THE e-SKILLS MANIFESTO 2014

Grand Coalition
for Digital Jobs

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TABLE OF CONTENTS

INTRODUCTION

A new twist in Europe's history is just around the corner. The third industrial revolution is underway and our actions will determine Europe's position in the emerging new economy. Joining the digital age is not just about adopting the latest technologies, but also about favouring risk taking, stirring faith in the future and supporting entrepreneurism.

We need to reinstate the passion for progress that Europe once embodied, that very passion which drove Europe when she sent vessels around the world and invented the modern world.

We also have to rethink education, from the way we learn to the way we think, work and live together.

All of the above is within our grasp. We can do it.

Europe is a principle zone of innovation in the world today as well as its largest source of scientific publishing. These unique assets are worth harnessing from a fresh perspective. We must rethink our culture which has grown too academic, too ridged and too centralised in order to be able to entrust the keys of our future to those who spend more time making the impossible come true than fine-tuning their next step.

The digital era affords us a unique opportunity. Far from being limited to a particular technique, it is ushering in a brand new culture. You need only watch the ease with which certain entrepreneurs move from payment systems to booster rockets or electric cars to get the picture.

This new culture is better accessed through learning about code and complex structures. This, together with agile and decentralised collaboration between stakeholders, will contribute to truly innovative forms of creativity.

THE BIGGER PICTURE
Excellence and innovation have become vital

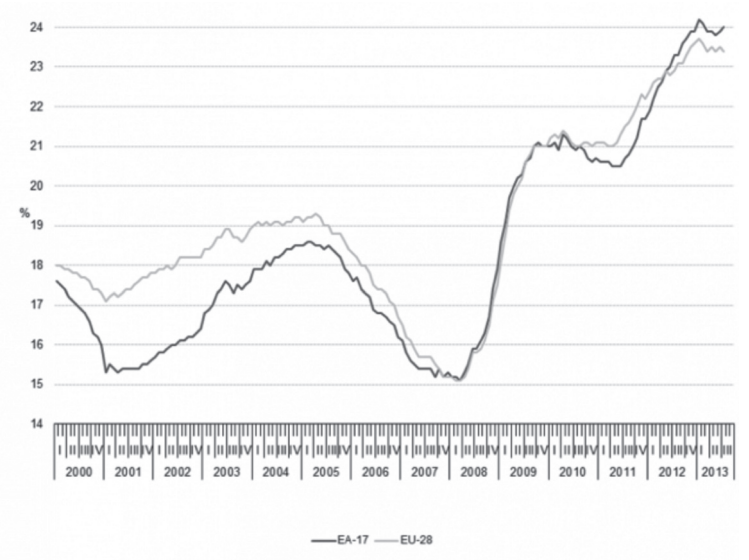
By Bruno Lanvin

The whole idea of Europe, as a realistic utopia is currently facing its real litmus test. Although it is undeniably global, the current crisis is taking different shapes and turns in various parts of the world. It is the first time in modern history that a crisis has erupted at a time when the main producing economy is not the main consuming economy. It is also the first time in modern history that international competitive advantages are being built on factors that have so little to do with natural endowments, geography and durable technological advantages.

A fresh sense of urgency

In such a rapidly moving environment, Europe is pressed to identify the bases of its future prosperity. Over the last decade, Europe has made strategic choices in this regard: building a competitive and inclusive economy, and being at the forefront of environmental protection and innovation are among them. The current crisis makes those choices more costly and more valuable. Today, few data illustrate better this renewed sense of urgency than the unprecedented high rates of unemployment among Europe's youth (defined as 15 to 24 year olds), close to 24% at the end of 2013 (see diagramme). Similar data point at youth unemployment rates around 8 % in the USA and 5 % in Japan.

Youth unemployment rates, EU-28 and EA (Euro area)-17, seasonally adjusted, January 2000 - July 2013



Source: Eurostat 2014

This sense of urgency is matched by a growing impression that new production techniques, new consumption patterns and new behaviours offer fertile grounds to generate a 'job-rich recovery' in Europe without compromising its ambition to be a world leader in productivity, innovation and inclusion. This is where information and communication technology (ICT) and e-skills become a central element of future analysis and policies to generate a job-rich and sustainable recovery in Europe.

A new range of opportunities

Developments in the field of information and networks (including cloud computing, big data, social media, mobile internet, and convergence to name a few) create needs for new skills, and tremendous opportunities for those who will generate and master them first.

Data on the current and anticipated levels of supply and demand of e-skills are provided later in this volume. They show a persistent deficit for Europe as a whole: the paradox of high unemployment rates combined with significant unfulfilled job offers in the "e-skills sphere" remains one of the most striking ones in the job landscape of Europe.

These are times when choosing the most strategic angle to address the e-skills issue is as precious as the tools and processes to be adopted to tackle it. As global competitiveness is increasingly driven by knowledge and innovation, it is clear that Europe needs to build on its strengths (such as its ICT sector and knowledge economy) to develop sustainable comparative advantages on the international scene. Yet, adapting the quality and structure of its workforce to the challenges and opportunities resulting from the advent of that global knowledge economy remains a challenge which, if left unaddressed, could jeopardize the future of other efforts made in shaping Europe's future as a global power and a model of *'competitiveness cum inclusion'*. This is what the "e-skills for the 21st century" challenge is about. No less.

A critical missing link, internally and externally

There is broad consensus among stakeholders that e-skills are crucial to boost competitiveness, productivity and innovation as well as the professionalism and employability of Europe's workforce. There is a need to ensure that the knowledge, skills, competences and inventiveness of managers, IT practitioners and users meet the highest global standards and that they are constantly updated in a process of effective lifelong learning.

Europe needs both e-skilled people to provide the infrastructure and e-skilled people to use it. An e-skilled society is thus a precursor to a knowledge-based society. In the absence of sufficient e-skills across Europe's population, the investments made and planned in infrastructure (e.g. broadband) will not generate full returns on investment. From an industry point of view, it is also clear that a continued substantial shortage of IT workers seriously jeopardises the success of the European economy. It affects the development of high-tech industries and slows down the velocity of innovation, which in turn influences employment and productivity in the related industries. Consequently, the shortage of IT practitioners weakens Europe's ability to compete globally. Internally, such shortages also constitute a threat to the achievement of a Digital Single Market.

e-Skills are key for European competitiveness, growth, and jobs

In 2007, following extensive consultation and discussions with stakeholders and member states in the context of the European e-skills Forum, the European Commission adopted a Communication on *"e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs"*, which includes a long term EU e-skills strategy. That strategy was welcomed by member states in the Competitiveness Council Conclusions of November 2007. Stakeholders also welcomed a long-term e-skills agenda. Industry established the e-Skills Industry Leadership Board to contribute to the implementation of the strategy.

A related study found that national IT policies tend to focus on developing basic IT user skills. The development of IT practitioner skills is often considered to be part of continuing vocational training policy. They found that nine countries had policies aimed at developing e-business skills. Twenty-six countries had policies designed for e-skills for users, while eleven countries (Denmark, France, Germany, Hungary, Ireland, Malta, Spain, Portugal, Romania, United Kingdom and Turkey) had policies specifically aimed at the development of e-skills of practitioners. The study identified a total of forty-five initiatives that were specifically targeted at the development of IT practitioner skills.

Good progress has been made on the implementation of the EU e-skills strategy. A European e-Competence Framework has been developed and a European e-skills career portal was implemented together with several high-level multi-stakeholder partnerships. New activities have been launched since then. These include actions related to supply and demand (including the development of foresight scenarios) to better anticipate change, the further development of European e-Competence Framework; the promotion of relevant financial and fiscal incentives. In this vein, the pan-European e-Skills for Jobs was a major awareness raising campaign to promote e-skills, share experiences, foster cooperation and mobilise stakeholders.

As Europe still struggles to fight its way out of the crisis, the insights of 2007 take on a new value: IT specific unemployment has stayed way below total unemployment rate at all times. This indicates that stimulating the growth of the IT sector (and of e-skills) deserves to be considered as a counter-cyclical policy instrument to generate the job-rich recovery mentioned earlier.

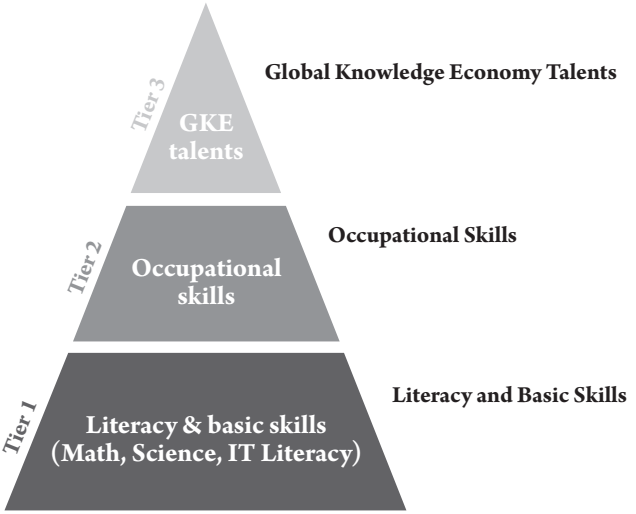
Playing Europe's cards in the global competition for talent

Using the INSEAD skills pyramid paradigm, Europe needs to address fresh challenges at each of its three levels:

(1) Literacy and basic skills including e-skills, maths and science (including coding);

(2) Occupational skills required for the job market and acquired in formal education, but also increasingly 'on the job';

(3) Global knowledge economy (GKE) talents, which are less tangible but involve leading teams and anticipating change, and which are critical for innovation.



Europe invests much less on higher education than the United States and Japan. An Economist Intelligence Unit (EIU) study identified the US, Singapore, the UK, Ireland and South Korea as the best-performing countries in developing the right IT talent. The EIU suggests that the key to these countries' success lies in vigorously expanding enrolments in higher education courses, including science and engineering. They also maintain world-class universities or technology institutes, which equip technologists with business and management skills, not just technical skills.

Pursuing and building the Digital Agenda for Europe

In 2010, the European Commission adopted the Digital Agenda for Europe, outlining seven priority areas for action: creating a Digital Single Market, greater interoperability, boosting internet trust and security, much faster internet access, more investment in research and development, enhancing digital literacy skills and inclusion, applying information and communications technologies to address challenges facing society like climate change and the ageing population. Examples of benefits include easier electronic payments and invoicing, rapid deployment of telemedicine and energy efficient lighting.

In the field of e-skills and digital inclusion the European Commission will:

- Promote e-leadership and ICT professionalism to increase the European talent pool and the competencies and the mobility of ICT practitioners across Europe;
- Support the development of online tools to identify and recognise the competencies of ICT practitioners and users linked to the European e-Competence Framework and the EUROPASS;
- Promote greater participation of women in the ICT workforce;
- Make digital literacy a priority for European Social Fund regulation (2014-2020);
- Propose EU-wide indicators of digital competences and media literacy.

It is relatively easy to see how the typology described above (e-skills pyramid) could be mapped most directly to each and every one of these action points. A challenge will be to do this consistently across European institutions and national governments.

Time to take action – innovate to excel and excel to innovate

Over the last few years, various stakeholders (industry in particular) have been quite vocal about making recommendations for immediate action. Based on recent analyses and data, the following seem of particular relevance:

- Thorough statistical work on IT skill shortages should be carried out to pinpoint the specific skill gaps. Annual Eurobarometer reports should be developed, mapping employer perceptions with regard to the e-skills needed in the next three to five years.
- Incentives for teachers to update their own IT training and modernise their teaching methods so as to mainstream digital teaching/learning should be introduced. Certifications for teachers attesting to their e-skills could be introduced.
- The European Commission should set up and fund inter-school maths and science competitions across Europe to reward excellence.

Moreover, it is clear that the e-skills challenge will be qualitative as well as quantitative. Europe needs a highly skilled pool of IT practitioners that meet the needs of employers. The traditional 'educate then work' model is becoming less relevant as market volatility increases. Employers and educators must

work in close collaboration in order to provide a more agile skill acquisition framework (i.e. learning how to learn).

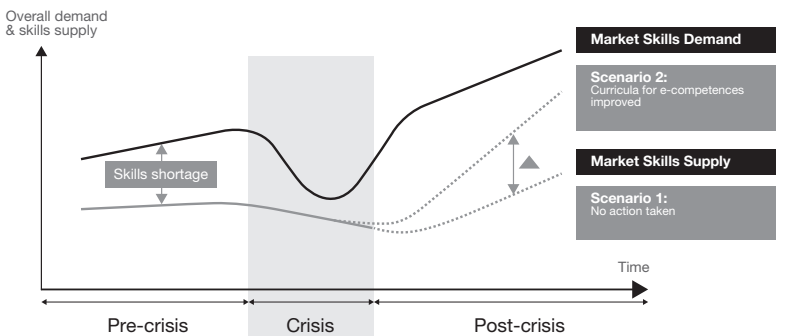
An EU-driven e-skills strategy cannot simply be a short-term theme. There is a clear supply and demand issue in respect of e-skills that will become increasingly acute. Demand will increase for traditional technology infrastructure skills plus the skills needed by a knowledge-based collaborative workforce.

Yet, all these recommendations are transcended by the 'global innovation imperative' that Europe is facing. e-skills are a crucial component of the innovation ecosystem; in other words, Europe needs to equip itself with excellence in e-skills in order to remain a lead contender in the global race for innovation. Europe needs to excel in order to innovate. Symmetrically, Europe needs to improve its education and training system to generate and attract more talent, researchers and highly skilled practitioners and managers. In tertiary education, as well as in lifelong learning and basic education, Europe needs to innovate in order to excel.

e-skills are a crucial component of the innovation ecosystem.

Recommendation – no time for waiting games

Europe as a region must be imaginative, widely supportive of policies that address e-skills deficiencies that are a structural, as opposed to cyclical, issue. The economic crisis somehow muddied the debate, since lower demand levels have led to misleading indications that the e-skills gap might be narrowing. This, however, is largely an illusion: if European businesses, government and academia do not react quickly, this gap will become apparent with a vengeance once the recovery gathers momentum. Those European economies that do not take advantage of the crisis to strengthen their ability to produce more e-skilled workers and managers will find themselves marginalised in the race for knowledge-based and innovation-driven global competitiveness.



Source: Lanvin, B. and Fonstad, N. (2010), *"Strengthening e-Skills for Innovation in Europe", INSEAD eLab, 2010.*

In the face of the immediate challenge that youth unemployment currently presents in Europe, the urgency of action is taking on a new meaning. We have only seen the beginning of the digital revolution: its future should be strongly harnessed to the broad objectives of Europe (inclusive competitiveness, sustainable and innovative growth) while remaining firmly anchored in addressing the current needs and expectations of Europe's citizens. Offering them the ability to acquire e-skills is a key ingredient in this complex edifice.

CHAPTER 1
The Digital Jobs of the Future

Impact of ICT on employment

The impact of the current wave of technology on employment is an important, yet unresolved issue. What is likely, however, is that the required adjustments will be profound, long-lived and painful. Unfortunately as of now, we have no way of knowing if the impact and trajectory of this technological wave will be different from previous technology driven revolutions. In short, will the net impact of these changes on employment, and ultimately social, political and economic structures be positive or negative? Those who seek comfort in the fact that the agricultural and industrial revolutions of the past did not create a long term increase in the unemployment rate would do well to remember the terrible social dislocations that accompanied these transformations (Charles Dickens' literary legacy was built documenting these realities). Whatever the rate of change or ultimate outcome of these changes we do know one thing: The workers of tomorrow will need skills which enable them to create economic value in a world where increasing swathes of the labour market likely get replaced by automation, software and robots.

Limitations in the available data

The formal analysis of the impact of technology on growth and employment is hindered by a number of limitations in the available data. A disconnect appears between slowing productivity trends observed at the macro level, and faster rates of growth reported by firms at the micro level. It is likely that official data do not accurately capture technology inputs or outputs. For example, IT capacity is traditionally approximated by investment in IT goods and services deployed within the firm, but today firms may well be sourcing more and better IT capacity on demand through the use of external cloud based services - such as Salesforce and Google Apps - while spending less than would be required for equivalent in-house capabilities.

Macro data also show a 'decoupling' of productivity and employment, and of productivity and pay (productivity continues to grow, while wage and employment growth tapers off). This reinforces what is sometimes referred to as 'superstar biased technological change', where technology creates a lot of wealth, but it accrues to very few people. Examples include Facebook, which has generated a lot of wealth for its creators and a small group of people, but has not created very much employment. Another example is the impact of software packages such as TurboTax that created much wealth for its creators, but has caused many tax preparers to lose their jobs.

It is also likely that the appearance of effects in the data is delayed as it takes time for technologies to diffuse and their uptake to be implemented to a scale where impacts can be quantified. Additionally, learning and absorption of new technological processes takes some time, and may require regulatory reform and skills updating – all of which delay the appearance of effects in the data.

Finally, classification of new technologies, jobs, tasks, and products may also be complicated as technology cycles change faster than official data collection systems. All of these issues combined lead to the likelihood of a significant divergence between what is actually observed on the ground and what shows up as measured in official data.

Differences in the adoption of new technologies across time and geography

Technological change is happening at an unprecedented pace, but there may be substantial differences in the adoption of new technologies across time and geography, at the institutional, firm and individual levels. Social and cultural differences also drive differential rates of acceptance and adoption of technological change. Some technologies that would displace jobs (e.g. automated check-out in supermarkets) have not had a uniform impact due to a lack of social acceptance. Some firms have also made a commitment to not let technology displace workers by finding them alternative productive tasks within the organisation.

It is, however, increasingly important to differentiate between tasks and jobs. Jobs are an aggregation of a number of different component tasks. An increasing number of tasks that are components of even the most highly skilled jobs are open to automation. If the steps of a task can be formalised and written down it is highly likely that the task can be automated with software. The most profound – and as yet unanswered - question is what percentage of the tasks of each job over the entire economy will ultimately yield to automation, and how much labour will then still be needed to do the remaining tasks.

In thinking about the impact of technology on employment, and displacement of workers, it will be important to look for complementarities between people and machines so that people can do the things that add value to increasingly automated work environments. Many 'non-routinasable' tasks requiring creativity, social communication, empathy, and dealing with new and un-formalised information are not likely to be automated in the foreseeable future.

Job replacement differences

Some jobs are destroyed, and new ones are created. However, often times these new jobs require very different skills sets from the ones that disappear. People

displaced by the jobs that are destroyed do not necessarily have the skills to perform the newly created jobs (for example, when robots replace manual workers on an assembly line, someone will need to maintain the robots and the software that controls them, but this role is unlikely to be filled by any of the displaced assembly line workers). The balance in jobs created and destroyed during this transition also remains to be seen and has become a topic of much debate. It is possible that in the early phase, more jobs disappear than are created. However, as economic growth accelerates aided by technology, new jobs may be created in a 'second round' effect. This means that adjustments will likely be long and painful, and large numbers of displaced workers will need to be accommodated in this process.

Existing and well-defined demographic pressures - including an aging population and the retirement of 'baby boomers' - will likely create tightness in the labour market, especially in most developed countries. This may create further friction and mismatches in the supply and demand of labour. At the same time, firms continue to report suffering from skills shortages, but this issue is generally not confirmed by the data (for example, there is little evidence of wage increases for jobs with skills in short supply at the aggregate level), or by their own experience, as they generally do not report that skills shortages have prevented them from carrying out contracts. It is clear, however, that in certain highly specialised jobs such as data-scientists and skilled software engineering salaries are rising significantly.

The combination of factors outlined here – without intervention to address skills shortages - may well lead to significant mismatches in the labour market moving forward and the change in demand for skills will likely be much faster than it has been in the past.

Requirements for technology related skills evolve rapidly

ICT skills, or e-skills, are a concept that comprises many different skill types and levels, which may change very rapidly, especially for highly specialised technical skills. They traditionally include skills for people involved in hard infra-structure roll-out (ranging from 'basic' cable layers to telecom and network engineers, for example), but also the soft infrastructure skills required to use ICT hardware, ranging from basic IT literacy skills, to basic and advanced user skills.

In addition, there is a broad spectrum of technical skills, ranging from basic (e.g. network administration, support engineers, and technicians) to very advanced technical such as systems engineers, systems programmers, architects, developers, high level service designers, user experience designers and data visualization, service architects and designers, data scientists, and data engineers. But in addition there is an increasing need for people with a combination of

technical and business – and other soft skills – or e-leadership skills. These skills sets combine business and other 'soft skills' with technical skills / technological awareness. This includes, for example, tech savvy managers who understand how technology can enhance and transform the business, understand this may require large investments and business restructuring and have the power, talent and courage to make transformative decisions. On the technical side, this refers to technical staff with the soft skills to identify and communicate how technology can create business opportunities to management.

Barriers impacting digital entrepreneurs

Digital entrepreneurs are also increasingly important for growth and employment, but run into a number of barriers, especially in Europe (Clayton and van Welsum, 2014). These barriers include a lack of flexibility and scale as a result of regulation induced market fragmentation (which limits the scope for experimenting, innovating, and taking risks) and difficulty to scale beyond national borders, difficulty in obtaining finance for both start-up and scale-up (especially for more innovative, and, therefore, inherently riskier initiatives); not being 'allowed to fail' (difficulties in trying again after a first or even many failures; this is a barrier to benefiting from ICT as many successful companies have been created after a string of failed attempts by so-called serial entrepreneurs), a lack of harmonisation and excessively complicated regulation and taxation – and uncertainty about regulatory change (it is very costly for businesses, and especially small businesses to keep up with regulatory changes and try to be in compliance; for small companies this may even be prohibitive); difficulty in recruiting across borders, and policies that seem biased to large and/or incumbent firms.

Entrepreneurs trying to operate in the very fast technology space need lean and simple ways of doing business in a dynamic and energised business environment. A fast, high-speed, reliable and affordable ICT infrastructure is also a pre-requisite, and if the right business conditions and regulations are in place, will allow entrepreneurs from any location to participate in the global economy. It will give them the ability to source inputs from anywhere in the world, whether it is particular types of talent or knowledge, or sourcing business support functions on demand, but it also opens up markets for their own products.

Some skills quickly become obsolete

Whose responsibility is it to supply the economy with the right skills? As technology evolves very quickly, certain skills may also become obsolete very quickly, some say every 2-3 years, and for particular types of niche skills (e.g. certain programming languages) this may be even faster. This has important implications for the supply of these skills: people are unsure which skills to get training for, and/or are reluctant to get trained on skills that do not stay valuable/competitive for long, companies are reluctant to train people because many skills are fungible and can be just taken to other companies, and educational systems are too slow to be able to adapt to such changing skills needs. This begs the question of whose responsibility it is to reskill people and to equip the workforce with the right skills.

The above observations, combined with increasing use of 'alternative work arrangements' (e.g. part-time jobs and freelancers), suggest that increasingly the skilling burden may shift to the individual rather than business or government. This would be a risky outcome though as workers do not appear to be investing in keeping themselves marketable (a change in mind sets will be needed for people to adapt to a future of constant or frequent change: you no longer go to school to learn the skills for a life-time job, but instead it will be a future of life-long learning and change, which requires a lot of adaptability). At the same time, the educational system is not teaching people the skills adapted to a technology enabled fast-changing world. Policy-makers may implement measures that can actually become hiring disincentives, and fail to remove labour market rigidities. And businesses appear to put a greater emphasis on asset management and (for the larger firms) short-term demands of shareholders and profit demands rather than on managing their human assets to the notable exception of the School 42 experiment in France.

Recommendations

These six factors combined create societal pressures and may be highly disruptive. Murray and van Welsum (2014) refer to this as "Information Technology's Triple Threat" where ICT developments are driving three disruptive forces: wealth inequality, labour force disruption and the future of work, and societal and political disruption. There appears to be much anxiety over the impact of technology on employment, and a feeling that the consequences may be dark and inevitable. At the same time, there is no formal (analytical) evidence yet that justifies these fears and that confirms that this technological wave may be different from cycles of the past.

However, it is clear that the labour market is increasingly polarised, that an increasing number of tasks – including in highly-paid 'knowledge worker' jobs – may be profoundly affected by automation, and there is some evidence

(e.g. in the US) that suggests that going forward, most of the fastest growing occupations are also the lowest wage occupations, which is a problem particularly in consumption-driven societies (if people have nothing to spend, growth will grind to a hold).

Given the multiple forces at work, and the uncertainty about their long term (net) effects, it is difficult to make recommendations other than that it is important to acknowledge that transformations will take place and that they may be highly disruptive. Automation through software and robotics will become ever more important in our daily lives, and the trick will be finding complementarities where people can add value to automated systems rather than compete with them. Interpersonal tasks that require physical and/or face-to-face interactions are likely to be important, especially with life-style changes and aging populations. Most likely, one of the most desirable attributes for people to have in the future is to be flexible and adaptable, able to cope with an environment that will change fast.

One of the most desirable attributes for people to have in the future is to be flexible and adaptable, able to cope with an environment that will change fast.

CHAPTER 2
The Value-Driven IT Function

Leadership does matter

All around us we see the impact of digitisation, where information technology (IT) is being used to transform industry and different parts of society. With the emergence of the Internet of Things the pace of change is accelerating even further. And yet, the organisation that should have the charter in a company to drive change, the IT function, sometimes seems to be caught in a time warp.

Ultimately the role of the IT function is to convert IT investment, in the form of people, process and technologies, into business value, with the help of e-literate users. But does it do this? IT is perhaps the most vibrant business resource available to organisations today yet some of the practices used to manage and apply IT fail to release its potential.

Research by the Innovation Value Institute, an Irish organisation, founded by the National University of Maynooth and Intel, to help transform IT management, shows that in many companies, IT departments are under-performing and company management is unwilling to fund IT innovation. In such organisations, the focus of the IT function is entirely operational and the potential of new technologies is not being tapped. In businesses of this type, the solitary objective of introducing cloud computing, for example, is perceived as its ability to cost reduce and better manage normal IT operations as opposed to its potential as an innovative enabler.

A vicious circle is also at play within the IT profession. Industry commentators lament poor career progression opportunities, geeky image, myopic focus on technology, increasing commoditisation and the declining strategic importance of IT within organisations. As insufficient numbers of adequately skilled individuals enter and remain in the profession, Europe's businesses struggle to capture the innovative capacity of IT. Competiveness on the global stage is threatened. To address this situation, CIOs must demonstrate the real value of IT better. This requires individuals with the appropriate mix of skills and knowledge, nowadays called e-leadership.

Addressing misperceptions and combining IT and business skills

Amongst young people there is sometimes the misunderstanding that IT people work in IT companies. The fact is that far fewer than 50% of all IT workers are

employed in the IT industry. Most are employed within the IT functions of end-user organisations. Another misperception is that a career in IT will be technology-oriented. Yet, when we look at IT in a broad sense, fewer and fewer people are pure technologists. The trend is towards a blend of technology and other business competences. Successful IT professionals are those that are bilingual in business and technology speak.

IT is primarily an enabler, and its potential as a source of competitive advantage is best realised where it is combined with business innovation.

Evidence suggests that leading organisations are best able to innovate where business and IT collide. IT is primarily an enabler, and its potential as a source of competitive advantage is best realised where it is combined with business innovation. Moreover, as newer technologies facilitate the democratisation of IT, the ability for individuals to exploit IT across the business is predicted to grow strongly. For example, the increasing sophistication and ease-of-use of platforms-as-a-service will facilitate the construction of innovative IT solutions outside of the traditional IT environment. But this requires adequately skilled individuals with the relevant mix of IT and business expertise. An important gap is that of IT and IT innovation-related management education, which should be folded into the MBA programmes at leading business schools.

The importance of IT

Freddy Van den Wyngaert, Chief Information Officer (CIO) of Agfa-Gevaert and President of the European CIO Association (EuroCIO), claims that even in the short term, companies will suffer if they fail to innovate and embrace the digital transformation by building e-skills and e-leadership. Today, for example, Agfa HealthCare, one of the company's business groups, is growing from a product oriented company, focused on chemical film and radiology, into an IT software and services company across the many healthcare sector domains. Digitisation and IT are essential to balance the quality of care, the patient's safety and the cost efficiency of the group's healthcare.

Michael Gorriz, CIO of Daimler, explains the pivotal role of IT in car manufacturing: "IT is an integral part of the whole organisational structure. IT is involved in all primary and secondary business processes. Even before the first piece of metal is used, a new Mercedes-Benz has already driven millions of test kilometres on the computer. Our cars are three dimensionally designed, constructed and developed on the computer. This includes crash and endurance tests as well as driver simulations. Only through these simulations can we predict the behaviour of a new model."

At Intel, IT is the nervous system of the company, and increasingly the muscle. Automated IT systems help enable Intel's global factories to manufacture and ship more than a billion high quality, high technology parts a year.

e-Skills in end-user companies

IT is the key differentiator in respect of new products and services. Yet, its potential is threatened by severe shortages of suitably skilled individuals. The pervasive need for IT skills across all job functions means that the promotion and use of an entry level certification such as the European Computer Drivers Licence (ECDL) would be advantageous to students, organisations and society at large.

For IT professionals, not only do we have a shortage in people studying information science, information management and related studies but in other subjects too little attention is paid to IT. In all traditional professions, IT knowledge is required in order to work professionally, particularly where innovation is involved. While Europe's universities foster e-skills in a variety of ways, we must ensure that curricula keeps pace with the fast changing IT environment. Social networks, cloud computing, Big Data, etc. have been around for only a short time, but are already impacting our lives in a significant way. e-skills should be included in our plans for lifelong learning.

"We need society to provide workers with the requisite e-skills and e-leadership skills whether they are 'power users', IT professionals or leaders in digital transformation," underlines Michael Gorriz. "This is not just a large company requirement, but a prerequisite to migrating towards a knowledge-based society."

Design Science can provide new tools to help IT and business executives manage and create value from IT. The IVI, for example, uses Design Science to create tools and training programs for working IT executives. Pooled knowledge is codified and encapsulated in a living framework and repository called the IT Capability Maturity Framework (IT-CMF). Training offerings can be spontaneously rendered from the repository to provide education and training that keeps pace with the ever accelerating rate of technology change.

e-Competency: establishing a level playing field

There is an unsustainable lack of alignment between education offerings and the requirements of industry. The low maturity of the IT profession means that there is no comparability of different IT competences and the related knowledge of IT practitioners. The introduction of a framework to consistently define e-skills across Europe will enable schools, tertiary education establishments, employers, employees, training companies and recruitment agencies to operate in a more joined up manner. Using such an approach, organisations

The European e-Competence Framework (e-CF) has the potential to act as a Rosetta stone of e-Competences across Europe.

can define job roles in terms of the relevant IT competences required and practitioners can define themselves in terms of the IT competences they possess. Educators can also provide transparency in the competences offered by their respective courses. The European e-Competence Framework (e-CF) has the potential to act as a Rosetta stone of e-Competences across Europe. Facilitating practitioner mobility will be the ultimate result through enabling consistent understanding across organisations and borders.

For its full potential to be achieved, all of the major stakeholders – industry, educational providers and governments – must urgently adopt e-CF's key measures. Without such coherence, the mobility and career progression of workers in Europe will be hampered.

Organisational capability and e-skills frameworks

Oscar Wilde wrote, "A cynic is a man who knows the price of everything and the value of nothing." Many CIOs will have someone in mind when considering this quote as there is an overwhelming focus on cost with respect to IT. The cost focus needs to move more towards value in order to unleash the business benefits of IT-fuelled innovation. CIOs and CEOs must look at the bigger picture of assessing IT organisational capability - people, processes and technologies - as opposed to considering the sum of individual employee competences.

Understanding an organisation's maturity provides insights into which strategies and tactics can be implemented to increase the business value delivered from human, technical and operational assets. ICT capability frameworks can be used to identify gaps in organisational IT capability and one possible output of such an assessment process may identify a need to develop improved proficiency in specific practitioner competences. There is a strong symbiotic relationship between organisational capability frameworks, such as the IT-CMF, and individual e-skills frameworks, such as the e-CF.

Shift in the role of CIOs

The convergence of important industry trends such as cloud computing, the democratisation of IT and service innovation are all impacting on the role of

CIO. The way in which the CIO manages the basic operational capability of IT (i.e. "keep the lights on") is likely to shift significantly as we continue to move into a utility model of cloud services. An increasing emphasis will be placed on managing relationships with third parties rather than on managing resources internally to provide this service. Many organisations will adopt a hybrid cloud model, retaining internal provision capabilities for their most sensitive processes and activities, while using an ecosystem of external providers for customer-facing business processes. Managing this transition will require changes to the skill sets of both CIOs and IT practitioners.

As increasing levels of responsibility for operational IT are assigned to external providers, CIOs are likely to focus on using IT to facilitate innovation. Research from Accenture shows that there is a far higher return on investment from using IT to transform the business rather than providing more internal efficiencies in a company. However, the way in which such innovation is created, delivered and managed is expected to change significantly. For example, rather than IT-enabled innovation originating predominantly from within IT, the increasing sophistication and ease-of-use of platform-as-a-service solutions will facilitate the design and construction of solutions outside of the IT function.

It should also be realized that products are increasingly digitalised or contain IT components, meaning that CIOs are increasingly involved in the primary processes of organisations, rather than only in the business support processes like ERP or HR. Optimising the business and supporting customers by linking internal IT systems with social media and developing external links with customers or partner organisations, means CIOs are coming more and more in the frontline of business. CIOs must encourage and manage solutions being developed in the business. This will require a significant shift in their role. To date, too many CIOs still focus on controlling and limiting the potential damage of end-users. A key macro business trend is leveraging the power of end users as a source of innovation. As the power of new platforms emerges, the role of the CIO must evolve to embrace and capitalise on the potential that end-user resources offer. Their proximity to the business and relative numbers mean that they represent a tremendous opportunity for new sources of innovation. Clearly, this will require a shift in the e-skills of CIOs, IT professionals, and these

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CIOs must develop the relevant business skills to show the value of IT in revitalising business and education providers must ensure this evolution is reflected in the way the next generation is taught. More than 5,000 IT executives globally have taken IVI developed training on demonstrating ICT value, and a new 'IT Management for Value' Master program is in operation. In parallel, the European CIO Association is developing its own e-leadership education program aligned to e-CF, which is directly focused on the requirements of the demand side. While these initiatives are important steps in improving IT management, they are unlikely to move the needle enough. Additional actions are necessary to reach a satisfactory solution.

Recommendations

Promote the adoption of the European e-Competence Framework and ICT job profiles to help standardise competences, role profiles, and education. Support educational institutes across Europe in the creation of education and training programmes that align with the e-CF and related ICT-profiles. Currently, it is too difficult for employers and practitioners alike to understand the outputs of different courses, particularly across countries. Alignment of education with e-CF and ICT-profiles should greatly help to order education supply and cut the jungle of education offerings.

Enhance IT education for non-IT professionals. IT is such a vital component of so many roles nowadays that students must be taught relevant IT skills to enable their rapid integration into the workplace. New technologies like Big Data, Internet of Things, 3D, cloud are not just technologies IT workers should know about. Other professionals, should know about them too because they impact all parts of the business, from sales to logistics, from governments to SMEs, healthcare, etc.

Develop closer links between industry and educational institutes. IT luminaries are rarely accepted as IT professors at respected universities or engaged in influencing the design of relevant study programs. This contrasts negatively with other professions such as law, medicine and engineering, where experienced industry experts are invited to assume such roles. Educational Program Boards should be established in which top-practitioners together with university professors decide together about new e-leadership curricula.

Improve relations between the executive team and the IT function. Senior managers in some organisations still focus on IT's productivity and cost, rather than its innovation enabling potential. The European Commission's support – through policy communications - might help foster improved recognition among senior stakeholders of the more important role for IT in Europe's businesses. These policy communications may also address other key topics such as information or digital governance, IT environmental strategic analysis and board-IT relations. It is advised to push for IT knowledge for Board and non-executive Board members. CIO and top IT management functions be up-skilled with more business knowledge, communication skills, change-management attitudes, so these "Chiefs" can play the required e-leadership and business renewal roles in their organisations.

Promote IT to young people. Without an accurate understanding of the many and diverse career opportunities available in IT, the level of interest in IT among young people is likely to decline, representing a genuine threat to Europe's competitive capability in the longer term. Efforts should be focused on high schools and possibly even primary schools, because that is where primary choices for careers are made. Many teachers do not have the skills nor knowledge to inspire young people about career options in IT. Inspirational e-Leaders (CIOs, IT-entrepreneurs) should be asked to tell their stories to inspire youngsters. Visits to leading industries can help to open young people's eyes to new career possibilities.

The e-Skills for Jobs 2014 campaign already plays a vital role in changing perceptions. Further coordinated action among industry, governments and targeted educational institutes could help build on this work further and support the key objectives of the Digital Agenda for Europe.

Push the establishment of national e-leadership taskforces. In some countries national efforts are done to bring academia, IT industry, IT user communities, governments together to develop national IT campaigns, launch actions on schools, push new kinds of IT education, etc. Some of the actions are led by a National Digital Champion. It is believed that such taskforces can play an important role in getting the messages discussed above across to broader groups in society.

Maturing the IT profession. Outside of classical professions in IT, no certificates are required to fulfil key positions. Nobody would even think about getting surgery from a doctor who had only experience. This lack of single position certificates to occupy key positions runs in parallel to the fact that large, international organisations and governmental institutions are completely dependent on the good functioning and risk-safety of IT systems. While not all positions need specialised knowledge and certificates, some key positions (business and/or enterprise architects, security officers, etc.) should require the right combination of proven theoretical and practical knowledge.

The European Commission in its e-skills and e-leadership programme has undertaken significant positive steps. There is strong support for these initiatives across the ICT industry and in IT demand organisations. Continued cooperation between several of the most important European Commission Directorates-General operating in this sphere (including for example DG Connect, DG Enterprise and Industry, DG Education and Culture, DG Research, DG Employment Social Affairs and Inclusion) will strengthen the policy solutions proposed and facilitate adoption. IT now pervades so many parts of our economies and society to such an extent that no single DG can retain "ownership" of the topic of IT.

Agreeing a focus and direction within the European Commission is the easiest part of the solution. The task of aligning and mobilising industry, national governments and academia is a significant challenge to address, and this is where the respective stakeholders must assume responsibility. Given IT's role as an enabler of business innovation, the need for collaborative and coordinated action on e-skills is clear. All stakeholders must take the call to action to heart and act now to prevent further loss of European economic competitiveness.

CHAPTER 3
The Impact of Globalisation

The nature of the global e-skills challenge

In today's global business landscape, the availability of skilled ICT workers is failing to meet intensifying global demand. In a recent e-skills report (2014), 70% of survey respondents perceived there to be a serious e-skills gap which impedes organisational performance and growth, and this e-skills challenge is augmented when examining new and emerging technological trends such as Big Data, Internet of Things, social tools and technologies, mobile, and cloud computing. The aforementioned report projected that in a period of future modest economic growth across Europe, there would likely be an e-skills gap of 509,000 jobs by 2015 with up to 1.2 million of a gap by 2020 due to lack of available talent. Within Europe, the UK, Germany and Italy accounts for 60% of vacancies but similar e-skills gaps are experienced globally in the US, Canada, Brazil, Australia, Russia, South Africa, Latin America, Malaysia and Japan.

Addressing the e-skills gap has been on the agenda of many nations for a number of years. A central theme throughout the literature is the extent to which the immaturity of the ICT profession is a key factor contributing to the e-skills gap. This chapter discusses the nature of the ICT profession and how it is influenced by the increasingly internationalised nature of ICT roles and functions. The growth of globalisation is a key factor in this shift in importance of the international context. This presents both challenges and opportunities for the ICT profession and, due to the pervasive nature of ICT, for societies as a whole. Research (Sherry et al, 2013; 2012 and 2014) illustrates that developing and maturing the ICT profession will better enable it to address the e-skills challenges and facilitate ICT's potential to drive growth and improve social conditions and quality of life. Conversely, a failure to develop the profession will both hamper growth and increase the potential risks of costly and dangerous ICT failures.

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The ICT profession

The report of the Innovation Value Institute and the Council of European Professional Informatics Societies, CEPIS, on 'e-Skills and ICT Professionalism – Fostering the ICT Profession in Europe' (2012) identified four building blocks for an ICT profession:

- Bodies of Knowledge (BoKs): The definition of an appropriate body of knowledge for a profession can be used as a basis to set standards and certification processes;
- Competences: an understanding of the capability and competency needs of people working in various roles is essential for organisations to effectively recruit and develop suitable employees;
- Education and training: Formal qualifications, certifications, and non-formal and informal learning are mutually supportive components of a professional's career development.;
- Professional ethics: A defining aspect of any profession involves adhering to professional ethical conduct.

There is no single agreed definition of an ICT professional as different countries and organisations have differing views on the topic. The definition used within the context of this research is derived from an earlier initiative by the European Commission. According to this 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.

Developing ICT professionalism at only a national level is no longer an adequate response to the scale and nature of the e-skills challenge.

To date, the ICT profession is not universally developed or matured at a high standard across these key professionalism components. This is a challenge on a national level. But it becomes more critical when understood in the international context. While ICT professionals have to work at a local level, their skills must also be understood and transferable anywhere in the world. Hence developing ICT professionalism at only a national level is no longer an adequate response to the scale and nature of the e-skills challenge.

The international dimension of the ICT profession

What evidence do we have that ICT is becoming an increasingly international profession? In a recent survey (2014) of stakeholders within the EU, more than three quarters (77%) of respondents believe that ICT is a global profession and that national efforts must align on a global basis to mature the profession successfully. Furthermore, a significant majority (80%) of respondents believe that ICT professionals should share a common understanding of a foundational ICT Body of Knowledge (a core body of knowledge that ICT practitioners must all be familiar with).

The international dimension is also becoming increasingly important within the European e-skills policy agenda. In March 2014, the European Commission organised an international workshop on e-skills in Brussels which included participation of ICT experts from all over the world including Europe, the US, Canada, Japan, Russia, Malaysia, Australia and Brazil. There was strong agreement about the need to strengthen dialogue and to collaborate at an international level in an effort to better address e-skills shortages, learn about international initiatives/good practices in an effort to foster a more mature ICT profession. Further insights into this workshop discussion are presented later in this chapter.

Maturing the ICT profession as a response the global e-skills challenge

Developing and maturing all of the building blocks of the ICT profession is considered key to providing an effective response to the global e-skills challenge. This needs to be undertaken in a manner that enables international movement of skilled workers, whilst respecting and acknowledging the cultural, economic and language differences between countries and regions. Increasingly,

advances in communications and the globalisation of many organisations means that workers may not need to physically relocate to provide their skills. The transferability of both work and workers is closely related to maturing the profession in terms of internationally recognised standards of qualifications and competence. This section examines all of the components of the ICT profession in turn, and discusses current initiatives to mature them on an international level.

Bodies of knowledge

BoKs provide a formalised ontology of the knowledge that is needed in order to be proficient in a certain profession. They contribute to professionalism by providing a formalised knowledge structure, which can then be used to develop curricula, standards and certification where appropriate (Agresti, 2008; Denning and Frailey, 2011). In any field they present a significant challenge in terms of their development and in keeping them up-to-date and relevant. Within ICT, these challenges are augmented due to the broad range of the profession and the rapid pace of technological change. A significant number of international initiatives have been undertaken to develop BoKs that have sufficient modularity and flexibility to work in a range of contexts i.e. the 'Software Engineering Body of Knowledge (SWEBOK) developed by IEEE, ACM's Computer Society Curricula, BCS' Chartered IT Professional Breadth of Knowledge Syllabus, CIPs and NASSCOM's Foundational Skills in IT). Further, a new 2014 project funded by the European Commission, currently being undertaken by Ernst and Young and Cap Gemini, focuses on developing a pan-European foundational body of knowledge for ICT.

Competence frameworks

The skills and competences necessary to perform in certain ICT professional roles can be formalised into a competence framework. Such frameworks can provide a more specific guide for educators and those involved in defining ICT job roles and recruitment. A range of such frameworks exist internationally and examples include the UK 'Skills Framework for the Information Age' (SFIA), the 'European e-Competence Framework' (e-CF) and, in Japan, the Common Career Skills Framework (IPA). The challenges in developing and using such frameworks include keeping them current and providing them in a format that is easy for educators and HR professionals to use. Some successful work has been done by the Australian Computer Society in developing teaching and HR templates to facilitate adoption. The consensus from the stakeholders consulted in this research project was that, in a similar way to BoKs, existing frameworks should be more effectively mapped rather than aiming to create a universal standard framework.

Education and training

Developing ICT as a profession requires education that provides a broad and deep understanding of the key concepts, as well as on-going training and development to keep ICT professionals up-to-date with developments in a fast changing field. There is a tension between the need for education to provide core understanding of concepts that do not change or change infrequently, and the perceived need of industry to have a workforce which is completely up-to-date with the latest technologies. Despite this tension, it is important to note that while university degrees and industry certifications are recognised credentials of importance, variances exist across countries as to the degree to which non formal/informal learning is recognised and valued (Carcary et al, 2012).

ICT professionals are rarely the isolated computer programmers conveyed by popular stereotypes. The majority need to work closely with the business and/or their organisations' social and political imperatives. Employers report that ICT graduates often lack the business or social skills needed and that extra training is required before they are 'work place ready'. This in itself raises the complex question of where the balance of responsibility should lie between state educators and employers in providing ICT education and training.

ICT professionals are rarely the isolated computer programmers conveyed by popular stereotypes. The majority need to work closely with the business and/or their organisations' social and political imperatives.

Recommendations include improving industry/academia collaboration that incorporates the use of mentoring and structured work placements. Curricula developments should also use competence frameworks and BoKs where appropriate to help ensure their courses relate to industry needs. New ICT trends and developments, such as Big Data, can be addressed through providing short focused 'boot camps' thus bypassing the difficultly of having to change entire third level curricula. In general, flexible and focussed approaches, for example Massive Open Online Courses (MOOCs), need to be used for updating in emerging skills, whilst more traditional channels can be used for foundational skills and conceptual understanding. Improving the quality of STEM (Science, Technology, Engineering and Mathematics) education at primary and secondary level is also seen as key to inspiring a pipeline of individuals who will be interested in ICT as a future career. Entrepreneurship skills and creativity are also increasingly incorporated in ICT education in different international contexts. All ICT education and training needs to work at being accessible and attractive to all sections of society as, at present, women and minority groups are under-represented.

Professional ethics

Ethical standards and a formalised code of ethics are seen as an essential part of professionalism within established professions, for example, that of law and medicine. Those who develop and control ICT within organisations have tremendous power to do harm either by failing in their duty of care or through malicious intent and, as such, also require high standards of ethical behaviour (Weckert et al, 2013). As ICT becomes more pervasive through society this level of risk increases. These factors would strongly suggest that the role of ethics in ICT professionalism needs to be strengthened and further formalised but this has challenges for such a diverse and global profession. As ICT operates closely with other aspects of a business, it may sometimes be expected to support or facilitate unethical behaviour that did not originate within the ICT function. Consultation with key international stakeholders at the recent international workshop suggested that ICT work on ethics needs to remain flexible enough to operate internationally and must be developed in usable formats for educators and professionals.

> The role of ethics in ICT professionalism needs to be strengthened and further formalised.

Professional associations are undertaking some interesting work in making ethical guidelines more adaptable and easy to use by professionals. CEPIS, for example, has done some work using stories and other tools to facilitate discussion and development of ethical understanding (CEPIS, 2014). The Australian Computer Society has developed extensive ethics case studies to show the relevance of ethics in various ICT professional contexts (ACS, 2014). Certification, except in very high risk contexts such as safety critical health ICT, was seen by the stakeholders consulted in this research as complex and potentially counterproductive.

Recommendations

All of the components or building blocks of the ICT profession need to be consistently matured in ways which work on an international as well as a national level. Indeed, ICT professionals increasingly work in global teams. Maturing the profession needs to be done through careful consultation and cooperation to ensure that cultural and language issues are respected, whilst facilitating the development of an internationally recognised ICT profession. This involves learning from 'what works' in other countries and coordinating the mapping of standards and frameworks that need to be internationally recognised.

CHAPTER 4
The e-Leadership Challenge

Overview

The accelerating power of information and communication technology, ICT, also referred to as 'e-' (electronic) or digital technology, has created a major transition in the global economy. This results in opening of new markets and changing the way organisations create their products and deliver services. Innovation helps to drive both these outcomes and the enabling processes (OECD 2010). This new reality, specifically the business models, ways of working and creating value, calls for new forms of organisation and, critically, significant adaptations in organisational leadership. To lead in today's global competition requires competence in identifying and exploiting a burgeoning range of innovation opportunities. Recognition is spreading in most Western economies of the growing demand for this quality of leadership in ICT innovation, increasingly referred to as e-leadership (e.g. Avolio et al 2001).

In the context of Europe's larger organisations, e-leadership requires not only thorough understanding of the fundamental capabilities of ICT and its latest developments, but also the ability to address organisational issues and lead staff highly qualified in disciplines outside ICT. Such a competently guided team can ensure the organisation takes advantage of new business models and exploits the innovation opportunities technology brings. In contrast, the effects of poor e-leadership are significant and have publically resulted in major delays and excessive costs for both public and private sector organisations.

The current e-skills gap in Europe

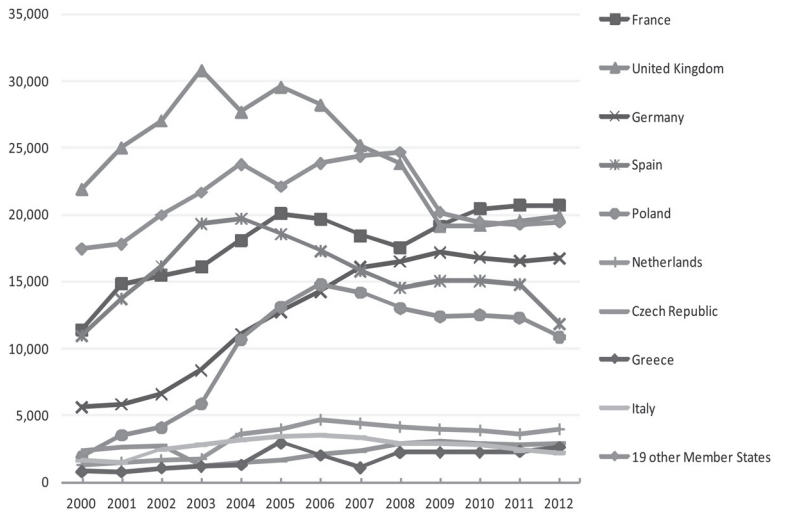
The economic downturn in Europe triggered by the 2007 financial crisis gave rise to unprecedented levels of unemployment, yet throughout that period, evidence grew that supply of certain areas of skills relating to ICT - e-skills - was inadequate, threatening economic growth, competitiveness and employment across the continent. The focus of addressing the skills gap needs to be both on technology and business exploitation of ICT.

For technology, the number of computer science graduates has been more or less stable, ranging from between 115,000 and 125,000 each year. Since 2006 there has been a decrease and since 2010 numbers have stagnated at the lower level of around 110,000 computer science graduates leaving higher education institutions annually in the member states of the European Union (EU27). The effect of the stagnation or decrease in the number of entrants to the ICT

workforce is intensified in Europe by an increasing number of exits, as ICT practitioners now begin to retire from the workforce.

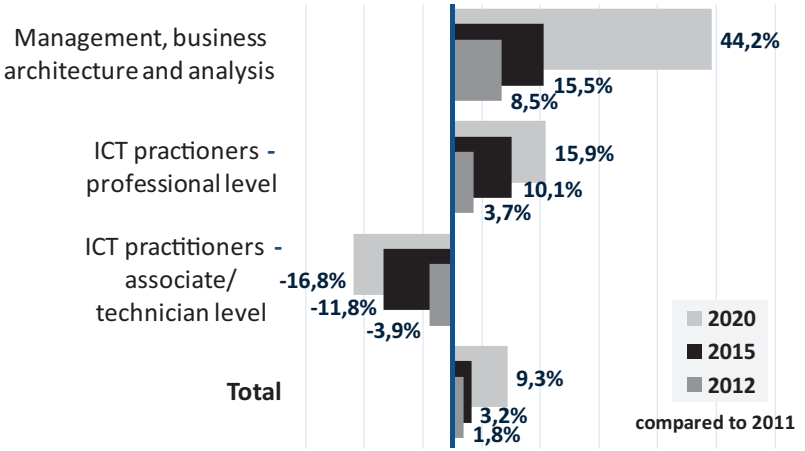
There are also some regional differences as shown in the figure below with UK computer science graduates declining by a third since 2003. France, overtaking the United Kingdom, now contributes 18% of European ICT graduates. The UK supplies 17% and Germany is third with a contribution of 15% of European computer science graduates entering the labour market. Ten years ago, the UK produced almost a third of Europe's Computer Scientists (30%) and Germany just 7% (Gareis et al. 2014).

Development of computer science graduates EU Member States 2000 – 2012



Source: Eurostat educ_grad5, some imputations apply

While the technology skills gaps remain a concern, the main area of unsatisfied demand in this market is in the higher skill categories, where e-leadership skills are located. The forecast presented in the figure below shows expected demand growth across broad ICT job categories, based on empirica and IDC projections of economic activity and labour market trends from the Eurostat Labour Force Survey. Overall the demand for e-skills is expected to grow most strongly in job categories related to management and business analysis. This presents challenges and opportunities to institutions of higher education.



ICT Workforce Development in Europe

These combined developments – a stagnating supply of computer science graduates and an increasing demand for the top e-leadership skills - have long been viewed with concern by leading industry groups. For example, the Human Resource Workgroup of EuroCIO, the European organisation of Chief Information Officers, concluded back in 2009 that extensive improvement was needed in the educational offers to meet these growing needs. EuroCIO acted on this concern, and engaged in innovative cooperation with leading business schools to develop new curricula for e-leadership. These are designed to improve skills and improve innovation-related decision-making at senior professional and executive levels of enterprises.

Responding to the inadequacies in the skills market flagged by stakeholders, the European Commission launched a series of initiatives designed to foster a full range of skills relating to ICT. These initiatives initially addressed the requirements for increased professionalism among IT practitioners, and developed strategies and instruments to bridge the gap between e-skills demand and supply at that level. The most recent focus has been on the skills gap in the e-leadership domain.

e-Leadership skills

The central challenge of e-leadership is to deliver greatly improved success in the detection, assessment and exploitation of ICT-related innovation opportunities. e-leadership skills can be seen to comprise the body of knowledge and set of competences that an individual in the modern economy requires to initiate and guide innovation utilising ICT. This view of e-leadership skills aligns with

well-established categorisations of e-skills, in particular, that presented by industry representatives in the 2004 European e-skills Forum report.

The European Commission chose to focus first on the leadership needs of medium to large enterprise at the top levels of decision-making. Here, decision-making on ICT-based innovation is oriented to more or less well-defined portfolios of multiple innovation opportunities (Peppard and Thorp 2013), and the pursuit of innovation requires engaging and leading highly qualified staff, some but not all with good understanding of ICT and its potential.

For effective leadership of the highly qualified, multi-disciplinary teams charged with innovation, the ability to appraise the work of these different specialists is essential. Accurate evaluation of ICT-related business opportunities is key to decision making at the top level of an enterprise. A leader in such a setting must communicate effectively with the teams and fully understand the tools for supporting decision optimisation. This requires not only profound, leading-edge ICT exploitation skills but also mature business skills, and skills to communicate and organise. e-leadership skills of this kind have been only partially contained in academic courses on information and computer science, whereas significant understanding of entrepreneurship and business management is needed up to CIO levels, and beyond.

Building on the e-leadership education landscape

Initiated by the European Commission, work began in 2013 to develop guidelines to support the expansion of provision of e-leadership curricula, with a focus on larger enterprises. Educational programmes based on these curricula are required to deliver multi-disciplinary capabilities at a very high level of expertise, suited to the leadership roles emerging today in larger private and public organisations in Europe.

An initial step was to identify the baseline in Europe's educational offer. Comprehensive research was carried out across Europe, covering the full landscape of relevant programmes. These typically combine the two basic skill sets for e-leadership - understanding of advanced IT and business innovation methods. Over 1,000 post graduate, Master's grade programmes were found across Europe delivering this mix of learning outcomes. However the vast majority of offers require full-time study and are targeted at career entrants. This is good for building a baseline for future e-leadership, but inadequate to deliver against innovation leadership requirements in the economy this decade. Less than 50 programmes across Europe potentially deliver full e-leadership skills to those who already bring with them significant experience in leadership, qualifying them to lead digital transformation in their organisations.

The programmes found in Europe with the potential to deliver e-leadership skills are too few to deliver the volumes to Europe's enterprise which industry

stakeholders are demanding, and action to scale up existing activity is necessary to meet EU innovation objectives: more e-leadership curricula are to be supported by training and education provider organisations in Europe.

Creating e-leadership education delivery tools for stakeholders

Guidelines to support this greater delivery of e-leadership skills education were developed from the educational programmes set up by EuroCIO. The intention was to scale up the existing intensive process of defining programme content in cooperation between employers and business schools. This work had proved capable of delivering successful e-leadership programmes that combined requirements arising in the management workplace with findings of the latest research in the relevant domains.

To encapsulate the guidelines, a format for profiling programmes and their underlying curricula was developed. The core of these curriculum profiles is a set of learning outcomes that are judged by academics and employers as essential to deliver decision-making competence on ICT innovation, particularly at C-level. Work with stakeholders in this process revealed a need for a number of different profiles of e-leadership, with professional topics from enterprise architecture to security and governance. Each such curriculum profile is validated by the involvement of knowledge-holders from industry.

The first e-leadership curriculum profiles were ratified by the board of EuroCIO in mid-2014. Many universities and business schools subsequently carried out an assessment of their programmes against the requirements of e-leadership encapsulated in the curriculum profiles, to assess the viability of the concept. The curriculum profiles have been accepted as facilitating dialogue between education and industry about required learning outcomes and can be used to improve programmes and education experiences by institutions of higher education in many European countries.

This work by the European Commission e-leadership initiatives for larger enterprises is complemented by work addressing SMEs and entrepreneurs. In both cases, stakeholders in industry and academia have been engaged in identifying opportunities to foster e-leadership skills development.

In Europe's smaller enterprises and among entrepreneurs, minimisation of learning workload for participants is top priority. It will be met by mixed mode teaching strategies that combine recorded content delivered remotely with on-site sessions. While maintaining networking value to participants, e.g. in short summer residential phases, and fully delivering the defined e-leadership learning outcomes, they make best use of teaching staff time. Individual study is combined with practices, which enable a maximum of continued active

leadership during a programme. Media designed for MOOC delivery have been found appropriate for some segments of learning.

Future directions

It is hoped that, in future, a greater number of educational institutions will team up with industry to roll out a range of courses based on e-leadership curricula, while re-defining and enhancing teaching formats. The increase in scale can be achieved by cooperative development and sharing of recorded content between educational establishments, relieving resource pressure, particularly on universities wanting to add technological depth to their programmes.

As the European Commission's e-leadership initiatives mature, governance needs to be transferred to trusted key actors/stakeholders, ensuring that governance processes are as lightweight as possible. A first step was to leverage existing governance structures set up by EuroCIO, created for its own executive educational programme. Dialogue with other top European associations and key stakeholders has taken place and in future decision-making at European level is likely to broaden in line with the multiplicity of interests involved.

The key message is that the e-leadership education ecosystem requires the active collaboration of multiple stakeholders to achieve the target of increased capability, innovation and value in Europe.

CHAPTER 5
The New Innovative Education

Preparing for a digital future: e-skills in education

The skills being developed via Europe's education system do not always mirror those needed in an increasingly digital world. Simultaneously, young people's high use of ICT is not always reflected by a willingness to study it: the number of maths, science and technology enrolments and graduates in Europe as a percentage of all fields has dropped over the past decade[1]. The result is a 'leaky pipeline' - a falling off of interest in science, technology, engineering and maths (STEM) studies – which begins at late primary level, continues through to tertiary level and ends with a shallow recruitment pool.

It is within this context that Europe is aiming for a 2020 EU employment rate for women and men of 75% for the 20-64 years age group. The "New Skills for New Jobs" initiative, launched in November 2010 aims to promote better anticipation of future skills needs; develop better matching between skills and labour market needs, and bridge the gap between the worlds of education and work.

In theory, Europe's education systems should already be equipping children and young people with the digital competences and e-skills needed for the 2020 job market. Yet, according to a newly constructed Digital Skills Indicator based on the Digital Competence Framework developed by the European Commission, 23% of the EU population has no digital skills (2012); ranging from 6% in Sweden to 50% in Romania. Considering that to function in the digital society one needs more than low-level skills, almost half the EU population (47%) can be considered as insufficiently digitally skilled (having low or no digital skills). This situation is potentially disastrous for the current generation who will find that the vast majority of jobs require e-skills when they arrive on the job market.

Education policy

Despite a clear gap in the competence of students compared to expectations, basic ICT knowledge is encouraged widely across the education system from a policy point of view. It is typically dealt with in a holistic manner at various levels of education: teacher competence; student competence; e-safety for all; ICT for people with special needs as well as actions addressing those impacted by digital divides. Policies also deal with infrastructure provision, ensuring that schools have access to relevant technologies such as interactive white boards, in some cases netbooks and tablets, as well as more traditional computer

1 From 24.1% in 2003 to 22.8% in 2012 (Eurostat)

laboratories (whether fixed or mobile). Digital content is also a priority in most European countries, from online communities of practice for teachers and students, through to the provision of e-textbooks or resource databanks.

European Schoolnet's 2013 Insight Country Reports from European member states indicate the existence of many relevant policies and practices from national Ministries of Education. These encourage the development of basic competences in ICT and the acknowledgement of digital literacy as a fundamental component of modern literacy concepts. There are a variety of approaches to implementing the teaching of digital literacy and competence at national level, from a standalone ICT curriculum, typically focusing on ICT user skills, through to embedding ICT into every subject.

Some countries (e.g. Germany) and regions use third party certification to validate basic ICT competence, for instance via the European Computer Driving License (ECDL). However, for the majority, the digital divide is not a key objective, and schools vary in how they actually implement top down government policies. This explains a great deal of the gap between policy objectives and student skill levels.

While current policies to ensure that ICT methods and tools filter down to the right parts of the education system must be maintained, in parallel, a focus on mainstreaming ICT approaches needs enhanced. Further attention should also be paid to digital divide issues, to ensure that all students acquire a good level of basic ICT competence, regardless of their background.

A major barrier to the learning of ICT skills remains the issue of teacher competence for which there is no common European standard. Global standards are not necessarily applicable in the European context so Ministries of Education are examining the need to establish their own standard, which should link to the European e-Competence Framework (e-CF). Multi-stakeholder initiatives allowing teachers to experiment with innovative pedagogy supported by technology are fundamental and European Schoolnet's Future Classroom Lab in Brussels is one such example: twenty-five technology companies have collaborated with Schoolnet's ministries to date impacting over 13,000 teachers.

Raising the bar

The e-CF, although useful as a starting point for basic digital literacy for all citizens, is not adequate for preparing those who may go on to more sophisticated IT training or academic pathways in computer science. This issue is endemic across the European member states and is well articulated in the Livingstone-Hope report published in 2011:

"Industries suffer from an education system that doesn't understand their needs. This is reinforced by a school curriculum that focuses in ICT on office skills rather than the more rigorous computer science and programming skills which high-tech industries like video games and visual effects need. At the same time, young people and their teachers need a greater awareness of the job prospects in these industries and the qualifications that can take them there. STEM subjects – the sciences, technology, engineering and maths – and art are key to success."

The report goes on to recommend that computer science as a discipline is given equal importance to other sciences such as physics and maths, taught from age eleven and up as part of the general basic curriculum in secondary schools. As a result of this call to action, the UK government has taken the step of replacing traditional ICT lessons (based on a digital competency approach) with computer science, focusing on programming, web design and development of applications for mobile devices.

Maths and physics

A crucial challenge in moving from basic IT competence to e-skills is achievement in mathematics and physics. Good mathematical skills – particularly understanding of algebra and algorithms - are essential for developing further programming and computational skills. Research from Microsoft Teaching and Learning indicates that mathematics is typically one of the areas where innovative methods are the least used in class. Similarly, physics knowledge and skills are essential for networking and computer science applications. The relatively low level of achievement and interest in these topics among students in Europe is worrying for the acquisition of higher-level e-skills.

Eurydice research points to a lack of policy at national level in many countries in Europe for supporting lower achievers. Countries that score higher in science and mathematics achievement in the OECD Programme for International Student Assessment (PISA) typically have robust systems in place to ensure that those who struggle with maths and physics are sufficiently supported to boost their achievement. Eurydice also points out that the specific role of ICT in mathematics is often neglected:

"The use of ICT in mathematics is prescribed in the majority of countries. However, despite their general availability, computers are rarely used during mathematics instruction. This contradiction points to a failure to make mathematics relevant by connecting it with a technology that students use on a daily basis."

Finally, mathematics and physics suffer particularly from low interest among girls. The examples and models used in these subjects typically appeal much more to boys than to their female counterparts. This often dissuades girls from taking up mathematics and physics at upper secondary level, acting as a barrier

computer science studies at tertiary level, and subsequent access to careers in the IT industry. A major factor in this challenge is the lack of focus on diversity concerns during pre-service teacher training, Eurydice finds:

"Dealing with diversity - i.e. teaching a diverse range of students, taking into account different interests of boys and girls - and avoiding gender stereotypes when interacting with students is the least often addressed competence in these programmes."

These concerns point to the need to enhance the quality of teaching and learning in mathematics and physics subjects, by implementing more innovative approaches, based on modern technologies, with much better attention to gender equality issues.

Computer science as a discipline

It is telling that there is little recent pan-European data on the role of computer science as a specific discipline in the curriculum. From European Schoolnet's Insight country reports, it is clear that computer science – if in the curriculum at all – is almost always optional. A rare exception to this is in Switzerland, where it became a mandatory subject in 2008. Another interesting case is Austria, where ICT for job roles is explicitly mentioned in national objectives, as well as "e-skills" above and beyond basic digital competence, including "practical computer science". Informatics is a standalone subject from early secondary. Competences acquired are certified via third party qualifications, such as ECDL but also via industry certifications from Cisco, Microsoft, SAP, Novell and Oracle.

Cyprus also implements computer science as a 'mandatory introduction' in the first year of upper secondary. In the following two grades of upper secondary students can elect to follow modules in computer science, applications and networks (the latter supported by the Cisco Networking Academy). In dedicated technical schools, an elective three-year computer engineering technician curriculum is offered covering the whole range of computer science.

A number of other countries have similar technical options available through the secondary vocational system, however, numbers of students, especially female students, in these optional courses are often low. Few countries mention the e-CF as a tool to map IT competence to a common European standard. This is a pity, as e-CF mapping would provide a better view of the situation across the EU.

Despite the relative lack of wider policies on computer science in European countries, there are nonetheless examples of lower level approaches to integrate computer science and technology in schooling:

- "Scratch", developed by The Massachusetts Institute of Technology (MIT) is a programming language for young children. Schools across the European Union are using it from primary level upwards. Scratch communities are particularly strong in the UK and Portugal;

- The SURFnet/Kennisnet project, financed by the Dutch Ministry of Education, Culture and Science, produces innovative applications and services that allow educational institutions to make optimum use of the potential of ICT. However, ICT is not compulsory in Dutch schools;

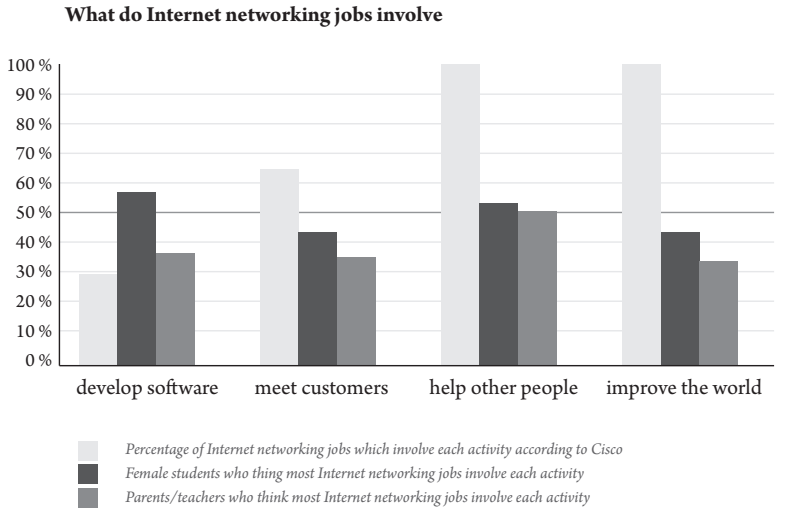
- Innovative Teaching and Learning (ITL) research sponsored by Microsoft's Partners in Learning programme, looks at the imperative to prepare youth for the 21st century. ITL focuses on teaching practices shown to have a strong relationship to 21st century learning outcomes. Results reveal that the majority of students are still in traditional roles of 'information consumers' rather than 'problem-solvers, innovators, and producers'. While ICT use in teaching is becoming more common, ICT use by students in their learning was the exception in many of the schools surveyed.

It is time to move from "islands of good practice" to a more mainstreamed approach to teaching and learning of computer science. Education systems across the European Union must examine the need to boost computer science, and to include much more sophisticated ICT skills as part of curricula. There is no need to wait for secondary or upper secondary level to bring in computer science topics – simple methods can be applied at the very youngest age of schooling.

It is time to move from "islands of good practice" to a more mainstreamed approach to teaching and learning of computer science.

Role models can influence negatively

Role models such as teachers, parents, careers advisors and media personalities influence young people's career choices. Female students, in particular, are reliant on the support of older role models in making career choices. The graph below compares views of female students, IT employees at Cisco and parents and teachers.



Parent and teacher perceptions of ICT careers appear particularly unrealistic: less than 35% believe that IT networking jobs have a positive effect on the world at large, and the vast majority believe that IT workers do not spend much time meeting others. This research indicates a strong likelihood that unrealistic career information is being passed on to young people. It is critical to improve parent and teacher perceptions of ICT careers if the pipeline of young people entering the field is to be expanded.

Bridging the gap between education and employment

Another major challenge in e-skills education is the divide between education and employment. Primary and secondary education reform is often driven by a perceived need to equip children with a corpus of knowledge that enables them to play a role as cultured citizens later in life. In many countries, there is scepticism about catering to industry needs in developing young people's skills for the future. This is driven by a concern that the education system should be more than just a pipeline for future jobs.

Undoubtedly young people need to acquire knowledge for its own sake and learn subjects that enhance their quality of life as well as employment opportunities. However, the balance has perhaps tipped too far in this direction: young people are suffering particularly from the impact of the economic crisis. Countries that have suffered less in the crisis – such as Netherlands, Germany and Austria – also have the strongest emphasis on youth employability measures, such as apprenticeships and employer engagement in schooling.

Dr. Anthony Mann, from the UK Education and Employers Taskforce observes that "OECD analysis demonstrates that those countries with education systems which offer combinations of classroom learning and workplace exposure linked to vocational pathways (as through the German-style apprenticeship system) typically experience much lower youth unemployment rates". His report goes on to say that "British evidence shows statistically significant positive relationships exist between the number of employer contacts (such as careers talks or work experience) that a young person experiences in school (between the ages of fourteen and nineteen) and their confidence (between nineteen to twenty-four) in progression towards ultimate career goals."

The European Commission's e-Skills for Jobs 2014 campaign is a good illustration of multi-stakeholder collaboration in this area. It brings together hundreds of cross-sector stakeholders to collectively raise awareness of IT careers and offer training and education opportunities to young people, the unemployed and employees re-skilling This federated action creates an impact which is more than the sum of its parts that should be sustained over the long-term to have the best possible impact.

On the wider challenge of science and technology, 'inGenious' funded at 50% via the European Commission's FP7 research programme and 50% by industry, is a joint initiative launched by European Schoolnet and the European Roundtable of Industrialists aiming to reinforce young European's interest in science and technology education and careers. All the actions undertaken in inGenious encourage school - industry collaboration to improve the image of STEM careers among young people and encourage wider interest in the opportunities STEM studies can bring.

Recommendations

The following issues are considered as priority:

- Raise the digital competence level of EU teachers. Introduce an e-CF compliant teacher accreditation to ensure that pupils across the EU benefit fully from investments in ICT infrastructure.

- Build digital competence from the bottom up. Ensure that e-skills are encouraged through primary and secondary education and, at upper levels, focus on higher-level e-skills in addition to digital competence.

- Enhance the teaching of science, specifically maths and physics. Increase the focus on diversity; support for struggling students and implement more innovative methods. Encourage employer engagement in careers advice programmes that also target critical role models, such as parents and teachers.

- Increase the number of multi-stakeholder partnerships bringing together industry and education partners to collectively address the challenge of both careers and skills acquisition.

- Continue to make e-skills and its supporting measures a key political priority to ensure long-term action and change in the education system.

CHAPTER 6
The New Digital Talent

Mining and harnessing talent

People with digital skills are almost always in short supply globally because ICT evolves at a rapid pace and education systems tend to transform more slowly. As the pervasiveness of ICT increases in our daily lives, shortages will become more acute. This chapter addresses two important issues at play in this situation:

- Existing skilled workers are not used to their full potential. Managerial strategies and techniques are needed to ensure that e-skills are fully exploited and effective IT-based innovation is facilitated.

- Millions of Europeans are marginalised with respect to the digital economy: women, seniors, disabled people and the digitally/socially excluded. Helping them to acquire e-skills could increase the supply of skilled workers.

Training programmes for the digitally excluded have proven to be successful, however, stronger, more widespread actions are needed. Despite the popular notion of the young "digital native", in 2013, one in four young Europeans still have low access to technology at home and school according to research conducted for the European Commission by European Schoolnet and the University of Liege. Action also needs to be taken to enhance the skills of the wider population, who although "included", are insufficiently confident and proficient to exploit technology to their advantage in everyday life and careers.

Addressing diversity

Low employee diversity continues to be of concern across Europe and the whole of the ICT sector, and it is especially acute in the IT-based SME sector. The image of the isolated young male worker, writing lines of programme code in a poorly lit office with no opportunities for autonomy and creativity lingers, and is often touted by influential role models. Yet the strengths of diverse teams are well documented and the collaborative nature of most ICT work is well understood, at least, within the sector. Research conducted by European Schoolnet for Cisco in 2009 shows significant discrepancies between the way workers describe their ICT jobs and the way role models – particularly parents and teachers – portray them[2]. While a lack of positive models in the media and culture at large dissuades people from seriously considering ICT careers. Women are a particularly large group that is impacted by this issue as ICT careers continue to be positioned and perceived as the preserve of men.

> "The lack of women in the fields of science and research has been a known fact for quite some time… If half of the 500 million Europeans don't get included and don't benefit from it, then we will have a gender and age imbalance as well as social injustice on a grand scale. We, as policy makers must take every measure to tackle this."
>
> Edit Herczog,
> former Member of the European Parliament.

Policy makers and ICT stakeholders need to come together to tackle this perception challenge. It deters potential new talent, restricts innovation in ICT development and use and results in an imbalance that impacts the wider economy and society. Edit Herczog refers to the elderly using researcher Mark Prensky's concept of "digital immigrants"; people who were not born into a web-enabled world. In calling for the demystification of ICT she observes: "Programmes and workshops should be continued to support and help them (the elderly) to understand that it's (ICT) a tool that assists in acquiring and exchanging information, not all that much different from radio or television… They (ICT-based services) can reduce the feeling of vulnerability and turn it to long-term independence."

As Europe's work force is ageing rapidly, e-skills can also provide an excellent addition to an experienced professional's profile, enhancing the relevance of their other skills in a changing job market. Other excluded groups can be tackled through models of non-formal education. IT-based community telecentres are an excellent platform for improving the digital literacy of disadvantaged groups across Europe. Typically located in public libraries, schools and community centres, and often run by voluntary or community organisations, telecentres are usually free, open and local. They provide access to technology, informal learning and networking opportunities that are attractive to the digitally excluded. Visitors often start learning basic digital skills impacting personal development, active citizenship and social inclusion and move on to employability, a critical construct of this model.

The MIREIA research estimated that there are almost 250,000 e-Inclusion organisations in the EU, or an average of one e-Inclusion organisation for every 2,000 inhabitants. However, national initiatives require synchronisation. With this in mind, the not-for-profit association Telecentre-Europe was formed.

Telecentre-Europe also plays a brokering role, encouraging information sharing between nations, thus enabling Europe to respond as an entity to evolving ICT needs.

e-skills deployment impacts success

Between 41% and 56% of firms in all sectors report that they are regularly recruiting IT specialists, and imply that many of these positions are "hard to fill". Empirical research from OECD and the European e-Skills Forum supports this view. It is vital, therefore, that we use our existing e-skills talent well.

ICT workers can be expensive to deploy, often requiring post hire re-training due to the specificity of many ICT companies. Furthermore, indicators reveal that European companies may be less able to harness e-skills for productivity than US organisations. Similarly, US-based firms in Europe appear to be more effective in achieving productivity gains through ICT than local companies. Differences in organisational and managerial practices and capabilities may explain this. There is also disparity among European companies. Large companies are very aware of the need for e-skills in new hires, while in SMEs this is less the case, despite strong evidence that SMEs can benefit greatly from effective IT use. In a global study conducted by Vanson Bourne, 60% of SMEs identified the use of computer technology as the deciding factor for their business thriving or just surviving. The public sector meanwhile demands e-skills due to increasing use of digital mechanisms for example in e-government and e-health.

Skills deficits can be addressed two ways: firstly enhance vocational training, workforce immigration or outsourcing; secondly improve the utilisation of trained or trainable personnel. Europe's current focus is on growing the talent pool yet attention must also be paid to harnessing that talent.

From the classroom to the workplace

Technology innovations shape the future of work so global trends in technology and innovation must be reflected in the delivery of education. Teachers need flexible learning solutions to engage and re-engage young people and lifelong learners, as well as the needed infrastructure in schools. School principals and teachers in Europe point to a shortage of computers in schools as being the biggest obstacle to innovative ICT-based learning, and one in two teachers would like more training in ICT pedagogy according to EU reports.

The evolution of cloud technology illustrates this point well. According to IDC, the cloud sector as a whole has a growth rate of more than 27% - yet 56% of European businesses cannot find staff to support cloud projects. Only a few innovative schools are starting to use cloud-based services in education, and higher-level cloud e-skills are still rare in university courses outside of computer science. Those versed with the right skills in cloud will be able to grow their

business. CIOs, therefore, need to be at the front line of cloud skills training. The evolution of new employment opportunities associated with cloud has been detailed in a Microsoft learning report entitled 'Cloud computing: what IT professionals need to know'.

The impact of technology or organisation and skills is a theme traversing the London School of Economics report 'Modelling the cloud: Employment effects in two exemplary sectors in the UK, Germany, Italy & the US'. The study reveals that cloud computing will result in managerial shifts across industry sectors and that managers will need to adopt more of a hybrid business and technology professional profile to succeed. IT skills are becoming more prevalent across the labour market and associated managerial implications are evident.

With record youth unemployment rates in Europe, the acquisition of 21st Century skills and accreditations will be critical if young people are to avail themselves of new job opportunities. The ICT industry must play a role in building and developing capability, working at all levels and in partnership with other stakeholders, to ensure ICT skills – combined with other job-relevant skills such as collaboration and effective communication - create clear pathways to employment opportunities.

Europe's e-skills challenge is also a management challenge

Findings from the London School of Economics Centre for Economic Performance reveal major differences in managerial practices regarding the use of IT, with European firms performing more poorly than their US competitors within the exact same markets, using the same technologies and recruiting from the same pool. This finding is backed up by research, also from the London School of Economics, which explored the management practices of both small and large firms within the aerospace industry. Wages and other incentives appeared to be greater in the USA for both high- and medium-level e-skills users and the types of tasks these workers routinely undertook appear to make better use of their skills.

Quality of management also impacts innovation. As one highly respected group of analysts of the economics and management of IT put it: "Firms do not simply plug in computers or telecommunications equipment and achieve service quality or efficiency gains. Instead they go through a sometimes lengthy and difficult process of co-invention. IT sellers invent technologies; they do not imply, but only enable, their application; IT users must co-invent applications. Co-invention, like all invention, has both process and product elements. On the process co-invention side, the effective use of IT often involves changes to organisations."

This observation points the spotlight on a hitherto under explored fracture in Europe's e-skills value chain. Europe's e-skills challenge is a management challenge – and increasingly a challenge across the full range of business skills such as finance, marketing and administration, which require effective e-skills to be able to deploy e-business tools to increase productivity and address business goals. Our focus should therefore move from the IT faculty towards the management school and policy makers would do well to reflect on this to avoid a misallocation of resources.

Talent attracts talent – beware Europe

Talented people tend to seek work in high performing organisations. Research on comparative wage levels shows that people will acquire more appropriate and higher level skills if they stand a reasonable chance of gaining employment in high performing organisations. And because such organisations can exploit skills better, they are able to offer higher salaries and better incentives for innovative work.

In an increasingly global market, European e-skills talent will pursue those organisations that provide the best opportunities. There is a real danger that these opportunities will increasingly lie beyond the confines of Europe. Thus as Europe refines its e-skills development processes, it risks becoming a net exporter of e-skills rather than a regional centre for high value innovation; an unfortunate outcome. However, it is a realistic one.

Recommendations

Europe's potential lies in the competencies of its people. Without pervasive infrastructure – particularly in education and training institutions - there can only be limited use of ICT and without skills there can only be limited economic and social value from that use. Increased access to devices and the Internet are essential, as well as better trained educators. If ignored, the lack of ICT skills will become the bottleneck that prevents the EU from being competitive in the global economy.

The Digital Agenda for Europe proposes a series of digital inclusion targets such as increasing regular Internet use from 60% to 75% by 2015 (and from 41% to 60% for disadvantaged people) and halving the proportion of population that has never used the internet by 2015 (to 15%). A Digital Literacy and Competence Action Plan is needed to achieve these goals. Such a plan would comprise specific digital literacy training actions for groups at risk of exclusion, promote multi-stakeholder partnerships and create incentives for private sector initiatives that provide training to all employed people. It should also be integrated in a holistic way with initiatives taken in the education sector.

As regards the challenges of productivity and leveraging the investment in existing technology talent, the following actions are key:

- Focus more on technology management and upon a self-conscious awareness of good management practice. Managers need better higher-level education that includes instruction on how best to leverage ICT resources while governments need to encourage poorly managed firms to acquire better skills;

- Employees with e-skills should be encouraged to play an active role in business strategy. Too often skilled personnel are limited in their activities to narrowly technical functions and not given the opportunity to apply their abilities in innovative, productivity enhancing ways;

- Ensure e-Skilled individuals have commensurately improved employment conditions. Pay and compensation, and in particular the unfavourable differential between those with skills and those with seniority but fewer skills, are disincentives for younger workers. While firms claim to face unmet supply, there is little evidence of increased wage levels in Europe for e-Skilled workers in general;

- Change the career prospects for e-Skilled individuals. ICT is deeply integrated into most successful organisations. However, e-Skilled personnel are rarely capable of, and even more rarely, encouraged to embark on the most attractive corporate careers in European firms;

- Governments need to ensure that their use of e-skills is exemplary; that their e-government functions are of top quality, and that they invest in experiments and best practice models;

- Ensure that basic skills are of comparable quality across labour markets so that employers can identify talent better. Employees will also benefit from a clearer understanding of what work expectations are through coordinated credentials and job descriptions.

Productivity growth through e-skills comes in two basic forms: through flexibility to adapt to new practices rapidly and cheaply, and through innovation. The European Commission and Member States should instil an enthusiasm for these capabilities in education, in government service and in public awareness programs.

The facts and the implications are clear. Policy makers, industry, academics, human resource specialists and organisational leaders are strongly encouraged to take heed.

CHAPTER 7
The Grand Coalition for Digital Jobs

Joining forces and working together

Europe is facing the paradoxical situation that 25 million people are currently out of work whilst, in certain countries, companies have a hard time finding skilled digital technology experts. In some countries, more than half of young people wanting to work are unemployed. At the same time, there could be up to 900,000 unfilled positions in information and communication technology (ICT) by 2020 if we do not take action. This is unacceptable. If we are to draw lessons from these statistics, we will need to explore how digital technologies are transforming Europe's society, economy and labour markets and what this means for our workforce.

The digital economy offers great job opportunities for Europeans but only if they have the right skills. One shift we are witnessing in our workforce is the polarisation of low- and high-skilled workers. Europeans with low qualifications are the worst affected by the economic crisis; they encounter increasing difficulties to find a job, face lower job stability and are outcompeted by medium-skilled workers even in elementary occupations. In contrast, high-skilled workers will greatly benefit from the shifting labour market. Europe is not particularly unique in this situation; we see this trend all over the world right now, such as in the US or Canada but also in several Asian countries.

Unlike most other parts of the economy, the ICT industry is creating new jobs. More than 100,000 new ICT jobs were created in 2012 while overall employment dropped. Digital skills are in high demand across all industries, not just the ICT sector. Companies in financial services, energy, automotive, retail, manufacturing, creative services and more are looking for ICT experts. Virtually, every sector of the economy relies on digital tools and people able to design, use and maintain them effectively. They all need experts for cloud computing, privacy and security, enterprise architecture, mobile application development, big data analytics or digital marketing, to name just a few. Many of these jobs are among the best paid in Europe.

Insights from the Grand Coalition for Digital Jobs

Given this situation, it is clear that we need to invest more in ICT training, revamp our education systems and promote careers in digital technology, especially among women. Only with a skilled labour force will digital technology continue to play a significant role in creating growth and value in Europe. This requires both short and long-term solutions. That is why the

European Commission launched the Grand Coalition for Digital Jobs in 2013 as a multi-stakeholder partnership to tackle the lack of digital skills in Europe and the several hundred of thousands of unfilled ICT-related vacancies. The experience with this initiative so far provides a few useful insights.

The **first insight** is that building a workforce fit for the digital age requires all stakeholders to work closely together: companies and governments, schools and universities. We need to improve the awareness about the exciting opportunities that exist in digital technology, in smaller and larger organisations. We need to adapt curricula and provide more in-house training opportunities. This is not trivial and requires decisive action, resources and a vision shared by all stakeholders. This vision is articulated around five broad goals:

(1) All Europeans need basic ICT training embedded in their education. We need to offer more aligned degrees and curricula at vocational schools and universities so students get the skills to succeed on the labour market. This includes coding skills.

(2) Young people, especially women, need to find out that digital technology is an attractive career option and that digital skills are essential for their professional success. We need to demystify ICT as a profession for geeks.

(3) Training packages need to be better co-designed with employers, ICT companies and traditional sectors so the skills people learn are the skills that business actually needs.

(4) Once people have completed their training, they need to get comparable certifications so employers recognise, reward and develop their skills.

(5) People need to be where the ICT jobs are. This requires better worker mobility in the EU or new approaches to bring the work where the people are.

The **second insight** from the Coalition for Digital Jobs is that all supporters are not merely discussing but taking action themselves: Fifty-five pledges have been submitted, including from large corporates, but also from smaller companies, education providers and NGOs. These supporters are pledging to offer training, internships and jobs; or to organise events and school visits to inform young people about ICT careers. We are also asking CEOs and political leaders to pledge substantial support for the Coalition, widening the membership to additional ICT and ICT-using companies. We want to create a stronger co-ownership of the Coalition by stakeholders and connect to funding opportunities through the Youth Guarantee, the European Social Fund and Erasmus+.

The **third insight** is that, as the challenges vary from country to country, national and local initiatives have to complement action at the European level

in the spirit of genuine subsidiarity. The EU should act only in areas where it provides European added value. National and local initiatives can take account of the specific needs at national, regional and local level. More than 10 national and local coalitions have been launched already and several others will start in the coming months.

The world is going digital and so is the labour market. The digital skills challenge will remain high on the political agenda for some time. Skills such as coding are the new literacy. Whether you want to be an engineer or a designer, a teacher, nurse or web entrepreneur, you will need digital skills. All of us, whether public policy makers, companies, educators and individuals, have a collective responsibility to ensure that Europe's workforce has the right digital skills. The right skills to remain at the avant-garde of digital technology and to enable our children to access tomorrow's jobs.

CHAPTER 8
The Vision for the Future

Moving ahead and raising our efforts

In 2014, Europe remains in dire need of productivity growth. The acute symptoms of the financial crisis may have receded but the underlying ills are not cured. Austerity and cost cutting alone cannot jumpstart prosperity. Fundamental long-term challenges such as ageing populations, uneven healthcare distribution, energy inefficiency and high pollution set ICT as a game changer.

Europe must foster the right skills to grow through innovation and entrepreneurial initiative. "Skills and workforce development are the currency of Europe's economic future," says Jan Muehlfeit, Chairman at Microsoft Europe and co-Chairman of the European e-Skills Association. And, innovation, says Peter Drucker, the father of modern management, "is the act of endowing resources with a new capacity to create value." ICT innovation has some particularities that determine the demand for skills:

- Fast-paced: Despite a dependency on longer term developments such as new mobile network standards or fundamental research in storage technologies, no other industry has comparable short cycles of innovation. Related skills therefore have a limited life span;

- Interdependent: ICT innovation rarely takes place in isolation. Concepts such as platform strategies are essential to the industry. Therefore, both technical developments and market dynamics inform the skills required, including in strategy;

- Social: ICT induces social phenomena such as mass collaboration, social media and crowdsourcing. It is reshaping social interaction and work processes. Hence, ICT drives skills demands in social, legal and management fields;

- Truly global: Having made location immaterial, ICT created one of the first truly globalised and globalising industries. Some aspects are local - in particular, those at the intersection with society, users and organisations - others are increasingly concentrated. For example, Google's services to over 100 countries are delivered out of just 12 large-scale data centres based in locations worldwide;

- Entrepreneurial: ICT innovation is increasingly driven by open innovation and processes like managing 'spin-outs' and external ventures as well as growth by mergers and acquisitions. Global players such as Facebook or Google were start-ups less than a decade ago;

- Transformational and disruptive: ICT enables waves of innovation, not only with new products and services, but also by creating a new nervous system within the enterprise to transform processes and organisational models. By providing the foundation for entirely new business models, ICT has the potential to both disrupt and reinvent industries.

Considering these important factors, a narrow, technology only oriented perspective of e-skills is not appropriate. People with an integrated skills set must support ICT. Education is at the heart of the solution. We have to integrate e-skills and ICT powered education deeper and more holistically into our educational systems and lifelong learning, including management and entrepreneurial skills and competencies.

As Michael Gorriz CIO of Daimler has remarked:

"The possibility to acquire and further develop the right e-skills for ICT professionals, and also for the structured task workers, should become the normal pattern in our society. This is not only needed within the larger organisations; it is also needed to build and develop Europe step-by-step towards an innovative society or to what is sometimes called a 'knowledge society."

Be warned

Europe is at risk. The pipeline that generates future European talent in ICT – a key discipline and industry of the 21st century – is deficient.

First, the potential to use ICT in primary and secondary education on a much larger scale and integrated with the curriculum remains largely untapped. It is during this phase of development that motivation for future studies is conceived and initial competences are acquired. ICT presents many opportunities for educators to develop innovative education models, in particular, by bringing the educational environment closer to the real world. Examples could be using open live data on environmental or traffic information in a geography lesson, accessing historical documents in digital libraries or performing data analytics based on large-scale realistic data in maths.

Study in ICT currently excludes critical e-skills competencies such as those related to the social dimension of ICT, entrepreneurship and innovation as well as general business skills. These skills are generally acquired after graduation, in professional life. Some universities recognise this challenge.

For example, the University of Warwick in the UK offers students the chance to take a short 'Key skills' programme.

This e-skills deficit in European primary, secondary school and higher education has created an ICT labour market environment where traditional academic credentials are of limited importance for employability. In reality, many ICT practitioners have academic degrees in areas other than computer science. ICT skills are demonstrated by work achievements, career paths, or simply claimed without formal possibilities to assess and verify them.

Now is the time to make it happen

In this Manifesto, leaders in their field are proposing a number of concrete actions to address the pipeline of ICT practitioners, which in turn will help rejuvenate and sustain both a healthy ICT sector and a broader e-Skilled workforce.

Start in primary and secondary education

The acquisition of e-skills early in life, starting from primary school to the outset of a student's academic career cultivates an innovative mind-set that will prove valuable when entering the workforce. Industry initiatives in schools and academia for teachers and students such as Microsoft's Imagine Cup, Intel's 'World Ahead Program' or Google's Science Fair underline the support of the ICT industry as well as the interest from pupils and students. Since its inception, 1.75 million students from over 190 countries have participated in the Imagine Cup.

A defining element in such initiatives is the use of creativity and entrepreneurial spirit by students while exposing them to problems that can be solved with the help of ICT. A further evolutionary step would be the integration of such learning elements into curricula in support of organisational innovation in educational institutions (e.g. exploring new learning spaces and topics), actually driving innovation in education with the help of ICT.

Increase the attractiveness of ICT careers

Integral to and building on from the action to transform education is the attractiveness of ICT as a profession. More transparent mapping of the vast opportunities and career progression within the field of ICT needs to happen for European citizens to build e-skills into their careers. For instance, the European e-Skills Career Portal facilitates matching the right skills to the right jobs in addition to breaking down some of the stigma around ICT careers.

A step change is still needed in regard to the perception of IT and among youth, women and the ageing workforce. One specific method would be to engage and

raise the profile of digital ambassadors in Europe as active role models in the ICT sector, as well as those from related communities, such as CIOs, digital entrepreneurs and leading scientists. Existing ICT practitioner stereotypes, if not addressed, will hinder the growth of the ICT service sector and hamper business innovation in almost all organisations.

Steps forward consider the active role that women can play in ICT. A good illustration of this is the Code of Best Practice of Women in ICT, an initiative of Neelie Kroes, Vice-President of the European Commission. It provides the first set of practical initiatives to enhance women's experience in ICT careers. Many academic and ICT industry partners have signed up to it.

Increase and broaden collaboration between academia and the ICT industry

In a fast-paced ICT world that is largely determined by entrepreneurial and market activity, academia has to maintain a close link to industry. Industry-driven programs involving universities such as the IBM Academic Initiative or Microsoft's Academic Alliance are important instruments. A first element has been to provide free or cost-reduced products and services to academia. New developments include the provisioning of industry scale data-centre capacities and big data analytics environments as in the joint Cloud Computing University Initiative by IBM and Google.

Further, the ICT industry has engaged in on-campus research centres, exchange of personnel and new forms of collaboration. An example of this is the Finnish Aalto University established in collaboration with Nokia Corporation and other industry partners and offering joint Design and Service Factories to support students' entrepreneurial activity and engagement in innovation projects.

The ICT industry has also engaged in advising academia on ways to improve and extend computer sciences and related curricula. An example of this is the IBM Service Science initiative that promotes curricula for ICT innovation on complex service systems such as healthcare or energy.

There is room for improved collaboration between private ICT training bodies, industry and academia. This touches on certification that should be offered as a complement to academic degrees. Skills subject to certification mostly relate to precise market demands, for example, maturity in software development methods and product training or specific programming languages. Certification can complement a broader academic education with specific elements that enable an employer to assess the maturity of a practitioner for a given ICT task, technology or tool. Certification, as it is described here, also addresses the problems of managing quality and of the fast-paced ICT market in which specific qualifications have a limited life span.

Promote European standards for certification

Raising the profile of ICT professionalism adds a new stimulus and dynamism to acquiring advanced ICT competences. When considering the investment of learning skills in a particular sector, accreditation is a very important benchmark because it fosters the mobility of professionals and provides the foundation for developing attractive career structures.

The development of the e-Competence Framework (e-CF) uniquely provides a consensual European multi-stakeholder reference for ICT practitioner competencies across member states and all industry sectors. The framework has the potential to become a major European asset. The ambitious work behind INSEAD's launch of the European e-Competence Curriculum guidelines, aligned with the e-CF, recognises ICT practitioners through a standardised curriculum. This strengthens the role of European universities in supplying ICT practitioners and e-competent managers in Europe. Indeed, this is a step in the right direction.

Partnerships for innovation in ICT education and e-skills development

Governments, industry and academia should work closely together to ensure that Europe has the advanced e-skills needed in emerging areas such as cloud computing, Green IT, cyber-security, interoperability and e-Health. Skills for success in the ICT industry will have to evolve and align to new streams of growth. The impact of e-skills upon sectors such as health will change and improve the way we address some of society's biggest challenges.

European organisations busy advancing ICT education and e-skills include but are not limited to: The European Institute of Technology and Innovation (EIT) – ICT Labs; The European e-Skills Association (EeSA); The European Learning Industry Group (ELIG); The European Foundation for Management Development (EFMD); European Schoolnet (EUN); DIGITALEUROPE etc. Each of them contributes to the wider goals set out in this manifesto and more broadly drives forward the European Commission's e-skills strategy at a grass roots level.

Poised to make the next steps, Europe and member states must now act upon the recommendations that have been outlined here. A large-scale and concerted investment is required by all stakeholders to ensure that Europe can fully benefit from improved competitiveness, stronger growth and better jobs.

Challenges can be summarised as:

- Create the integrative e-skills needed for the ICT professions of the future.
- Advance the role of ICT and learning in primary and secondary education to achieve wider interest and motivation for ICT careers.
- Broaden and innovate with academic curricula on computer sciences and related disciplines to tackle the ICT challenges of the future; this implies overcoming the predominant technical focus on the ICT discipline.
- Create new partnership models between industry and academia, in particular, to foster student involvement in ICT based innovation and entrepreneurial learning.
- Complement academic qualifications with industry-led non-formal qualifications following standards accepted throughout Europe and certification schemes.

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