT leaders. There are two sessions per year, 50 top managers each year. It is a project of RUCIO. RUCIO is a member of the International Academy of CIO.
		Higher Courses of CIOs	www.cioacademy.ru	Feature of the courses is that they include the master classes of prominent leaders of IT industry. Master classes are published for free at the portal of CIOs: GloabalCIO.ru
		Softline Academy Alliance	http://www.it-academy.ru/	The Alliance of multi-stakeholder partnerships integrates academic initiatives of selected ICT vendors and 25 leading classical and technical Russian universities in the idea to provide ICT students an opportunity to get supplementary ICT qualification and prepare them for vendor's certification exams. The Alliance was established by the private ICT company Softline, which has a lot of regional branches.
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	-"DEVELOPMENT STRATEGY ICT Sector in the Russian Federation for 2014 - 2020 years, and up to 2025" and Roadmap "Development of Information Technology Industry"	http://minsvyaz.ru/ru/doc/?id_4=1033	First points of main directions of Strategy realization plan concerns ICT workforce development and includes: development of ICT personnel potential and education; stimulation of highly skilled ICT professionals in Russia; popularization of ICT as a field of activity. Roadmap of the Strategy implementation includes: development of ICT professional standards; establishing admission quotas of students for HE institutions in ICT specialists; development proposals to address the

		2014 - 2020		deficit of ICT specialists; coordination of activities to address the deficit ICT specialists; modernization of Federal State Educational Standards for ICT, etc.
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development	NARK, ASI	http://www.asi.ru/en/; http://www.nark-rspp.ru/	Nine levels National Qualification Framework (NQF) was developed by NARK "in the purposes of development 800 Professional Standards". 30 ICT Professional Standards are developed by the rules of NQF. ASI is responsible for the development of the National system of competences and qualifications (NSCQ).
		Ministry of Education and Science	http://eng.mon.gov.ru/	The ministry issues licences to Universities and provides effective and strict control of their compliance. Federal State Educational Standards (FSES) is the backbone of the educational system. New generation competence-based FSES (3+), including BA & MA ICT programs for HE are under development now.
		International project INARM of EU program Tempus-IV	http://inarm.uni-koblenz.de; http://cs.msu.ru/node/611;	The aim of the project is to develop qualifications frameworks (SQF) in the fields of Informatics and Management. The project integrates EU, Russian, Ukrainian and Armenian HE institutions. ICT SQF will present learning outcomes on the base of the EU Bologna-style approach and individual national policies in education field.
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications	National Agency for Qualifications	http://www.nark-rspp.ru/?page_id=784	NARK coordinates the development of the National Certification System (National ICT Certification

	and providing a wide range of ICT certification programmes, if relevant.	Development (NARK) National system of testing and certification (Alltests)	http://www.alltests.ru	System is a part of this system). Alltests vendor- independent ICT certification system was established by the private company Softline and operates in Russia and CIS countries. Alltests certification system uses efficient methods of professional tests development and introduction aimed at appropriate skills and knowledge evaluation taking into account requirements of employers to employees' competence. More than 20,000 people passed ICT tests.
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.	Ministry of Education and Science	http://eng.mon.gov.ru/	There is only one National Certification. Four Universities (Moscow State University, Nizhny Novgorod State University, St Petersburg State University and St Petersburg NIU ITMO University) have joined the European Association (Informatics Europe) in order to be able to issue European Certificates.
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			Number of Computer Science graduates: Secondary VE 41K; HE 52K (source: AP KIT, 2006) Number of Microsoft certified professionals 34K (source: Microsoft RUS, 2011).
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**

Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.	Russian National Body of Standardization Technical Committees 'Information Technology' (TC-ITC-22)	www.itstandard.ru	TC-ITC-22 develops ICT State Standards (GOST) and translates international ICT Standards into Russian language. In 2013, in cooperation with Softline company, the European e-Competence Framework v. 2.0 was translated into Russian language and approved as GOST.
Promoted By				TC-ITC-22
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			Currently there are no national or international bodies responsible for monitoring and controlling the behavior of ICT professionals.
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Russian Information & Computer Technologies Industry Association (AP KIT)	http://www.apkit.ru/board/charter/index.php	AP KIT developed and promotes Code of Conduct for CIO Managers.
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Ministry of Education and Science	http://eng.mon.gov.ru/	Translation Computer Science Curricula 2001 and Software Engineering Curricula 2004 into Russian were supported and are promoted by AP KIT.

		National System of Research and Education Centers on Supercomputing Technologies in Federal Districts of Russia	http://hpc.msu.ru/?q=node/55	The idea of the project is to develop the Composite Set (Body) of Knowledge and Skills (professional competencies) in "Supercomputers and Parallel Computing" and to describe how an educational process must be organized. The structure of the created Body of Knowledge is consistent with the recommendations of the international professional communities ACM and IEEE Computer Society.
		National Open University (INTUIT)	http://www.intuit.ru/	INTUIT provides free educational e-Learning programs, most of them are ICT programs (about 750 curriculums) for any types of vocational ICT education including HE programs. More than 400,000 students were trained by 2014. INTUIT has state accreditation, and was nominated for RF awards: 'ICT Education in RUNET' and 'Systems of Open Education'.
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Viktor Ivannikov, Director of the Academic Institute of System Programming, Moscow Vladimir Vassiliev, Correspondent-academic, Rector of the NIU ITMO University, St Petersburg Prof. Vladimir Voevodin, Deputy Director, Research Computing Center, Moscow State University Prof. Andrey Terekhov, CEO of Lanit-Tercom, Chair of System Programming of the State University, St Petersburg Boris Nuraliev, CEO of 1C, Chairman of the Education Committee of APKIT Prof. Sergey Golovin, Chairman Russian National Body of ISO/IEC JTC, Moscow		

ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	Russian Universities are the absolute world leaders in terms of the number of wins in the ACM International Programming Collegiate Contests, the most prestigious competition of programming skills among students of Universities.

Country Profile Template			COUNTRY POPULATION	SOUTH AFRICA 51,770,560 (Census 2011)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Department of Communications (DOC)	http://www.doc.gov.za/	The DOC mandate is to create a vibrant ICT sector that ensures that all South Africans have access to robust, reliable, affordable and secure ICT services in order to advance socio-economic development goals and support the Africa agenda and contribute to building a better world.
		Department of Science and Technology (DST)	http://www.dst.gov.za/	The DST mandate is to create a prosperous society that derives enduring and equitable benefits from science and technology**.** To develop, coordinate and manage a national system of innovation that will bring about maximum human capital, sustainable economic growth and improved quality of life.
		Department of Trade and Industry (DTI)	http://www.thedti.gov.za/default.jsp	The DTI mandate is to create a dynamic industrial, globally competitive South African economy, characterised by inclusive growth and development, decent employment and equity, built on the full potential of all citizens.
		Department of Higher Education and Training (DHET)	http://www.dhet.gov.za/	The DHET mandate is to develop capable, well-educated and skilled citizens that are able to compete in a sustainable, diversified and knowledge-intensive international economy, which meets the developmental goals of our country. The department will undertake this mission by reducing the skills

				bottlenecks, especially in priority and scarce skills areas.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	e-Skills Institute (e-SI)	http://esi-sa.org/	The e-Skills Institute (e-SI) is a South African Government initiative that aims to harness the potential of Information and Communication Technology (ICT) across the whole of society in order to help address the major socio-economic challenges that South Africa faces in service delivery, wealth creation and global competitiveness. The institute sees itself as a catalytic collaborator in e-skilling the nation in employment readiness, effective e-governance and service delivery, business development, socio-economic development and research and development.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Institute of Information Technology Professionals (new name of Computer Society of South Africa)	http://www.iitpsa.org.za	The main objectives of the IITPSA are captured in the Constitution and Articles of Association with the IITPSA's take-out line being "promoting the ICT professional". This means that the Institute represents the interests of its members with Commerce, Industry and Government and seeks to help influence policy formulation in a positive way, in the interests of all of its stakeholders. In addition, it encourages the growth of professionalism and professional use of ICTs throughout the South African economy. Approximately 4 000 members.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.	CompTIA Africa	http://www.comptia.org/global/en-ZA/home.aspx/	CompTIA is the voice of the world's information technology (IT) industry. As a non-profit trade association advancing the global interests of IT professionals and companies, we focus our programmes on four main areas: education, certification, advocacy and philanthropy.

Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	Congress of South African Trade Unions (COSATU) Communication Workers Union (CWU)	http://www.cosatu.org.za/ www.cwu.org.za	COSATU was founded in 1985 and is the largest of the country's three main trade union federations, with 21 affiliated trade unions, altogether organising 1.8 million workers. The Communication Workers' Union of South Africa is the most progressive and growing union in the communication industry, with 18,662 members spread across most of the communication industry of South Africa. CWU is a very young trade union that was formed in 1996.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	South African Chamber of Commerce and Industry (SACCI) Business Unity South Africa (BUSA)	http://www.sacci.org.za/ www.busa.org.za	The SACCI membership comprises approximately 20,000 small, medium and large enterprises across the breadth of the nation and across all economic sectors. Large enterprises are generally direct members of SACCI while small and medium enterprises are members through more than 50 local and regional chambers and 15 national associations. Business Unity South Africa (BUSA) was created in October 2003 through the merger of the Black Business Council and Business South Africa. It began operating in January 2004. The merger created the first truly unified organisation for business in South Africa.
Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder	IITPSA - Computer Professional Education Programme (CPE)	http://www.iitpsa.org.za/index.php/overview	IP3 - CPEP - The CPE Program has been developed by IT Professionals for IT Professionals and fills the gap between university education and work experience – so you can advance to the next step of your career. The CPE Program will not only provide IITPSA Members improved employment and career prospects, but it also offers a revolutionary new method of talent retention and development for

	partnerships, international collaboration initiatives…	Joburg Centre for Software Engineering	http://www.jcse.org.za/skills/professional/cio http://www.jcse.org.za/skills/professional/cpd	employers who need a strong structure within which members of their team can be fast-tracked to success. The Australian Computer Society underwrites the CPE qualification. JCSE CIO Programme JCSE CPD Programme
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…	National e-Skills Plan of Action (NeSPA) Recognition of Professional Bodies	http://www.doc.gov.za/index.php?option=com_docman&task=cat_view&gid=67&Itemid=104 http://www.saqa.org.za/show.asp?id=2806	The National e-Skills Plan of Action (NeSPA 2012) advances the base laid by NeSPA 2010 after the first e-Skills Summit, (Cape Town in October 2010). It recognises and valorises the foundational premises of the National Development Plan (NDP) – Vision 2030 that building capabilities has to be at the core of developing more equitable prosperity and global competitiveness in the South African socio-economic platform that is increasingly dominated by new forms of ICT. The SA Qualifications Authority recognizes professional bodies that meet their criteria and registers their professional designations.

EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against	National Qualifications Framework (NQF)	http://www.nqf.org.za/	

	various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development			
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.			IITPSA CompTIA ISACA
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.			IITPSA/SAICSIT negotiating formation of SACAB, to become Seoul Accord signatory
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)			This data is not readily available.
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those	SFIA	http://www.sfia.org.uk	SFIA – Skills Framework for the Information Age

	competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.	IITPSA	www.iitpsa.org.za	
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**
National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?	SAQA IFIP	www.saqa.org.za www.ifip.org	
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	IITPSA	http://www.iitpsa.org.za/index.php/codes-of-behaviour	IITPSA Codes of Behaviour
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.			
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in	Prof. Alta van der Merwe, University of Pretoria Moira de Roche, IITPSA/IFIP		

	shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.	Prof. Barry Dwolatzky, University of Witwatersrand
ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

Country Profile Template			COUNTRY POPULATION	USA 315,563,992 (Estimate 2013)
GENERAL/INSTITUTIONAL				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Government Departments	Provide list of Government departments responsible for devising and implementing policies (relevant to e-skills and ICT professionalism) and a **brief** summary of their key work areas. If there is no specific department with responsibility for e-skills and/or ICT professionalism, please state "No specific department responsible".	Department of Commerce (DOC)	http://www.commerce.gov/	The Department of Commerce fosters, promotes, and develops the foreign and domestic commerce, economic development, and technological advancement of the United States.
		Department of Education (ED)	http://www.ed.gov/	The Department of Education establishes policy for the nation's schools, and administers and coordinates most federal education assistance.
		Department of Labour (DOL)	http://www.dol.gov/	The Department of Labour supports the work force by improving working conditions, and protecting employee benefits.
Government Agencies/Bodies	Provide list of Administrative units of the government, responsible for oversight and administration of specific functions that are relevant to the ICT profession. Give a **brief** summary of their key work areas. If there is no specific agency with responsibility for e-skills and/or ICT professionalism, please state "No specific agency responsible".	National Telecommunications & Information Administration	http://www.ntia.doc.gov/	NTIA is the Executive Branch agency that is principally responsible for advising the President on telecommunications and information policy issues. NTIA's programs and policymaking focus largely on expanding broadband Internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the Internet remains an engine for continued innovation and economic growth.
		Office of Innovation and Improvement (OII)	http://www.ed.gov/oii-news	The OII makes strategic investments in innovative educational programs and practices, and administers more than 25 discretionary grant programs managed by five program offices: Charter Schools Program, Improvement Programs, Parental Options and Information, Teacher Quality Programs, and the Investing in Innovation Programs.

		Employment & Training Administration (ETA)	http://www.doleta.gov/	Employment and Training Administration (ETA) programs, resources and online tools help workers in all stages of the job and career development.
Professional Bodies/National Computing Associations	Provides names of National computing or informatics societies or bodies, and their key work areas, if relevant. + Please estimate the number of members of the main professional ICT body in your country.	Association for Computing Machinery (ACM)	http://www.acm.org	ACM, the world's largest educational and scientific computing society, delivers resources that advance computing as a science and a profession. ACM provides the computing field's premier Digital Library and serves its members and the computing profession with leading-edge publications, conferences, and career resources.
		IEEE Computer Society (IEEE-CS)	http://www.computer.org	The IEEE Computer Society purports to be the world's leading computing membership organization and the trusted information and career-development source for a global workforce of technology leaders including: professors, researchers, software engineers, IT professionals, employers, and students. Members have endless opportunities to network with the world's foremost technology professionals, to lead the community by volunteering and mentoring, and to both gain exposure and contribute to the field as authors and reviewers. The IEEE-CS has about 90,000 members in more than 140 countries.
		Association for Information Systems (AIS)	http://www.aisnet.org	The Association for Information Systems (AIS) serves society through the advancement of knowledge and the promotion of excellence in the practice and study of information systems. AIS is the premier professional association for individuals and organizations who lead the research, teaching, practice, and study of information systems worldwide. AIS has members from more than 90 countries.

		TechAmerica	http://www.techamerica.org/	TechAmerica is the leading voice for the Information and Communications Technology (ICT) industry in the United States. TechAmerica's membership is comprised of large, medium and small technology companies who create a variety of products and deliver a multitude of services in the private sector and to governments at the state and national level. The Association's top priority is to foster an environment for our members to succeed through comprehensive global, national and regional advocacy and high-level business intelligence that delivers an edge in the marketplace.
Industry Association	Cite any national industry association focusing specifically on e-skills. Provide names of these national industry associations and **brief** summary of their work areas, if relevant.			
Trade Unions	Unions of workers and union leaders (relevant to the ICT industry) seeking to protect and promote their common interests and improve workplace conditions. Provide names of these Trade Unions and **brief** summary of their work areas, if relevant.	National Education Association (NEA)	http://www.nea.org/	NEA is the largest professional organization and largest labour union in the United States, representing public school teachers and other support personnel, faculty and staffers at colleges and universities, retired educators, and college students preparing to become teachers. The NEA has 3.2 million members and is headquartered in Washington, D.C.
		Communications Workers of America (CWA)	http://www.cwa-union.org/	CWA is the largest communications and media labour union in the United States, representing about 550,000 members in both the private and public sectors.
Chambers of Commerce	Associations of business representatives promoting and protecting the interests of the business community. Provide names of these Chambers of Commerce and **brief** summary of their work areas, if relevant.	US Chamber of Commerce	http://www.uschamber.com/	The U.S. Chamber of Commerce is the world's largest business organization representing the interests of more than 3 million businesses of all sizes, sectors, and regions. Our members range from mom-and-pop shops and local chambers to leading industry associations and large corporations.

Best Practices	Are there any specific examples of best practices relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries? E.g. CIO training programmes, Lifelong learning initiatives, ICT apprenticeship programme, multi-stakeholder partnerships, international collaboration initiatives…			
Policy initiatives	Cite any specific examples of policy initiatives relating to e-skills and ICT professionalism that you feel should be promoted to other Member States and other countries. E.g. multi-stakeholder partnerships and policy initiatives focusing on matching workers with jobs, e-skills certification, support systems for career development and lifelong learning, creation and delivery of training…			
EDUCATION AND TRAINING				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Qualification Framework	National framework against which qualifications of various educational institutions can be mapped against various criteria, for example, knowledge, skills and competence levels. Provide name and state of progression of its development			
Certification Bodies	Provide list and **brief** summary of Bodies promoting the take up of ICT certifications and providing a wide range of ICT certification programmes, if relevant.	Institute for the Certification of Computing Professionals (ICCP)	http://iccp.org/	

		IEEE-Computer Society	http://www.computer.org	
Accreditation Bodies	Provide list and **brief** summary of Bodies responsible for assisting in the international acceptance of certifications by determining if a certification scheme conforms to specific standards, if relevant.			
Supply estimates	If available, please provide headline statistical data relating to the supply of education in your country. For example, such data might include: Number of Computer Science graduates (2012) Number of ICT Certifications issued (2012) Number of tertiary state education institutes for ICT education(2012) Number of private education providers for ICT education (2012)	National Center for Education Statistics (NCES)	http://nces.ed.gov/	Bachelor degrees awarded by degree-granting institutions in the field of computer and information sciences: 43,072 (2010-2011). 17,6% females, 82,4% males. Master's degrees awarded by degree-granting institutions in the field of computer and information sciences: 19,446 (2010-2011) Doctor's degrees awarded by degree-granting institutions in the field of computer and information sciences: 1,588 (2010-2011)
E-COMPETENCES				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Skills Framework	Frameworks specifying individuals' competencies or characteristics that help result in improved job performance and proficiency levels related to those competencies. Provide name and **brief** details of this framework, if relevant.			
Promoted By	Body promoting/advocating the above skills framework.			
REGULATORS AND PROFESSIONAL ETHICS				
Type	**Guidance**	**Name**	**Website**	**Specifics**

National regulators	Name any specific national (or indeed international bodies with relevant jurisdiction) responsible for monitoring and controlling the behaviour of ICT professionals in your country, if any. Is there an ICT Professionals Licencing scheme (or similar) in place?			
Professional Body's Code of Ethics/Conduct	Names of the Codes of Ethics/Conduct of national computing society that specify principles of members' behaviour. Provide **brief** synopsis of the areas covered in this code if known, if relevant.	Association for Computing Machinery (ACM) Code of Ethics and Professional Conduct IEEE-CS Software Engineering Code of Ethics and Professional Practice	http://www.acm.org/about/code-of-ethics http://www.computer.org/portal/web/getcertified/resources/code_of_ethics	
BODIES OF KNOWLEDGE				
Type	**Guidance**	**Name**	**Website**	**Specifics**
Bodies of Knowledge (BoKs)	Provide list and **brief** summary of Bodies of Knowledge that are commonly used, or referred to, by ICT Professionals at national level, if relevant.	Software Engineering Body of Knowledge	http://www.computer.org/portal/web/swebok	
CONTACTS				
Type	**Guidance**	**Specifics**		
Country Experts	Where practical, please identify 2-3 individuals within government, industry and/or education who are most actively engaged on an operational basis in shaping the future ICT profession in your country. **Note:** In many instances, these individuals may be subject matter experts or operational staff rather than national Ministers or digital champions.			

ADDITIONAL INFORMATION		
Type	**Guidance**	**Specifics**
National Context	Any additional info particular to the landscape of ICT professionalism and e-skills in the country/region.	

APPENDIX B: ICT PROFESSIONALISM DEFINITIONS

This appendix contains a table of definitions collected from many of the source documents used in the desktop research, as well as definitions created during the course of the service contract (e.g. “ICT professional”).

Term	Definition	Source
Accreditation	Assessment of conformity of an object of interest with specific obligatory or voluntary standards. Process of accrediting an institution of vocational education or training, a programme of study, or a service, showing it has been approved by the relevant legislative and professional authorities by having met predetermined standards.	"ICT Skills Certification in Europe Report" 2005
ADM	Architecture Development Methodology promoted in the TOGAF.	
Assessment	The sum of methods and processes used to evaluate the attainments (knowledge, know-how, skills and competences) of an individual, and typically leading to certification.	"ICT Skills Certification in Europe Report" 2005
Body of Knowledge (BOK or BoK)	is a term used to represent the complete set of concepts, terms and activities that make up a professional domain, as defined by the relevant professional association. While the term *body of knowledge* is also used to describe the document that defines that knowledge — the *body of knowledge* itself is more than simply a collection of terms; a professional reading list; a library; a website or a collection of websites; a description of professional functions; or even a collection of information. It is the accepted ontology for a specific domain. Bodies of knowledge will typically contain knowledge on generally accepted good practice.	Wikipedia 24/May/11. PMBOK®

Term	Definition	Source
Certificate/ diploma	An official document, issued by an awarding body, which records the achievements of an individual following a standard assessment procedure.	"ICT Skills Certification in Europe Report" 2005
Certification (of skills and competences)	Certification results from a voluntary evaluation process whereby an individual's knowledge and/or skill in a particular area of interest are validated against a set of predetermined skills requirements e.g. skills standards by means of an objective assessment.	"ICT Skills Certification in Europe Report" 2005
Certification process	The certification process comprises all activities by which a certification body establishes that a person fulfils specified competence requirements.	"ICT Skills Certification in Europe Report" 2005
Certification process	All activities by which a certification body establishes that a person fulfils specified competence requirements, including application, evaluation, decision on certification, surveillance and recertification, use of certificates and logos/marks.	"ICT Skills Certification in Europe Report" 2005
Certification scheme	Specific certification requirements related to specified categories of persons to which the same particular standards and rules, and the same procedures apply.	"ICT Skills Certification in Europe Report" 2005
Certification system	Set of procedures and resources for carrying out the certification process as per a certification scheme, leading to the issue of a certificate of competence including maintenance.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
CIO	Chief Information Officer The chief information officer (CIO), or information technology (IT) director, is a job title commonly given to the most senior executive in an enterprise responsible for the information technology and computer systems that support enterprise goals. A chief innovation officer or CIO is a person in a company who "originates new ideas but also recognizes innovative ideas generated by other people."	http://en.wikipedia.org/wiki/Chief_information_officer Heidrick & Struggles (Time Inc. website) "What Makes a Successful Chief Innovation Officer?
Comparability	The extent to which it is possible to establish equivalence between the level and content of formal qualifications (certificates or diplomas) at sectoral, regional, national or international levels.	"ICT Skills Certification in Europe Report" 2005
Competence	A demonstrated ability to apply knowledge, skills and attitudes for achieving observable results	Cited by Jutta Breyer, CEN e-CF & ICT professional profiles team leader, Jan 2011
Competence	Demonstrated ability to apply knowledge and/or skills and, where relevant, demonstrated personal attributes in a habitual or changing situation, and/or as defined in the certification scheme.	"ICT Skills Certification in Europe Report" 2005
Craft	A craft refers to a set of practices shared by a community of practice, but it has no special social status. Wood crafting and programming are examples.	(Peter J Denning, 2011)
Digitization	The mass adoption of connected digital services by consumers, enterprises and governments.	

Term	Definition	Source
Discipline	A discipline refers to a field of study or research that provides knowledge. Chemistry and computer science are examples.	(Peter J Denning, 2011)
e-Business skills	are defined as the capabilities needed to exploit opportunities provided by ICT, notably the internet, to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organisational processes; and/or to establish new businesses.	European e-Skills Forum (2004) established by the European Commission and cited in "e-Skills — The Key to Employment and Inclusion in Europe" Sponsored by: Microsoft
Education	Education is responsible and lays the foundation for the initial transfer of core knowledge and basic understanding (know-how) of ICT workers. Education e-Skills Certification in Europe teaches concepts, theories, problem solving capabilities and constitutes the prerequisite to be trained on specific job requirements.	"ICT Skills Certification in Europe Report" 2005
e-Skills	e-skills encompasses a wide range of capabilities (knowledge, skills and competences) and issues with an e-skills dimension span over a number of economic and social dimensions. The term 'e-Skills' includes ICT Practitioner Skills, ICT User Skills and e-Leadership Skills.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
e-Skills deficiencies	**Shortage**: an insufficient number of skilled people in the labour market or in an occupational segment **Gap**: a competence shortfall between the current and needed competence levels of individual staff within organisations; mismatch: a mismatch between the competence of the trainee or graduating student/learner and the expected competence needs of the employers. **Mismatch:** is assumed to arise from course/curricula misalignment	EUROPEAN E-SKILLS 2009 CONFERENCE FOSTERING ICT PROFESSIONALISM, 20 November 2009, Brussels - CONFERENCE REPORT
e-skills Gap	A competence shortfall between the current and needed competence levels of individual staff within organisations.	
e-skills Shortage	An insufficient number of skilled people in the labour market or in an occupational segment.	
Formal learning	Learning that takes place in the form of physical, face-to-face, teacher-centred classroom training (instructor-led training).	"ICT Skills Certification in Europe Report" 2005
Fundamental truth	Pertaining to the foundation or basis; serving for the foundation. Hence: Essential, as an element, principle, or law; important; original; elementary; as, a fundamental truth; a fundamental axiom. So basic as to be hard to alter, resolve, or overcome	http://www.brainyquote.com/words/fu/fundamental167551.html#ixzz1LnD3AFKD Oxford Dictionary of English, 2nd Edition, 2005, Seiko electronics version

Term	Definition	Source
Future internet	The future internet will be faster, cheaper and it will encompass machine-to-machine (M2M) connections and services. It will be based on IP6 addresses and enable concepts like the "Smart Grid", smart dust; in effect smart connected everything. The opportunities to automate, innovate and transform the way we and machines do things is vast.	Project team
Generally recognised	**"Generally recognised"** means the knowledge and practices described as applicable to most projects most of the time, and there is a consensus about their value and usefulness.	PMBOK® Version 4.
Good practice	**"Good practice"** means there is general agreement that the application of these skills, tools, and techniques can enhance the chances of success over a wide range of projects. Good practice does not mean the knowledge described should always be applied uniformly to all projects; the organisation and/or project management team is responsible for determining what is appropriate for any given project.	PMBOK® Version 4
ICT	Information and Communication Technology	
ICT	Information and communication technology (ICT) is technology that provides for the electronic input, storage, retrieval, processing, transmission and dissemination of information.	"ICT Skills Certification in Europe Report" 2005
ICT practitioner	(synonyms: IT practitioner, IT or ICT professional, IT or ICT worker): people whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems) (cf. "ICT practitioner skills").	

Term	Definition	Source
ICT practitioner skills	Defined as the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems. ICT practitioners are people whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems). For their surveys, Eurostat has operationally defined the following: "ICT specialists or IT specialists have the capability to specify, design, develop, install, operate, support, maintain, manage, evaluate and research ICT and ICT systems. ICT is the main job."	European e-Skills Forum (2004) & Eurostat
ICT practitioners	ICT practitioners possess the capabilities required for specifying, designing, developing, installing, operating, supporting, maintaining, managing, evaluating and researching ICT systems, for the benefit of others. ICT Practitioners include both professional ICT ("Informatics") and non-professional ICT workers.	"ICT Skills Certification in Europe Report" 2005

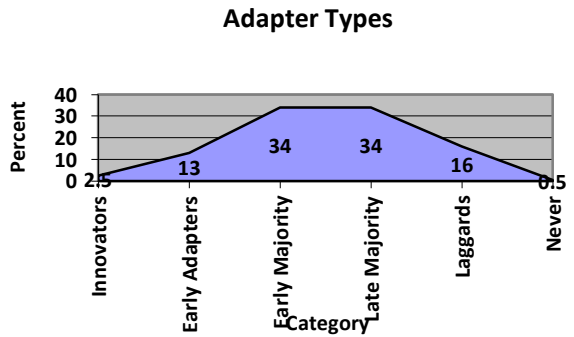
Term	Definition	Source
ICT Professional	ICT Professionals: • possess a comprehensive and up-to-date understanding of a relevant body of knowledge (the term "relevant body of knowledge encompasses the requirement for a broad and deep knowledge base which is up-to-date, accommodating both a common ICT body of knowledge, and pertinent specialist knowledge and skills). • demonstrate on-going commitment to professional development (professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. keeping abreast of latest technological trends), via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education; • adhere to an agreed code of ethics (where professionals are accountable to themselves, the ICT profession to society, through an agreed code of ethics/conduct or applicable regulatory practices) /conduct as well as non-technical aspects (e.g. developing better presentation skills).and/or applicable regulatory practices and, • through competent practice (competent practice communicates the concept of quality of products and services being	Definition derived during the course of the work and accepted by CEPIS Council members.

Term	Definition	Source
ICT skills	The skills needed for efficient use of ICT. Professional ICT skills: ability to use advanced ICT tools, and/or to develop, repair and create such tools. Applied ICT skills: ability to use simple ICT tools in general workplace settings (in non-IT jobs). Basic ICT skills or "ICT literacy": skills needed to use efficiently the basic functions of information and communication technologies (ICT). Ability to use ICT for basic tasks and as a tool for learning.	"ICT Skills Certification in Europe Report" 2005
ICT user skills	are defined as the capabilities required for the effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialised tools supporting business functions within industry. At the general level, they cover "digital literacy". For their enterprise ICT surveys, Eurostat has operationally defined the following: "Capabilities enabling the effective use of common, generic software tools (basic user skills) or advanced, often sector-specific, software tools (advanced user skills). Jobs requiring ICT user skills: ICT is an important tool for the job and is used to produce work output and/or used intensively at work (in day-to-day activities)".	European e-Skills Forum (2004) established by the European Commission and cited in "e-Skills — The Key to Employment and Inclusion in Europe" Sponsored by: Microsoft

Term	Definition	Source
ICT users	ICT users need the capabilities required for effective use by the individual of ICT systems and devices. ICT users make use of the systems as tools in support of their own work, which is, in most cases, not ICT. User skills cover the utilisation of common generic software tools, such as word processing, spread sheets, presentations, e-mail and internet, and use of specialized tools supporting business functions within user sectors.	"ICT Skills Certification in Europe Report" 2005
Informal learning	Learning which takes place in the work context, relates to an individual's performance in their job and/ or their employability, and which is not formally organised into a programme or curriculum by the employer. Learning resulting from daily activities related to work, family or leisure. It is not organised or structured (in terms of objectives, time or learning support). Informal learning is in most cases unintentional from the learner's perspective. It typically does not lead to certification.	"ICT Skills Certification in Europe Report" 2005
Internet of Everything	"The intelligent connection of people, process, data and things"	Cisco website
Know-how	Practical knowledge or expertise.	"ICT Skills Certification in Europe Report" 2005
Knowledge	Knowledge summarises the capabilities and skills applied by individuals to provide solutions for specific problems. Two major categories for knowledge are: explicit and implicit. Explicit knowledge can be accessed and transferred by other individuals; implicit knowledge is bound to the personal capacities and experience of a certain individual.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Knowledge base	Is a superset of the *bodies of knowledge* that includes all necessary current information as is appropriate to the business and its technology management positioning; as an innovator, early adapted, early or late majority or laggard. The augmentation of the bodies of knowledge is typically achieved, through research and partnership with vendors, suppliers, industry associations, academic links and open collaboration. Influencing and shaping is often achieved via participation in standards bodies, lobbying and political awareness.	
Learning	Learning is a cumulative process whereby individuals gradually assimilate increasingly complex and abstract entities (concepts, categories, and patterns of behaviour or models) and/or acquire skills and competences.	"ICT Skills Certification in Europe Report" 2005
Learning outcome(s)/ learning attainments	The set of knowledge, skills and/or competences an individual acquired and/or is able to demonstrate after completion of a learning process.	"ICT Skills Certification in Europe Report" 2005
Learning outcomes	Statements of what a learner is expected to know, understand and/or be able to demonstrate after completion of a process of learning.	Learner Centred Methodologies, UCD School of Education and Lifelong Learning, P17, 2005
Lifelong learning	All learning activity undertaken throughout life, with the aim of improving knowledge, skills and/or qualifications for personal, social and/or professional reasons.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Non-formal learning	Non-formal learning includes any organised, learner-centred, more flexible educational activity outside the established formal system.	"ICT Skills Certification in Europe Report" 2005
Practice	Practice refers to the skills displayed by professionals at various levels of competence as they render service.	(Peter J Denning, 2011)
Practitioner	Practicing professionals are often called practitioners.	(Peter J Denning, 2011)
Profession	A profession is a community of practice that forms to take care of people's enduring concerns in some area of life or work.	(Peter J Denning, 2011)
Professional	A professional is a member of a profession who renders service to clients of a profession.	(Peter J Denning, 2011)
Qualification	Demonstration of personal attributes, education, training and/or work experience. Qualification as certificates or diplomas or other evidence linked to the delivery and assessment of training received. The requirements for an individual to enter or progress within an occupation.	"ICT Skills Certification in Europe Report" 2005
Quality standards	Quality standards are provided in formal way by independent standardisation bodies and sector associations documented in form of normative documents. De facto standards are offered by public and/or private initiatives and are achieved through a broad acceptance by the actors in a specific sector/field. Quality standards can be distinguished concerning their focus e.g. on process, method, content.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Recognition	The process of granting official status to skills and competences either through the award of certificates or through the grand of equivalence, credit units, validation of gained skills and/or competences (formal recognition). The acknowledgement of the value of skills and/or competences by economic and social stakeholders (social recognition).	"ICT Skills Certification in Europe Report" 2005
Skills	The knowledge and experience needed to perform a specific task or job. Capabilities of an individual, definable by content, to be acquired and activated through related professional training. In this context, capabilities are the physical or psychological attributes of an individual to be applied in activity-related approaches.	"ICT Skills Certification in Europe Report" 2005
Technology adapter categories	 Adapted from Rogers E.M. 1995. Diffusion of Innovations **Innovators** typically make up the most innovative 2.5% of the population. They have been described as rash, risky, and daring. An ability to work with complex and often underdeveloped technology as well	Hargandon A.B., Diffusion of Innovations

Term	Definition	Source
	as substantial financial resources helps them absorb the uncertainties and potential losses from innovations. Innovators are not usually opinion leaders when it comes to new innovations; their skills and risk taking behaviour often set them apart from the rest of the social system, but they often play a large role in importing innovations from outside and adapting them for broader adoption. **Early adopters** are more integrated with the existing social system than innovators, and often have the greatest degree of opinion leadership, providing often potential adopters with information and advice about a new technology. Change efforts surrounding new innovations often target this population first as they represent the successful, discrete, and objective adopters that hold the respect of the larger social system. **The early majority** adopts just ahead of the average population. They have much interaction within the social system but are not often opinion leaders; instead they typically undertake deliberate and, at times, lengthy decision making. Because of their size and connectedness with the rest of the social system, they link the early adopters with the bulk of the population, and their adoption signals the phase of rapid diffusion through the population. **The late majority** is described as adopting innovations because of economic necessity and pressure from peers. While they make up as large a portion of the overall population as the early majority, they tend to have fewer resources and be more sceptical, requiring more evidence of the value of an innovation before	

Term	Definition	Source
	adopting it. **Laggards** are the last in a social system to adopt a new innovation. They tend to be relatively isolated from the rest of the social system, have little or no opinion leadership, and focus on past experiences and traditions. They are the most cautious when it comes to risking their limited resources on a new technology.	
Technology Leader	The first firm to introduce a new generation or technology in an industry.	Launch Strategies for Next generation Products, Michael R. Hagerty and Prasad Naik
Test	Provision of information about an individual's standing with respect to a specific set of knowledge, skills, and competence as defined by a specific job profile or occupational role.	"ICT Skills Certification in Europe Report" 2005
TOGAF	The Open Group Architecture Framework	
Trade	A trade refers to an organised group of practitioners, such as a guild or labour union with restrictions imposed by society in return for freedom to practice for the benefit of society.	(Peter J Denning, 2011)
Validation of informal/ non-formal learning	The process of assessing and recognising a wide range of knowledge, know-how, skills and competences, which people develop throughout their lives within different environments, for example through education, work and leisure activities.	"ICT Skills Certification in Europe Report" 2005
Vocational and education and training (VET)	Education and training which aims to equip people with skills and competences that can be used on the labour market.	"ICT Skills Certification in Europe Report" 2005

Term	Definition	Source
Work experience	Continuously gathered by individuals fulfilling their occupational role, and gained in the daily working process, but as well by informal learning and continuous professional development.	"ICT Skills Certification in Europe Report" 2005

Note: Working definition: "ICT Professional"

Different countries have different cultural, historical and linguistic interpretations of the term "professional". The definition provided below is a working definition for the term, for the purposes of this service contract.

"ICT professionals possess a comprehensive and up-to-date understanding of a relevant body of knowledge[1]; demonstrate on-going commitment to professional development[2], via an appropriate combination of qualifications, certifications, work experience, non-formal and/or informal education; adhere to an agreed code of ethics/conduct[3] and/or applicable regulatory practices; and through competent practice[4] deliver value for stakeholders".

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1 The term "relevant body of knowledge" encompasses the requirement for a broad and deep knowledge base which is up-to-date, accommodating both a common ICT body of knowledge and pertinent specialist knowledge and skills.

2 Professional development focuses on improving professional competence in a professional role, with the objective of enhancing personal performance and career progression opportunities. It can encompass both technical aspects (e.g. developing better presentation skills).

3 Professionals are accountable to themselves, the ICT profession to society, through an agreed code of ethics/conduct or applicable regulatory practices.

4 Competent practice communicates the concept of quality of products and services being delivered by practitioners.

APPENDIX C: OVERVIEW OF SOME HIGHER EDUCATION PROGRAMMES IN ‘CLOUD COMPUTING’ AND ‘BIG DATA’ IN THE UNITED KINGDOM, GERMANY AND THE USA

Cloud Computing Programs	Educational level	Institution	e-skills (: = part of a course/session & :: = full course)	Business skills and knowledge	Legal knowledge	Security management	Security awareness	Remarks
USA								
Enterprise and Cloud Computing	MSc	Stevens Institute of Technology - The Innovation University	:: Enterprise and Cloud Computing :: Engineering of Enterprise Software Systems :: Distributed Systems and Cloud Computing :: Database Management Systems	:: possible to select management courses	:: Enterprise anc Cloud Computing	:: Enterprise anc Cloud Computing		six electives: three in Computer Science and three can be chosen freely from the curricula of cooperating disciplins: Computer Science, Software Engineering, Management and Information Systems
Computer and Information Science: Cloud Computing and Virtualization concentration	B.Sc.	ECPI University	Cloud Computing and Virtualization students learn to virtualize servers and clients, utilize cloud technologies, create storage solutions, and deploy thin applications for large, medium, and small organizational networks: :: Cloud Computing Concepts :: Networking II :: Introduction to Routing and Switching :: Storage Area Networks and Disaster Recovery :: Windows Client and Server :: Network Virtualization Fundamentals :: Network Virtualization Administration :: Enterprise Network Security	:: Network Virtualization Administration Part of Core Curiculum: :: Fundamentals of Customer Service :: Principles of Business & Management :: Applied Project Management		:: Cloud Computing Concepts :: Enterprise Network Security		Besides the concentration courses students have to complete core courses in Computer Science as well as electives from other Arts and Science disciplines like English, Humanities, Math, Physics or Psychology
Cloud Computing and Virtualization Certificate	Certificate	Saint Louis University	:: Cloud Essentials :: Virtualization Essentials :: Monitoring and Operating a Private Cloud with System Center 2012	:: Cloud Essentials :: Virtualization Essentials				Electives (54 hours) can be chosen freely. Computer and Network Security or Business Analysis courses are available
Cloud Computing Technologies Program	eleven-week in-depth program	DePaul University - College of Computing and Digital Media	:Cloud Computing Concepts :Cloud Computing Architecture :Cloud Computing Standards :Cloud Computing Implementation Strategies :Exploiting Software as a Service (SaaS) : Delivering Platform as a Service (PaaS) : Deploying Infrastructure as a Service (IaaS) : Workload Patterns and Resource Management : Build your own Cloud using services from providers such as Amazon, IBM, Microsoft, Salesforce.com : Migrating to the Cloud Case Studies and Best Practices					
Hadoop: Building Big-Data Apps in the Cloud	five-day course	John Hopkins University - Engineering for Professionals						connections between Cloud and Big Data trends
Virtual and Cloud Computing	Professional Education Program	UC Berkeley	:: Cloud Computing: Discovering its Power ::Agile Development, Virtualization and Cloud Deployment :: Building your Private Cloud with Linux :: Business and Technical Models of Cloud Computing :: Cloud Computing: Systems Engineering and Analysis :: Multivendor Virtualization :: Optimizing Cloud Computing for Profitability :: Scalable Storage in the Cloud Computing Era :: Virtualization Theory for CPU, Memory and Storage	:: Cloud Computing: Discovering its Power ::Business and Technical Models of Cloud Computing :: Cloud Computing: Systems Engineering and Analysis :: Optimizing Cloud Computing for Profitability				
Software Engineering, Cloud Computing & Virtualization emphasis	MSc	San Jose State University	:: Virtualization Technology :: Enterprise Software Technologies :: Cloud Technology :: Cloud Services :: Mobile Software System Design :: Engineering Reports and Grad. Research :: Software Systems Engineering :: Network and Storage Virtualization :: Mobilie Technologies For Enterprise Applications					

University Courses: Selection of courses combining different areas of Cloud Computing - Source http://cloudcomputingwire.com/cloud-computing-universities/ or Websearch:									
Cloud Computing Programmes		**Educational level**	**Institution**	**e-skills (: = part of a course/session & :: = full course)**	**Business skills and knowledge**	**Legal knowledge**	**Security management**	**Security awareness**	**Remarks**
	Best Practices Managing Security and Privacy for Cloud Computing	Course AIT 670 (Fall 2012)	George Mason University Department of Applied Information Technology	x		x	x		
	Contracting for Cloud Computing Services	Two-Day short course	UCLA Extension - Engineering & Technology Short Courses	(general understanding of CC) : What is Cloud Computing : Challenges of Cloud Computing	: Gathering Data/Qualifying Cloud Vendors : Acquiring Cloud Computing Services : Build your Own Contract/Contract Checklist : Service Level Agreements and Key Performance Indicators : Managing the Vendor and the Contract			: Key Risks Associated with Cloud Services	
	Challenges in Cloud and Mobile Computing	Course (COMS E6998-7)	Columbia University	: Cloud Computing Challenges			: Cloud Computing: Cryptographic Solutions : Trusted Hardware Solutions : Distributed-Trust Solutions : Auditing Solutions		
	Cloud Computing: Selling and Marketing SaaS Solutions to the Enterprise	Course (BUS 105)	Stanford University - Continuing Studies	: general understanding of SaaS cloud computing	: Selling SaaS				
	Cloud Computing	Course (CSCI E-90)	Harvard Extension School	: Cloud Computing : Overview of key Amazon offerings : Bundling Amazon instances : Elastic bloc storage : RDS & RedShift : Java AWS DK, S3 API : Messaging in the Cloud : Pig Latin & HIVE : RESTFul WebServses AWS Cloud Formation : Right Scale and Eucalyptus : MapReduce : VMWare Cloud and Virtalization technology : Microsoft Azure				: Cloud Computing	

Cloud Computing Programs	Educational level	Institution	e-skills (: = part of a course/session & :: = full course)	Business skills and knowledge	Legal knowledge	Security management	Security awareness	Remarks
UNITED KINGDOM								
MSc Advanced Computer Science (Cloud Computing)	MSc	University of Leeds	:: Systems Programming :: Algorithms :: Advanced Distributed Systems :: Cloud Computing					Six of the following electives: :: Bio-Inspired Computing :: Mobile Application Development :: Knowledge Representation and Machine Learning
Web and Cloud Computing	MSc	Sheffield Hallam University	:: Cloud Technologies :: Cloud Applications :: Intelligent Web Applications :: Handling Data in the Cloud	:: Social and Economic Aspects of the Cloud :: Industrial Expertise		:: Cloud Security		
Cloud Computing	MSc	Newcastle University	:: Big Data Analytics :: Distributed Algorithms :: Enterprise Middleware :: Systems Design :: Cloud Computing :: Advanced Programming in Java			:: Information Security and Trust		Course is sponsored by industrial companies: • Red Hat Inc. • Arjuna Technologies Ltd • Prism Technolgies • HP • IDT • ADlink
Cloud Computing	MSc	University of Essex (Computer Science and Electronic Engineering	:: Cloud Technologies and Systems :: Converged Networks and Services :: High Performance Computing			:: Computer Security		**Electives:** :: Advanced Web Technologies :: Cloud Technologies and Systems :: E-Commerce Programming :: Ip Networking and Applications :: Mobile & Social Application Programming :: Mobile Communications :: Network Security :: and more in the field of Computer Science
Cloud Computing	MSc/Postgraduate Diploma	University of Leicester	:: Advanced Web Technologies :: Internet and Cloud Computing :: Service-Oriented Architectures					**Four of the following electives:** :: Analysis and Design of Algorithms :: Algorithms for Bioinformatics :: Communication and Concurrency :: C++ Programming and Advanced Algorithm Design :: Compression Methods for Multimedia :: Software Reliability :: Cryptography and Information Security :: Discrete Event Systems :: Introduction to Financial Mathematics :: Game Theory in Computer Science
Internet Computing	MSc	University of Surrey	:: Agile Web Development :: Cloud Computing :: Enterprise Systems Development :: Network Technologies and Security :: Collective Intelligence :: Databases and Knowledge Discovery :: Technologies and Applications	:: Challenges for Computing Professionals :: Enterprise Systems Development :: Project Management and Business Strategy	:: Challenges for Computing Professionals	:: Challenges for Computing Professionals :: Information Security Management :: Network Technologies and Security :: Web Hacking and Countermeasures		

Computer Science (Cloud Computing & Web Services Specialization)	MSc	Liverpool Hope University	:: Cloud Computing and Web Services					
Distributed Computing and e-Science	MSc	Cranfield University	:: Object Orientated Programming and Design :: Advanced Graphics :: Computational Methods :: Cloud Computing :: Virtualiation :: Cluster Management :: Distributed Computing & Data Management :: Computing Infrastructures :: High Performance Technical Computing :: e-Engineering Applications :: Advanced Java	:: Management for Technology				
Cloud Computing Programs	**Educational level**	**Institution**	**e-skills** **(: = part of a course/session & :: = full course)**	**Business skills and knowledge**	**Legal knowledge**	**Security management**	**Security awareness**	**Remarks**
GERMANY								
Computer Networking - IT Sicherheit, Mobile Systeme	BSc	Hochschule Furtwangen	:: Computernetze, Datenbanken, Objektorientierte Programmierung :: Verteilte Infrastrukturen für mobile Systeme Mobile Systeme und Anwendungen	:: BWL und Int. Management	:: IT-Recht / Privacy und Datenschutz	:: Mathematische Grundlagen der IT Sicherheit :: IT-Sicherheit in Verteilten Systemen :: IT-Sicherheitsmanagement		
Informationswirtschaft	MSc	Karlsruher Institut für Technologie - Fakultäten für Wirtschaftswissenschaften und Informatik	x	x	x	x		Different modules enable a specialization in cloud computing

High Performance & Cloud Computing	MSc	TU Chemnitz	:: Parallel Computer Systems :: Parallel Software Systems :: Distributed Systems					**Electives:** :: Effiziente Algorithmen :: Themenschwerpunkte Informatik I&II :: Komplexitätstheorie :: Quantencomputing :: Wahrscheinlichkeitsrechnung und Algorithmik :: Datensicherheit und Kryptographie II **:: Sicherheit Verteilter Systeme** :: XML-Werkzeuge :: Formale Spezifikation und Verifikation :: Hardware/Software Codesign I **:: Datenbanken und Web Techniken** :: Datenbanken und Objektorientierung :: Betriebssysteme für verteilte Systeme :: Echtzeitsysteme **:: Verlässliche Systeme** :: Computergrafik II :: Virtuelle Realität :: Neurokognition I :: Neurokognition II :: Medienprogrammierung :: Medienretrieval
Advanced Computer Science (Cloud Computing and Distributed Systems research focus)	MSc	Hochschule Furtwangen	:: Modellbasierte Entwicklung in Software-Produktlinien :: Softwaretechnik :: Verteilte Systeme :: Advanced Middleware :: Architektur komplexer Systeme :: Elective (e.g. Cloud Computing Technologies)			possible through electives		
Distributed System and Services (Cloud Computing)	International Master	EIT ICT Labs Master School (TU Berlin, Aalto, University of Rennes 1, KTH, Universite Paris-Sud)	:: Distributed Systems :: Advanced Network Technologies :: Service Technologies :: Cloud Programming Models	Innovation & Entrepreneurship Courses: :: I&E basics :: Business Development Lab (market survey/business model generation/venture development exercice)				**Specialization in Cloud Operation (TU Berlin):** :: Cloud Operations :: Sustainable Inforamtion Systems Management :: Hot Topics in Information Mangagement :: Scalable Data Analysis and Data Mining :: Network Architectures - Mesh Lab :: Digital Communities **and Cloud Infrastructures (University Rennes 1):** :: Internet and Networks of the Future :: Internet of Services: Programming Models & Infrastructures :: Distributed Algorithms and Distributed Computability :: Performance Evaluation :: Continuous and Combinatorial Optimization :: Compression, Transmission & Rendering of Video, Audio & 3D Data :: Images & Motion :: Real or Virtal Capture & Manipulation
MSc Technische Inormatik/ Wirtschaftsinformatik concentration in Verteilte Systeme (Distributed Systems) **Students can freely select from the courses listed**	MSc	TU Berlin	:: Ad-hoc- and Sensor Networks :: Advanced Agent Competition :: Algebraische Prozesskalküle :: Cloud Computing in der Praxis :: Verteilte Systeme :: Betrieb komplexer It-Systeme :: Aktuelle Themen aus dem Bereich der IT-Infrastrukturen oder der Verteilten Systeme :: Communication Technologies for Embedded Systems :: Digital Communities :: Distributed Communities :: Embedded Systems :: Engineering betrieblicher IS in der Finanzindustrie im Rahmen von Enterprise :: Hot Topics in Operating Systems and Distributed Systems :: Learning from strategic interactions :: Mobile Services :: Operating Systems :: Parallel Systems :: Theorie Verteilter Algorithmen :: Usability :: Web Technologies	:: Engineering betrieblicher IS in der Finanzindustrie im Rahmen von Enterprise		:: Intelligente Sicherheit in Netzwerken :: IT Security Lab: Vulnerability Assessment :: Special Topics in Communications Networks and Autonomous Security		

Data Science / Big Data Programs		Educational level	Institution	Statistics	Mathematics	Data engineering	e-skills in general	Information extraction (learning, language, visual information, social/network information)	Computer Vision	Cloud Computing	Visualization & Communication	Specific Applications	Business skills and knowledge	Other qualifications	Further electives
USA															
Masters in Data Science		Master	Columbia University NYC	::Probability (3) STATS W4105 Statistical Inference and ::Modeling (3) STATS Exploratory Data Analysis and ::Visualization (3) STATS	Algorithms for Data Science (3) CSOR	Data Engineering (3) COMS		Machine Learning for Data Science (3) COMS			Exploratory Data Analysis and Visualization (3) STATS		::Data Science Capstone & Ethics (3) ENG ::Elective Courses		x
Udacity's new Data Science and Big Data track	**online**	MOOC	Udacity												
	Introduction to Data Science	MOOC	Udacity	::Data Analysis with Statistics and Machine Learning :: Data Manipulation :: Data at Scale -- Working with Big Data				Data Communication with Information Visualization			Data Communication with Information Visualization				
	Exploratory Data Analysis	MOOC	Udacity	::Exploring One Variable ::Exploring the Relationship of Two Variables :: Exploring Multiple Variable :: Exploring Data Sets							:: Exploring Multiple Variable :: Exploring Data Sets	Intro to R			
	Data Wrangling with MongoDB	MOOC	Udacity			:: Data Quality and Beyond :: Storing Data		::Getting and Cleaning Data Part 1& 2				MongoDB & Hadoop	:: Case Study --RNA Data/Human Transcriptome		
	Introduction to Hadoop and MapReduce	MOOC	Udacity				:: What is 'big data'? The dimensions of Big Data. Scaling problems. HDFS and Hadoop ecosystem.					:: The Basics of HDFS, MapReduce and Hadoop cluster. :: Writing a MapReduce program to answer questions about data.	:: Final Project: Answering questions about big sales data and analyzing large website logs.		
Data Sciences Certificate		MOOC	Coursera/John Hopkins University	:: Exploratory Data Analysis :: Statistical Inference :: Regression Models		::Getting and Cleaning Data	:: Data Scientist's Toolbox	:: Getting and Cleaning Data :: Reproducible Research :: Practical Machine Learning			:: Developing Data Products	:: R Programming :: Reproducible Research (using R)		:: Reproducible Research :: Capstone Project	
datascience@berkeley (partly online)		Professional degree	UC Berkeley	::Exploring and Analyzing Data :: Advanced Course -- Experiments and Experimentation with Data		:: Storing and Retrieving Data :: Advanced Course -- Really Big Data: Scaling up and Parallelism		:: Introduction to Machine Learning			:: Visualizing and Communicating Data	:: Exploring and Analyzing Data (Program R) :: Storing and Retrieving Data (MapReduce/Hadoop)	:: Research Design and Application for Data and Analysis	:: Advanced Course -- Privacy, Security, and Ethics of Data	
Certificate in Data Science (Starts Autumn 2014)		Certificate	University of Washington Professional & Continuing Education									MapReduce/Hadoop	(capstone project)		
Master of Science in Predictive Analytics		MSc	Northwestern University (online)	:: Statistical Analysis (adjusted to several vertical industries) :: Analytics and Data Collection :: Predictive Modelling I & II (including best practices for management)	:: Data Warehouse & Data Mining (Algorithms)			:: Analytics and Data Collection :: Data Warehouse & Data Mining			:: Special Topics (Presentation, Visualization)		:: Statistical Analysis (adjusted to several vertical industries) :: Analytics and Data Collection :: Predictive Modelling I & II (including best practices for management) :: Project Management :: Leadership :: Capstone Project	elective Courses: :: Marketing Analytics :: Risk Analytics :: Web Analytics :: Text Analytics	
Master of Science in Analytics		MSc	Northwestern University	:: Analytics for Competitive Advantage :: Statistical Methods for Data Mining :: Predictive Analytics :: Analytics for Big Data	:: Optimization & Heuristics		:: Data Management and Information Processing	:: Statistical Methods for Data Mining :: Data Mining				:: Analytics for Big Data (Hadoop) :: Introduction to Java Programming	:: Leadership fo Analytical Organizations and Functions :: Analytics for Competitive Advantage		x

MS in Data Science	MSc	New York University	::Introduction to Data Science :: Statistical and Mathematical Methods :: Machine Learning and Computational Statistics	::Introduction to Data Science (Algorithms) :: Statistical and Mathematical Methods	:: Big Data		:: Machine Learning and Computational Statistics :: Big Data :: Inference and Representation			::Introduction to Data Science	e.g. MapReduce		:: Capstone Project and Presentation in Data Science	x
Mining Massive Data Sets Graduate Certificate	Graduate Certificate	Stanford University					:: Social and Information Network Analysis :: Machine Learning :: Mining Massive Data Sets :: Information Retrieval and Web Search							
Master of Science in Analytics	MSc	North Carolina State University	:: Analytic Foundations :: Analytic Tools and Techniques :: Analytics Methods and Applications I	:: Analytic Tools and Techniques (linear Algebra) :: Analytics Methods and Applications I	:: Analytics Methods and Applications I (databases) :: Analytics Methods and Applications II		:: Analytic Tools and Techniques :: Analytics Methods and Applications I :: Analytics Methods and Applications II			:: Analytic Tools and Techniques ::Analytics Practicum I :: Analytics Practicum II		:: Analytics Methods and Applications I (marketing science: customer analytics) :: Analytics Practicum I :: Analytics Methods and Applications II (Risk, Finance, Web, Customer Analytics)	:: Analytics Practicum I :: Analytics Practicum II	
Master in Strategic Analytics	Master	Brandeis University Graduate Professional Studies	:: Foundations of Data Science and Analytics :: Business Intelligence, Analytics and Decision Making :: Statistics and Data Analysis :: Strategic Analytics and Visualization for Big Data		:: Foundations of Data Science and Analytics		:: Foundations of Data Science and Analytics :: Strategic Analytics and Visualization for Big Data			:: Strategic Analytics and Visualization for Big Data	:: Strategic Analytics and Visualization for Big Data (MapReduce/Hadoop)	:: Organizational Leadership and Decision Making :: Foundations of Data Science and Analytics :: Business Intelligence, Analytics and Decision Making :: Social, Web and Marketing Analytics	:: Data Governance, Security, Quality, and Ethics	x
Master of Science in Data Analytics	MSc	University of Maryland	:: Foundation in Data Analytics :: Predictive Modeling		:: Decision Management Systems		:: Decision Management Systems :: Data Mining :: Predictive Modeling			:: Decision Management Systems :: Predictive Modeling	:: Big Data Analytics (MapReduce/Hadoop)	:: Foundation in Data Analytics :: Decision Management Systems		
MS in Data Analytics (online)	MSc	Southern New Hampshire	:: Foundations of Data :: Decision Methods and Modeling :: Predictive Analytics :: Advanced Data Analytics :: Quantitative Analysis for Decision Making	:: Quantitative Analysis for Decision Making	:: Decision Methods and Modeling		::Decision Methods and Modeling			::Decision Methods and Modeling :: Presentation and Visualization of Data		:: Foundations of Data :: Enterprise Data Management :: Optimization and Risk Assessment :: Advanced Data Analytics :: Business Research :: Management Science through Spreadsheets :: Project Management	:: Capstone in Data Analytics	
Master's Degree in Data Analytics	M.S.	CUNY School of Professional Studies	:: Information and Systems :: Statistics and Probability for Data Analytics	:: Fundamentals of Computational Mathematics :: Mathematical Modeling Techniques for Data Analytics	:: Information and Systems :: Advanced Programming Techniques :: Simulation and Modeling Techniques :: Data Acquisition and Management		:: Information and Systems :: Advanced Programming Techniques :: Data Acquisition and Management			::Simulation and Modeling Techniques :: Knowledge and Visual Analytics	:: Information and Systems	:: Information and Systems	:: Fundamentals of Computational Mathematics (business, urban systems, social networks) :: Analytics Master's Research Project	x
Master of Science in Analytics	MSc	University of Chicago Graham School of Continuing liberal and professional studies	:: Statistical Analysis :: Advanced Data Mining and Predictive Analytics :: Linear and Nonlinear Models for Business Application :: Time Series Analysis and Forcasting	:: Advanced Data Mining and Predictive Analytics	:: Database System Design and Implementation		:: Data Mining Principles :: Advanced Data Mining and Predictive Analytics : Time Series Analysis and Forcasting				:: Statistical Analysis (SAS and R)	:: Research Design for Business Applications :: Linear and Nonlinear Models for Business Application :: Leadership and Management I & II		x

Data Science	BS/MS/Certificate	Worcester Polytechnic Institute	:: Introduction to Data Science :: Statistical Methods for Data Science :: Big Data Analytics	:: Big Data Analytics	::Introduction to Data Science ::Data Management :: Big Data Analytics		::Introduction to Data Science :: Big Data Analytics		::Introduction to Data Science ::Data Management	::Introduction to Data Science	:: Data Management(MapReduce Infrastructure)	::Introduction to Data Science :: Special Topics in Data Science	:: Special Topics in Data Science	x
Master of Science/Graduate Certificate in Business Intelligence & Analytics	MSc/Certificate	Stevens Institute of Technology at The Innovation University New Jersey	:: Process Analytics and Optimization :: Multivariate Data Analytics :: Experimental Design :: Statistical Learning & Analytics :: Social Network Analytics		:: Data Management :: Data Warehousing and Business Intelligence :: Process Analytics and Optimization :: Web Analytics (distributed computing)		:: Data Management :: Knowlege Discovery in Databases :: Web Analytics			:: Data Warehousing and Business Intelligence :: Social Network Analytics :: :: Web Analytics	::Data Management (Querry Databases SQL, DDL, QBE)	:: Financial Decision Making :: Data Warehousing and Business Intelligence :: Process Analytics and Optimization (transportation, logistics and supply chain optimization, capital budgeting, asset management, portfolio analysi) :: Risk Management Methods and Applications :: Social Network Analytics		x
Master of Science in Applied Statistics	MS	Southern Methodist University Dedman College of Humanities & Sciences	:: Introduction to Statistical Computing :: Probability and Statistics for Scientists and Engineers ::Statistical Quality Control :: Introductory Econometrics :: Survey Sampling :: Experimental Statistics I & II :: Statistical Design and Analysis of Experiments :: Predictive Analytics/Data Mining :: Introductory Nonparametric Statistics :: Computational Statistics :: Statistical Methods in Epidemiology :: Linear Regression :: Time Series Analysis	:: Introduction to Mathematical Statistics I & II	:: Computational Statistics ::SAS II and Database		:: Predictive Analytics/Data Mining				::SAS II and Database :: Computational Statistics (program R)	:: Economic and Business Forecasting :: Statistical Design and Analysis of Experiments :: Statistical Methods in Epidemiology :: Statistical Consulting		
Master of Science in Analytics	MSc	University of San Francisco	:: Review of Probability and Statistics :: Linear Regression Analysis :: Exploratory Data Analysis :: Time Series Analysis for Business and Finance ::Multivariate Statistical Analysis :: Analytics for Social Networks :: Web Analytics	:: Review of Linear Algebra	:: Distributed Databases	:: Computation for Analytics	:: Data Acquisition :: Machine Learning :: Text Mining :: Distributed Computing :: Analytics for Social Networks :: Web Analytics			:: Business Communications for Analytics :: Data and Information Visualization	:: Introduction to Programming in SAS	:: Introduction to Data-Driven Business Strategies :: Business Communications for Analytics :: Time Series Analysis for Business and Finance :: Business Strategies for Big Data	:: Interview Skills	

Master in Information Systems Management		Master	Carnegie Mellon University Heinz College	:: Statistics for IT Managers :: Analytics and Business Intelligence :: Advanced Business Analytics :: Large Scale Data Analysis :: Measuring Social		:: Database Management :: Organizational Design and Implementation :: Distributed Systems :: Data Warehousing		:: Data Mining :: Text Analysis :: Measuring Social :: Geographic Information Systems			:: Geographic Information Systems	:: Object Oriented Programming in Java	:: Analytics and Business Intelligence :: Advanced Business Analytics :: Organizational Design and Implementation :: Financial Accounting :: Principles of Finance :: Economic Analysis	:: Professional Speaking :: Professional Writing	
Master of Business & Science - Analytics - Discovery Informatics & Data Science concentration		Master	The State University of New Jersey	:: Regression Analysis :: Fundamentals of Analytics		::Database Design and Management :: Database Systems :: Database System Engineering :: Advanced Database Systems	:: Introduction to Parallel and Distributed Computing :: Parallel and Distributed Computing :: Programmin Methodologies for Numerical Computing and Computational Finance :: Introduction to Computation and Modeling	:: Data Mining :: Machine Learning		:: Introduction to Parallel and Distributed Computing :: Parallel and Distributed Computing		:: Applications of Parallel Computers	:. Colloquium in Ethics and Professionalism for Science & Technology Management :: Principles of Communication & Professional development for Science & Technology :: Principles of Finance and Accounting for Science & Technology Management :: Marketing Core Course :: Marketing for Decision Making :: Capstone Project		x
Data Science / Big Data Programs		**Educational level**	**Institution**	**Statistics**	**Mathematics**	**Data engineering**	**e-skills in general**	**Information extraction** (learning, language, visual information, social/network information)	**Computer Vision**	**Cloud Computing**	**Visualization & Communication**	**Specific Applications**	**Business skills and knowledge**	**Other qualifications**	
Europe															
UNITED KINGDOM															
Master of Science Web Science and Big Data Analytics		MSc	Computer Science UCL	::Complex Networks and Web	:: Information Retrieval and Data Mining (basics) ::Complex Networks and Web	:: Distributed Systems and Security ::Multimedia Systems :: ::Complex Networks and Web		:: Information Retrieval and Data Mining ::Multimedia Systems :: Supervised Learning :: Applied Machine Learning	:: Computer Vision	:: Cloud Computing (Birkbeck)		:: Information Retrieval and Data Mining (MapReduce)	:: Web Economics :: Entrepreneurship: Theory & Practice	:: Interaction Design :: Understanding Usability & Use	
Masters in Big Data															
	MSc in Computational Finance	MSc	Royal Holloway University London	:: Data Analysis		:: Database Systems		:: Data Analysis :: Programming for Data Analysis					:: Foundations of Finance :: Investment Portfolio Management		x
	MSc in Data Science and Analytics	MSc	Royal Holloway University London	:: Data Analysis :: Large-Scale Data Storage and Processing		:: Database Systems :: Large-Scale Data Storage and Processing		:: Data Analysis :: Programming for Data Analysis				:: Large-Scale Data Storage and Processing (MongoDB, Hadoop, Pig)		:: Object-oriented Programming	x
	MSc in Machine Learning	MSc	Royal Holloway University London	:: Data Analysis :: Probability :: Inference	:: On-line Machine Learning (algorithms) :: Probability :: Inference			:: Data Analysis :: Programming for Data Analysis :: Computer Learning :: On-line Machine Learning			:: Programming for Data Analysis	:: Programming for Data Analysis (Matlab, Weka & R)		:: Object-oriented Programming	x
MSc Data Science		MSc	Information School University of Sheffield	:: Introduction to Data Science :: Data Analysis		:: Introduction to Data Science ::Information Retrieval: Search Engines and Digital Libraries :: Database Design :: Information Systems Modelling :: Information Systems Organisation		::Data Mining and Visualisation			::Introduction to Data Science ::Information Retrieval: Search Engines and Digital Libraries ::Data Mining and Visualisation	::Introduction to Data Science (R & R Studio) :: Data Analysis (SPSS & R) :: Database Design (SQL)	:: Introduction to Data Science :: Business Intelligence :: Researching Social Media	:: Research Data Management :: Information Governance :: Human Computer Interaction and User Interface	

MSc in Data Science	MSc	Goldsmith University of London	:: Data Mining and Analytics	::Data Mining and Analytics	:: Data Mining and Analytics		::Data Mining and Analytics :: Natural Language Process				:: Big Data Analytics (Hadoop) :: RapidMiner, Hbase, Mahout, Python, Pig	::Data Mining and Analytics		x
Applied Data Analytics MSc	MSc	Bournemouth University	:: Data Mining and Analytic Technologies		:: Data Mining and Analytic Technologies :: Advanced Data Management		:: Data Mining and Analytic Technologies :: Analytics for Data streams :: Web Mining and Analytics		:: Big Data and Cloud Computing	:: Analytics for Data streams	:: Big Data and Cloud Computing (NoSQL, Hadoop, MapReduce) :: SAS Programming	:: Business Intelligence	:: Research Methods & Professional Issues	
MSc in Computing (Data Analytics)	MSc	Dublin Institute of Technology	:: Probability & Statistical Inference		:: Data & Database Design for Data Analytics :: Data Management		:: Machine Learning :: Data Mining			:: Visualisation		:: Problem Solving, Communication and Innovation :: Case Studies in Computing	:: Problem Solving, Communication and Innovation :: Research Writing & Scientific Literature :: Research Methods and Proposal Writing	x
Data Science MSc	MSc	University of Dundee	:: Analytical systems - introduction and overview :: Data analysis and visualisation :: Advanced statistics and data mining	:: Big Data Analysis	:: Analytical systems - introduction and overview :: Big Data Analysis :: Analytical database models and design		:: Analytical systems - introduction and overview :: Analytical database models and design :: Data analysis and visualisation :: Analytical languages :: Advanced statistics and data mining		:: Big Data Analysis	:: Analytical systems - introduction and overview :: Data analysis and visualisation	:: Big Data Analysis (NoSQL, Hadoop, MapReduce) :: Analytical languages (MDX, R)			
MSc Big Data and Text Analytics	MSc	University of Essex		:: High Performance Computing	:: High Performance Computing		:: Machine Learning and Data Mining :: Natural Language Engineering :: Text Analytics		:: Cloud Technologies and Systems				:: Professional Practice and Research Methodology	x
MSc Advanced Computer Science (Data Analytics)	MSc	University of Leeds		:: Algorithms			:: Machine Learning and Reasoning :: Data Mining and Text Analytics	:: Image Analysis		:: Scientific Visualisation			:: Systems programming :: Scientific Computation	x

Data Science / Big Data Programs	Educational level	Institution	Statistics	Mathematics	Data engineering	e-skills in general	Information extraction (learning, language, visual information, social/network information)	Computer Vision	Cloud Computing	Visualization & Communication	Specific Applications	Business skills and knowledge	Other qualifications	Further electives
GERMANY														
Data & Knowledge Engineering	MSc	Universität Magedeburg	:: Intelligent Data Analysis :: Information Retrieval		:: Data Bases II		:: Data Mining :: Machine Learning :: Information Retrieval	:: Fundamentals of Computer Vision		:: Visualization			:: Scientific Seminars	
Datenwissenschaft MSc	MSc	TU Dortmund	:: Multivariate Statistische Verfahren :: Computergestützte Statisitk :: Optimierung :: Modellgestützte Analyse und Optimierung :: Effiziente Algorithmen und Komplexitätstheorie	:: Optimierung :: Effiziente Algorithmen und Komplexitätstheorie								:: Fallstudien II	:: Datensicherheit :: Grundbegriffe der theoretischen Informatik	
Web Science MSc	MSc	Universität Koblenz Landau	:: Data Science	:: System Analysis and Mathematical Modelling	:: Network Theory and Dynamic Systems :: Data Science :: Advanced Data Modelling :: Web Engineering	:: Introduction to Web Science	:: Web Retrieval :: Semantic Web :: Data Science :: Machine Learning and Data Mining			:: Data Science		:: E-participation :: Online Consumer Behaviour :: New Product Development		x
Social Science Data Analysis	MSc	Universität Konstanz	:: Econometrics I :: Statistics I :: Probability Theory and Statistical Inference	:: Econometrics I :: Algorithms and Data Structures :: Mathematics I	:: Database Systems :: Algorithms and Data Structures :: Big Data Scripting		:: Big Data Scripting				:: Big Data Scripting	:: Econometrics I	:: Introduction to Survey Research :: Research Design I	x
Information Engineering with 'Data Mining' Specialization	MSc	Universität Konstanz	:: Algorithmen für die Analyse großer Datenmengen :: Stochastik	:: Algorithmen für die Analyse großer Datenmengen	:: Multimediale Datenbanksysteme :: Digitale Signalverarbeitung		:: Data Mining 1 & 2 :: Text Mining			:: Information Visualization :: Zeichnen von Graphen	:: KNIME	:: Einführung in die Volkswirtschaftslehre :: Business Intelligence: from Reporting to Analytics	:: Anorganische Chemie und Analytische Chemie	
Bioinformatik	MSc	Universität Halle-Wittenberg	:: Bioinformatik	:: Bioinformatik :: Datenbanksysteme und effiziente Algorithmen	:: Datenbanksysteme und effiziente Algorithmen :: Datenbanken und Informationssysteme	:: Bioinformatik :: theoretische Informatik :: Softwaretechnik und Programmiersprachen :: Technische Informatik				::Bildverarbeitung, Computergrafik			:: Bioscience courses	
MSc Technische Inormatik/ Wirtschaftsinformatik concentration in Datenanalyse (Data Analysis) Students can freely select from the courses listed	MSc	TU Berlin	:: Statistische Methoden Künstlicher Intelligenz und Machine Learning		:: Advanced Information Management 1-3 :: Database internals & Scalable Database Programming	:: Advanced Computer Achitectures :: Compiler Construction 1-2 :: Digitale Nachrichtenübertragung :: Parallele Systeme :: Randomized Algorithms :: Simulation I&II :: Simulation und Modellbildung :: Technische Diagnose I&II :: Quellencodierung :: Optimization of Multicore Systems	:: Advanced Semantik Search :: Automatic Image Analysis :: Digital Image Processing :: Digitale Signalverarbeitung :: Machine Learning/Intelligence (several courses) :: Information Management :: Neuronale Informationsverarbeitung	:: 3D Computer Vision :: Advanced Computer Vision :: Computer Vision :: Photogrammetric Computer Vision :: (Optical) Remote Sensing ::	:: Theorie Verteilter Algorithmen					x

APPENDIX D: EUROPEAN ICT PROFESSIONAL PROFILES

These profiles have been developed and published as CEN WORKSHOP AGREEMENT CWA 16458, May 2012, ICS 35.020.

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

The formal process followed by the Workshop in the development of this Workshop Agreement has been endorsed by the National Members of CEN but neither the National Members of CEN nor the CEN-CENELEC Management Centre can be held accountable for the technical content of this CEN Workshop Agreement or possible conflicts with standards or legislation.

This CEN Workshop Agreement can in no way be held as being an official standard developed by CEN and its Members.

This CEN Workshop Agreement is publicly available as a reference document from the CEN Members National Standard Bodies.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

The 23 European ICT Professional Profiles, their titles (A-Z) with Summary Statements and examples of alternative titles used for smilar Profiles are provided in the following tabular overview.

European ICT Profile title	**ICT Profile Summary statement**	***Alternative titles that may be found and used by the market for similar Profiles - Not necessarily accurate***
Account Manager	Senior focal point for client sales and customer satisfaction.	*Sales Advisor (AITTS)* *Customer Representative (General multi-sector use)*
Business Analyst	Analyses Information System for improving business performance.	*Business Development Manager (ICT Role, ACS)*

European ICT Profile title	ICT Profile Summary statement	*Alternative titles that may be found and used by the market for similar Profiles* - **Not necessarily accurate**
Business Information Manager	Proposes plans and manages functional and technical evolutions of the Information System within the relevant business domain.	*Business Intelligence Developer (Microsoft)* *Business/ Systems Analyst (ICT-Role)*
Chief Information Officer	Develops and maintains Information Systems compliant to business and organisation's needs.	*Head of Computing (Demand side title)*
Database Administrator	Designs and implements, or monitors and maintains databases.	*Database Developer (Microsoft)* *Database Manager (Eucip)* *Network Administrator (ACS)*
Developer	Builds/codes ICT solutions and specifies ICT products according to the customer needs.	*Component Developer (AITTS)* *Application Developer (ITA-J)* *Programmer (IBM)*
Digital Media Specialist	Creates websites and multimedia applications combining the power of digital technology with effective use of graphics, audio, photographic and video images.	*Front-End Web Developer (IWA)* *User Experience Designer (IWA)* *Web & Multimedia Master (Eucip)* *Web Content Manager (UK-Gov, IWA)* *Web Developer (Bring-IT-On, Microsoft, UK-Gov)* *Web Editor (UK-Gov)* *Digital Media Developer (AITTS)* *Multimedia Designer (Bring-IT-On)* *Multimedia Developer (ACS)*
Enterprise Architect	Designs and maintains the Enterprise Architecture.	
ICT Consultant	Supports understanding of how new ICT technologies add value to a business.	*Consultant (ACS)* *Consultant and Contractor (ACS)* *Enterprise Solutions Consultant (Eucip)* *Logistics & Automation Consultant (Eucip)* *Sales & Application Consultant (Eucip)* *Technical Consultant (Bring-IT-On)*
ICT Operations Manager	Manages operations, people and further resources for the ICT activity.	*IS Service Manager (Airbus)* *Service Advisor (AITTS)* *Computing Manager (Demand side title)*

European ICT Profile title	ICT Profile Summary statement	*Alternative titles that may be found and used by the market for similar Profiles - Not necessarily accurate*
ICT Security Manager	Manages the Information System security policy.	*Security Advisor (Eucip)* *Security Analyst (ACS)* *Security Service Personal (UK-Gov)* *Security Services Specialist (ITA-J)* *Security Specialist (aux, ICT Role)* *Security Technician (AITTS)*
ICT Security Specialist	Ensures the implementation of the organizations security policy.	
ICT Trainer	Educates and trains ICT professionals and practitioners to reach predefined standards of ICT technical /business competence.	*Technical Trainer (IBM)* *Instructor (multi-sector common title)*
Network Specialist	Ensures the alignment of the network, including telecommunication and/or computer infrastructure to meet the organization's communication needs.	*Network Engineer (Bring-IT-On, UK Gov)* *Network Manager (Eucip, UK Gov)* *Network Services Specialist (ITA-J)* *Network Support (ACS)* *Network Administrator (ACS)*
Project Manager	Manages project to achieve optimal performance that conforms to original specifications.	*IS Project Manager (Eucip)* *Project Coordinator (AITTS* *Web Project Manager (IWA))*
Quality Assurance Manager	Guarantees that Information Systems are delivered according to organization policies (quality, risks, Service Level Agreement).	*Quality Management Coordinator (AITTS)* *Quality Manager (SME)*
Service Desk Agent	Provides first line telephone or e-mail support to clients with technical issues.	*Help Desk Supervisor (Eucip)* *Helpdesk Professional (UK-Gov)*
Service Manager	Plans, implements and manages solution provision.	*Service Advisor (AITTS)* *IS Service Manager (Airbus)*
Systems Administrator	Administers ICT System components to meet service requirements.	*Network Administrator (ACS)* *Server Administrator (Microsoft)* *System Administrator (SME)* *Database Administrator (Microsoft)* *Enterprise Administrator (Microsoft)* *Enterprise Messaging Administrator (Microsoft)* *Web Server Administrator (IWA)*

European ICT Profile title	ICT Profile Summary statement	*Alternative titles that may be found and used by the market for similar Profiles* - **Not necessarily accurate**
Systems Analyst	Analyses requirements and specifies software and systems.	*Information Scientist (UK-Gov)* *Information Systems Analyst (Eucip, ACS)*
Systems Architect	Plans and is accountable for the implementation and integration of software and/ or ICT systems.	*Telecommunications Architect (Eucip)*
Technical Specialist	Maintains and repairs hardware and software on client premises.	*Computer Service and Repair Technician (UK-Gov)* *Consumer Support Technician (Microsoft)* *Service Engineer (general multi-sector use)* *Customer Engineer (IBM)*
Test Specialist	Designs and performs testing plans.	*Computer Games Tester (UK-Gov)* *Software Tester (SME)* *Systems Integration & Testing Engineer (Eucip)* *Test Specialist (ITA-J)* *Tester (AITTS)*

APPENDIX E: BIBLIOGRAPHY

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