Strengthening e-Skills for Innovation in Europe

Building on partnerships between academia, industry and government for better e-competences curricula

Nils Olaya Fonstad
Bruno Lanvin
INSEAD eLab

Prepared for the European Commission

European Commission
Enterprise and Industry

INSEAD

Foreword

Costas Andropoulos

Head of Unit:

ICT for Competitiveness and Innovation
Innovation Policy Directorate
DG Enterprise and Industry
European Commission

The European Union needs to ensure that the knowledge, skills, competence and creativity of the European workforce – including its ICT practitioners – meet the highest global standard and are constantly updated in a process of effective lifelong learning.

The European Commission adopted in September 2007 a Communication on "e-Skills for the 21st Century" presenting a long term e-skills agenda[1] for Europe and including key action lines at EU level. The Competitiveness Council of Ministers welcomed this Communication and adopted Conclusions on a long term e-skills strategy at its meeting on 22-23 November 2007. Stakeholders also welcomed this initiative and have established the e-Skills Industry Leadership Board to contribute to implementing the strategy.

To take full advantage of the strategic and operational opportunities offered by information and communication technologies (ICT), it is clear that more and better qualified ICT practitioners as well as e-skilled professionals and citizens are needed. The e-skills strategy has progressed with several visible achievements and the European e-Skills Conference which took place on 20 November 2009 in Brussels delivered some very welcome messages of encouragement in today's challenging times. Europe is increasingly developing its human capital to be globally competitive and is making significant progress towards the important goal of implementing a long-term e-skills strategy.

The European Union must remain an attractive place to live and do business. To this end it is necessary to continue to work at providing a rich science and technology environment and the availability of a breadth and depth of skilled labour force performing well in the latest technologies. This study provides useful guidelines to improve the quality, the relevance and the attractiveness of ICT education and training. It is particularly interesting because there is a real need to strengthen the cooperation between government, industry and universities in supplying ICT practitioners and e-competent professionals in Europe.

[1] http://ec.europa.eu/enterprise/sectors/ict/e-skills/index_en.htm

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Acknowledgements

This project would not have been possible without the generous participation of many.

We are grateful of the support and contributions of the Steering Committee, consisting of Elena Bonfiglioli of Microsoft, Peter Hagedoorn of EuroCIO, Terry Hook of e-skills UK; Markku Markkula of TKK Dipoli and Aalto University, Corinna Schulze of IBM, and Heino Schrader of SAP. Within the European Commission our contact point was André Richier (Enterprise and Industry Directorate-General, Innovation Policy Directorate, ICT for competitiveness and innovation Unit).

We are especially grateful for the assistance of Annemieke Biesma, David Fréderix, Kristine Bitnere, Roberto Bruni and Sonja Ekholm from RB & Partners. Finally, we are very grateful to the many professionals who took time from their important efforts at enhancing ICT capabilities to talk with us.

Imprint: This brochure has been prepared by INSEAD eLab on behalf of the European Commission, Enterprise and Industry Directorate General. It is a publication of the European e-Competences Curricula Development Guidelines project, which was carried out by Nils Olaya Fonstad and Bruno Lanvin of INSEAD eLab. INSEAD eLab is INSEAD's center of excellence for thought leadership, community outreach and value creation in the knowledge economy.

Part I: Better curricula for better e-competences

e-competences are critical for innovating and for operating more effectively and at lower cost

Definition of e-competences

We define e-competences as an integrated set of technical and managerial capabilities that organizations need to achieve their objectives.

E-competences are e-skills with a strong emphasis on inter-personal and business skills. The European e-Skills Forum (2004) has defined e-skills as consisting of three types of skills:

- ICT user skills: the capabilities required for effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work, which is, in most cases, not ICT. User skills cover the utilization of common generic software tools and the use of specialized tools supporting business functions within industries other than the ICT industry.
- ICT practitioner skills: the capabilities required for researching, developing and designing, managing, the producing, consulting, marketing and selling, the integrating, installing and administrating, the maintaining, supporting and service of ICT systems.
- e-Business skills: the capabilities needed to exploit opportunities provided by ICT, notably the Internet, to ensure more efficient and effective performance of different types of organizations, to explore possibilities for new ways of conducting business and organizational processes, and to establish new businesses.

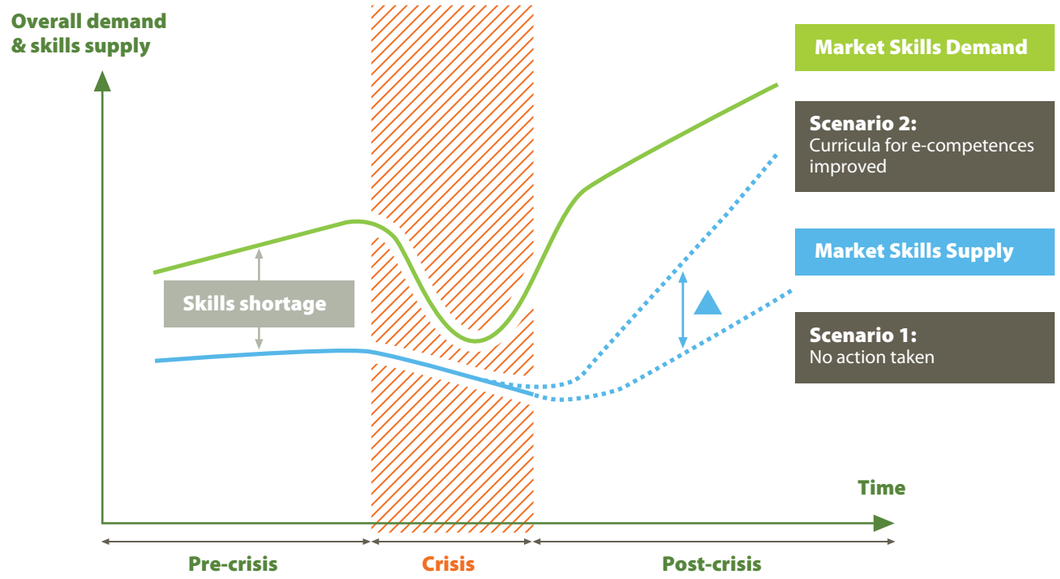
Demand for e-skills has been growing steadily for several decades - from both firms that provide ICT services and those who do not, from non-profit and from public sector organizations. In the coming years, e-skills and ICT-skills will be a core component of Europe's 'new skills for new jobs' strategy for at least two reasons:

- A greater number of organizations are using ICT to support an increasing percentage of operational processes, products, and services. This is the result of three main factors: the cost of ICT and ICT services has decreased, ICT vendors are offering better and more relevant products and services, and, as more organizations use ICT, the network value of ICT has increased.
- As ICT becomes a more integral part of their operations, organizations are discovering new strategic uses and roles for ICT professionals, such as managing projects and pursuing synergies across traditionally independent business units (e.g., standardizing technology and integrating data to develop a "single face" to the customer), innovating collaboratively, and involving their consumers, partners and even competitors in new ways of creating value.

In the trail of this growing demand for ICT professionals, we also witness a growing demand for professionals with a broad variety of both technical and business capabilities. Today, many organizations are struggling to find e-competences managers. Even before the current economic crisis, companies all over the world were increasingly struggling to hire people who were competent in both information technology and business management. This trend will be even stronger once signs of recovery start to spread.

All firms – whether small, medium, large and whether or not in the ICT sector – need e-competences to compete.

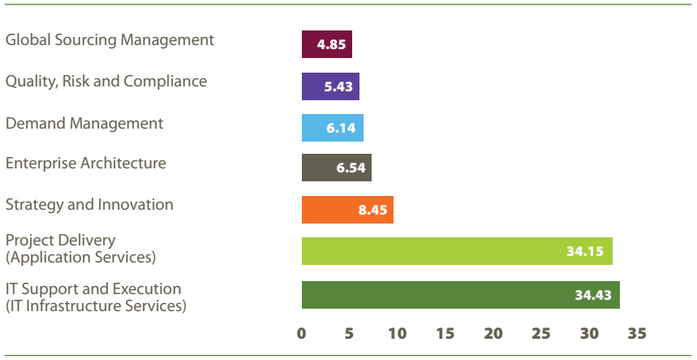
Europe's Skills Gap



Before the current economic crisis, companies all over the world were increasingly struggling to hire people who were competent in both information technology and business management.

In Europe, the most recent research findings underscore the cost to competitiveness due to shortage of key ICT skills. A December 2009 study by Empirica and IDC EMEA Government Insights anticipates that by 2015, the gap between the ICT professionals that firms need and those that are available in Europe (i.e. "unfilled vacancies of ICT professionals") will be between 1.7% and 13% of the estimated 5 million available. The researchers of the study developed five foresight scenarios for Europe including a "back to normal" scenario, which anticipates how the labor market for ICT practitioners will evolve if Europe returns to previous, pre-crisis trajectories.

The number of ICT professionals in Europe was 4.7 million in 2007 and researchers forecast it to be between 4.95 and 5.26 million in 2015 depending on the five foresight scenarios they developed. According to the study, the EU labour market may face an excess demand of 384,000 ICT practitioners by 2015 (Catteneo et al., 2009).



Average percentage of e-competent full-time equivalents that belong to a specific function.

Source: Fonstad and Lanvin (2010). "Final Report for the European e-Competences Curricula Development Guidelines Project." Funded by the European Commission.

e-competences are fundamental to innovation and cooperation

e-competences consist of three types of skills that together correlate with global competitiveness.

In February 2009, INSEAD eLab produced a background report for the 2009 European Business Summit, entitled 'Who Cares? Who Dares? Providing skills for an innovative and sustainable Europe' (Lanvin and Fonstad, 2009).

The report emphasized how e-competences are critical to competitiveness, and used a simplified model (INSEAD eLab Skills Pyramid) to describe the various skills gaps to be addressed in Europe.

The Importance of e-competences at Daimler

This vignette consists of responses provided by Michael Gorriz, CIO of Daimler Benz AG, to interview questions from the authors. We are grateful to Sandra Schmid for her assistance in developing this vignette.

The roles of information technology management

IT is the central nerve system of Daimler AG. Nearly all of the company's business processes are supported by information technology – from product development to vehicle production and processes in sales, HR, Finance and accounting. Secure, powerful and efficient IT systems are a prerequisite for Daimler's business success.

As CIO of Daimler AG, I am responsible for leading the organization Information Technology Management (IT-Management), a network of 4,600 highly productive and motivated IT employees in over 500 locations worldwide. Over the past years, the role of IT-Management has extended far beyond simply providing and managing IT services.

Today, IT-Management splits its time in the following manner across four areas of responsibilities:[1]

Managing IT Services (40 percent): Fundamentally, IT-Management provides stable, efficient systems for 173,000 Daimler employees worldwide. The team has the task of maintaining the functionality of more than 5,000 applications at all times, and of continuously optimizing them.

1. These four categories are drawn from Weill, P. and S. Woerner. (2009). "The future of the CIO." MIT Sloan CISR Research Briefing. IX.1. January 2009

Working with Non-IT Colleagues (30 percent): IT-Management actively partners with the business units and functional areas to provide technology for their initiatives. A stringent project portfolio management guarantees the prioritization of those initiatives compliant with the strategy of the divisions and creating value add for the company.

Working with External Partners (15 percent): The management of external partners such as suppliers and/or the continuous exchange with external service providers is a self-evident task of IT-Management; including the establishment of electronic linkages via a secure, corporate IT environment to protect our business partners from security threats.

Managing Enterprise-wide Processes (15 percent): The intelligent digitalization of business processes is a key competitive factor driven by IT. Examples at Daimler are the product development process, which has been integrated from a first idea into the 'digital plant', or the new point of sales for Mercedes-Benz Cars, where IT-Management has integrated all processes into one portal regarding car information, leasing and financing processes as well as customer relationship management processes. IT-Management is also the driver for organizational changes and a new management style. For example, it lead the implementation of a consolidated Enterprise Resource Planning system within the Powertrain department of Mercedes-Benz Cars, eliminating 30 individual legacy systems and reducing operating costs by 25 percent.

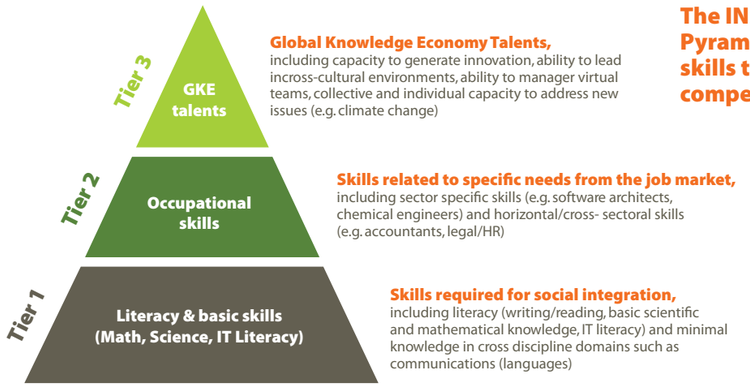
In the future, I anticipate spending less percentage of my time on managing IT services and more time on managing enterprise-wide processes.

The roles of e-competences for the mobility concept car2go

Innovation is the key for the competitiveness of enterprises in a global competition. car2go is an example for IT as enabler for a new business model and revenue generator.

car2go is a completely new mobility concept from Daimler AG which redefines individual transportation in congested areas. For the first time, customers can rent two-person Smart vehicles everywhere, anytime at attractive "by-the-minute" rates. Vehicles can be located via cell phone or Internet and used either on the spur of the moment or reserved in advance. Innovative telematics technology facilitates an easy, convenient rental process. The vehicles do not have to be returned to the point of pick up at the end of the rental period. Daimler currently is piloting this innovative concept in two cities – Ulm, Germany and Austin, Texas in the United States.

There was no 'ready-to-go' solution available on the market. The concept had to be created from scratch. This required a variety of e-competencies from the project group of Daimler IT, such as analyzing the business processes; specifying and building the software systems; preparing a test infrastructure; integrating hundreds of key components, and operating the system within the European Data Center of Daimler in Stuttgart. Last but not least, business consulting skills for architecture and/or security questions, comprehension of business processes, and customer relationship management were essential to the success of the innovation.

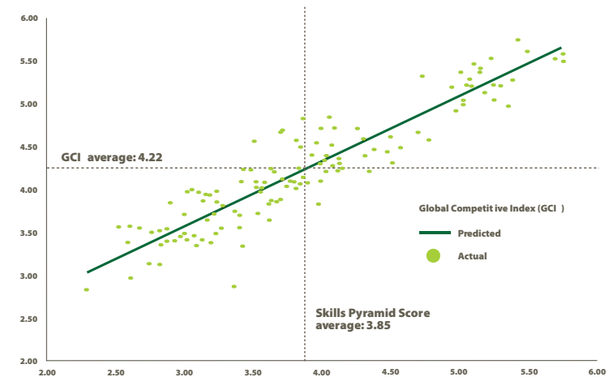


Global Knowledge Economy Talents, including capacity to generate innovation, ability to lead incross-cultural environments, ability to manager virtual teams, collective and individual capacity to address new issues (e.g. climate change)

Skills related to specific needs from the job market, including sector specific skills (e.g. software architects, chemical engineers) and horizontal/cross- sectoral skills (e.g. accountants, legal/HR)

Skills required for social integration, including literacy (writing/reading, basic scientific and mathematical knowledge, IT literacy) and minimal knowledge in cross discipline domains such as communications (languages)

The INSEAD eLab Skills Pyramid - Three types of skills that correlate with competitiveness.



A large part of the variation in global competitiveness is explained by skills.

Eighty four percent of the variation in the WEF Global Competitiveness Index is accounted for by the INSEAD eLab Skills Pyramid.

Source: Lanvin, B. and Fonstad, N. (2009) "Who Cares? Who Dares? Providing skills for an innovative and sustainable Europe." Background report prepared by INSEAD eLab for the European Business Summit 2009.

Defining Demand

Collaboration between universities, firms and governments has already allowed significant progress in one fundamental aspect of effective e-curricula development: defining demand.

A number of multi-stakeholder collaborations have developed complementary definitions of what key capabilities constitute "e-competences." Several of these collaborations have identified a range of specific capabilities that go beyond traditional technical ICT capabilities (e.g., important operational capabilities) and that reflect new roles for ICT in organizations, such as strategic enterprise architecture, systems management, business process mapping, change management, and project portfolio management. At a national level, examples of especially effective multi-stakeholder collaborations include the Advanced IT Training System (Germany), e-skills UK, and CIGREF (France).

At a European level, **Career Space** was an important early example of a multi-stakeholder partnership focused on defining and fostering e-skills. Between 1998 and 2002, the Career Space initiative included major universities, ICT companies and different stakeholders such as British Telecom, Cisco Systems, IBM Europe, Intel, Microsoft Europe, Nokia, Nortel Networks, Philips Semiconductors, Siemens AG, Telefonica S.A. and Thalès. In addition, the European Information and Communications Technology Industry Association (EICTA), the Convention of National Societies of Electrical Engineers of Europe (EUREL), the E-skills National Training Organization (NTO UK), and many more associations participated in this pioneering effort.

While Career Space was intentionally European-centric - engaging in particular with the European Commission - several other industry groups worked together in a global context, to develop common efforts to identify critical skills and functions, and to channel resources towards their development.

European e-Competence Framework (e-CF)

One of the most relevant multi-stakeholder collaborations is the CEN/ISSS Workgroup on ICT Skills, which includes representatives from industry, academia, and government who have collaborated in developing the e-Competence Framework. To synchronize e-skills-building efforts in the EU and implement the recommendations of the European e-Skills Forum, the European Commission supported the development of the European e-Competence Framework (e-CF) in coordination with a wide variety of ICT stakeholders. The aim of the framework is to establish a common understanding for ICT competences in Europe. It articulates the knowledge, skills and competence as needed and applied in the ICT workplace that can be used by ICT user and supply companies, the public sector, educational and social partners in Europe. In particular, the framework provides a reference point for users in order to develop their general competences and for managers in the industry to use in long-term strategy planning.

Over the two-year period, participants in developing the framework identified 32 core ICT competences for practitioners and managers regardless of hardware/software components. The resulting framework classifies each skill into planning, building, running, enabling or managing skills that reflect the ICT business process and its main sub-processes. Furthermore, the skills were organized by five competence areas (e-1 to e-5) ranging from support/services to strategy management. These can be used to provide detailed profiling where various competence combinations are involved.

e-competences combine three types of technical and business skills.

To complement other e-competence frameworks and matrices and to emphasize the richness of "e-competences" we have developed an INSEAD e-competences matrix.

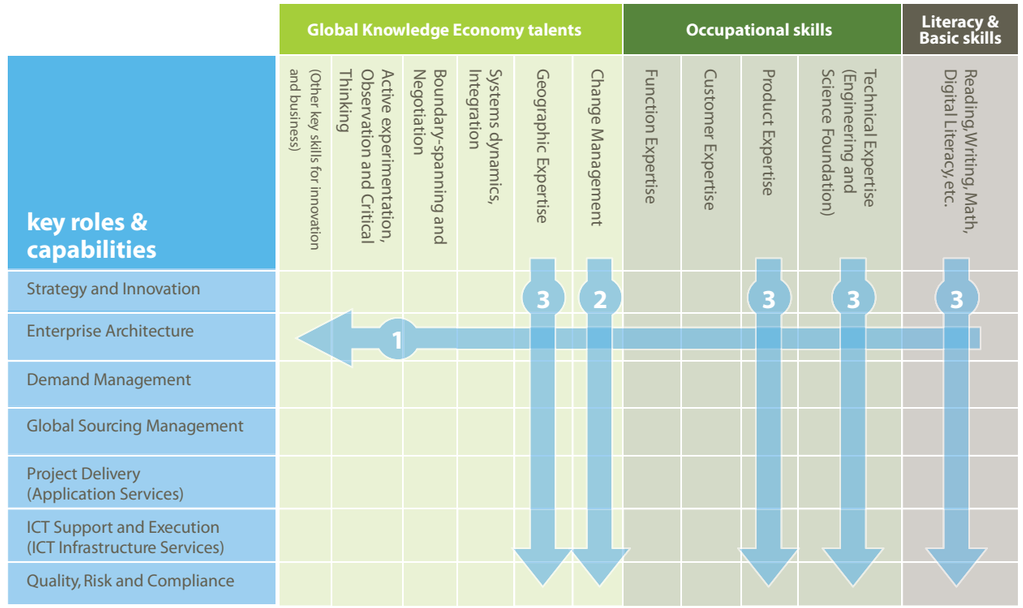
The rows of the INSEAD e-competences matrix consist of the seven key capabilities that make up EuroCIO's e-competences matrix. They were used for our survey of CIOs. The columns of the matrix provide a more detailed view of the three types of skills that make up the INSEAD eLab Skills Pyramid (please see page 7).

In the case of Occupation Skills, we have incorporated our findings on the prevalence of matrix organizations. An important occupational aspect of some ICT professionals is not simply technical expertise (e.g., software programming) but also product, customer, or functional expertise. Finally, in addition to occupational skills and basic math and literacy skills, e-competence professionals must have Global Knowledge Economy talents. We have listed just a few, based on recent research on change management and innovations skills.

Arrow One refers to specific e-competence curricula (e.g., enterprise architecture) that consist of opportunities for developing all three types of skills in an integrated manner.

Arrow Two refers to curricula that are focused on one specific business skill (e.g., change management), applied to a variety of roles of ICT professionals in matrix organizations. Enterprise architects, for example, need to manage change when introducing a new standard; global sourcing managers need to manage change when transforming a service from internally to externally serviced; etc.

Arrow Three refers to larger programs that are focused in a specific function (or set of functions) within a specific industrial sector (e.g., reservoir analysis and management in the oil and gas industry). Curricula for these programs address an integrated set of three types of skills as well as a variety of roles.



Source: Fonstad, N. and Lanvin, B. (2010) "Final Report for the European e-Competences Curricula Development Guidelines Project," funded by the European Commission

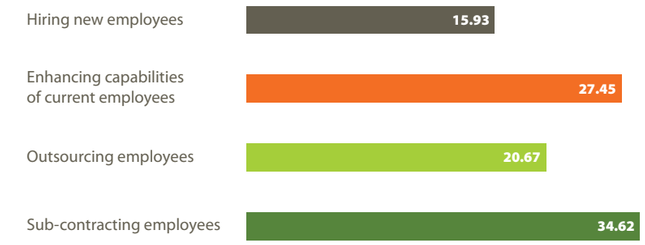
Satisfying Demand

The e-competences priorities and concerns of employers are well defined.

1. Firms rely on a variety of e-competences, however those that are in greatest demand (e.g., enterprise architecture) do not necessarily involve the greatest number of people and tend to be at more senior-levels of the organization. Thus the greatest demand is for a select however strategically key people.
2. Firms rely on a portfolio of approaches to meet their need for e-competent managers. (figure, below).
3. Firms invest in a portfolio of options for building e-competences of current employees.
4. E-competence curricula are seen as critical to meet demand while respecting firms' priorities, concerns and practices.

Firms are addressing their needs for e-competences in four complementary ways.

1. Hiring new employees – either from other firms or from Universities.
2. Enhancing capabilities of current employees – investing resources into building capabilities of employees (up-skilling and re-skilling).
3. Sub-contracting employees – temporarily hiring employees.
4. Outsourcing employees – accessing employees who work for an external service provider.



Average percentage of demand for e-competent managers that is met by one of four ways.

Source: Fonstad and Lanvin (2010). "Final Report for the European e-Competences Curricula Development Guidelines Project." funded by the European Commission.

Universities have a fundamental role in satisfying the demand of companies for e-competences

Universities are providing a wide variety of opportunities for those entering the workforce and those from the existing workforce to develop e-competences.

- **For those entering the workforce**, courses are offered in business and ICT management that can lead to a University degree (e.g., a BA or MSc) or to a certificate (e.g., certificate of attending open enrolment Executive Education Seminar, ICT vendor courses for earning a vendor certificate).

For those from the existing workforce, Universities offer the same options as well as on-site training (e.g., custom programs, internal University courses) and off-site advanced degree programs designed to accommodate work hours.

- **Firms rely on a variety of methods to enhance the e-competences of existing employees** – all of which involve curricula and universities. Our research found that firms invest in at least six different opportunities for developing the e-competences of existing employees:

in-house training provided by a University; in-house training provided by an external firm; in-house training provided by employees; external business degree programs; external ICT degree programs; external University courses. In practice the e-competence development within a company is organized as a combination of several of these forms.

Average percentage of total up-skilling budget spent on different opportunities.

	Average percentage of the total amount spent of re-skilling that was spent on the following option						
	External Business Degree Programs (%)	**External IT Degree Programs (%)**	**External University Courses (%)**	**In-House Training provided by a university course (%)**	**In-House Training provided by an external firm (%)**	**In-House Training provided by employees (%)**	**Other (%)**
Avg. across all participating firms (35)	5%	7%	11%	8%	23%	13%	9%
Percentage of firms that invest in this option	40%	49%	69%	57%	83%	63%	17%
Of the firms that do invest in this option, avg. percentage of total invested	16%	21%	22%	20%	39%	30%	72%

Source: Fonstad and Lanvin (2010). "Final Report for the European e-Competences Curricula Development Guidelines Project." funded by the European Commission.

Building e-Competences

Industry and business have often taken the lead in successful efforts to build better curricula for e-competences. Best practices can be identified from those experiences, providing additional energy and insights on how multi-stakeholders partnerships can help Europe face its current and future e-skills challenges.

Industry-led efforts

A significant array of ICT vendors have developed successful courses and certification processes, which can be offered by academic institutions. Examples of such approaches include Microsoft Academy, SAP University Alliance, and IBM's efforts at developing Services Science.

University-led efforts

University-led efforts at developing e-competence curricula have involved not only Universities, but also industry and government entities. Notable examples include Aalto University (in Finland), CEFRIEL (led by Politecnico Milano in Italy), Foundation Degrees (gathering a wide range of educational institutions in the UK), It-vest (led by three universities in Denmark, including Aarhus School of Business), and the Petroleum Learning Centre at Tomsk Polytechnic University (a joint effort in Russia with Edinburgh's Heriot-Wat University).

Microsoft IT Academy Program

The Microsoft IT Academy Program is an annual membership program that enables academic institutions to deliver training on Microsoft technologies to students and resources on the latest Microsoft technologies to faculty.

Microsoft IT Academy has developed curriculum and certificates for a range of careers. Careers consist of "pathways" – i.e., sequences of job roles that build on each other in terms of coursework and certificates. For example, to become a Systems Engineer requires a Microsoft Certificate in Systems Engineering (MCSE), which is earned taking four courses and exams – all of which are taken after having become a Systems Administrator, which requires a Microsoft Certificate in Systems Administration (MCSA), which is earned taking three courses and exams – all of which require first becoming a Digitally Aware Individual and then a Computer Technician. Microsoft has designed seven such pathways consisting of over 40 courses and examinations and 7 certifications.

Microsoft IT Academy provides various benefits to members, such as curriculum (e.g., Microsoft Official Courseware) and multimedia courses (which include simulations, games, videos, and interactive text designed to help students master skills, and to provide instructors with ongoing professional development opportunities), software and resources, certification exams, instructor professional development, and marketing resources.

Most recently, Microsoft and the IT Academies of UK's National Health Service have partnered to deliver best practice IT skills through the launch of a comprehensive suite of IT Professional training for NHS employees. This has come as a result of a significant collaborative effort between the NHS and Microsoft in a bid to integrate the NHS IT Academies with Microsoft's existing NHS Resource Centre online IT training platform. This strategic partnership has enabled Microsoft to support NHS efficiency, cost saving and EWA value by delivering best practice IT training to all staff, from end users to IT Pros. In conjunction with the IT training vouchers already available as part of the Enterprise Wide Agreement, Microsoft is now offering a compelling and accessible route to self-development and career progression to all NHS employees.

Microsoft has developed a portfolio of efforts to complement its IT Academy, most notably WenS (Werk en Scholing), in the Netherlands. Each year, the WenS project in the Netherlands trains and employs 150 students from 40 regional vocational colleges (all Microsoft IT Academy members), helping them get certified and find internships with industry firms and government organizations for a practical year of study. Such internships often lead to permanent employment.

It-vest and Aarhus School of Business (Denmark)

It-vest is an educational and scientific network between four University institutions in the Western part of Denmark: University of Southern Denmark, Aalborg University, Aarhus University and Aarhus School of Business. It-vest was formed in response to public and private enterprises in Denmark claiming and forecasting a severe lack of qualified ICT employees with University degrees. Fewer high school students were considering enrolling in ICT programs as they considered ICT a tool, not an area to study or a profession. At the same time other graduates - especially from the humanities - found it difficult to find jobs in private companies. In 1999, the Danish government established and financed the it-vest network to strengthen the ICT courses and research developed by the participating Universities. The primary goal of it-vest is to develop and market educational programs.

It has a board consisting of deans from the participating Universities and representatives from the ICT industry.

The activities of it-vest are among others:

- Initiating the development and support of new ICT education programs.
- Branding tertiary ICT educations in the Western part of Denmark.
- Increasing the number of ICT graduates in Denmark.
- Reinforcing the cooperation between existing educational and scientific settings.
- Establishing cooperation between the Universities and the corporate world regarding courses and research within IT.
- Initiating the application of ICT in teaching.

It-vest has created three successful educational opportunities for three different types of learners.

An interdisciplinary MSc in IT degree program aimed at bachelors of any background. Since 1999, under the slogan "Add it to your bachelor," it-vest Universities have offered a number of full time Masters of Science (MSc) in IT programs aimed at any type of bachelors. As of October 2009, 616 students had graduated from these MSc programs.

A flexible continuous education program with the potential for Masters, aimed at professionals. Since it was introduced in 2002, approximately 500 students have enrolled in this program.

ICT education programs aimed at high school students. Under the headline "Future people" it-vest, in cooperation with all Danish ICT educational institutions at a University level, and the Danish ICT industry, markets such programs.

Critical Success Factors in Effective e-Competence Building

It is difficult to imagine one synthetic indicator of success in developing e-competences curricula. For universities, however, a critical measure of success can be found in the number of students registering for a particular course/curriculum (this number being of course directly influenced not only by immediate interest for the course/curriculum in question, but also by future prospects in terms of employability and career development).

Although many computer science departments are facing declining numbers of students (especially females), we have identified several university e-competence building efforts that are experiencing stable or even growing enrolment.

We spoke with over 30 universities to find out what kinds of courses they were offering to build e-competences. We considered such efforts successful when they generated both of the following:

1. an increase in the number of students participating in the course; and
2. an increase in the proportion of graduates finding work.

Looking across these successful efforts at building e-competences, we identified six critical success factors.

Success Factor 1
Curricula generate e-competences, not simply ICT competences

Courses address a portfolio of e-competences and relate their value to specific situations.

Successful courses introduce participants to multiple e-competences and relate the value of those e-competences to organizational (i.e., not just IT) interests. For example, the Petroleum Learning Institute offers courses that are primarily focused on developing competences that are valuable to oil exploration. Coincidentally or not, those competences include e-competences such as developing new applications (i.e. project delivery) and using IT to restructure processes for oil exploration (i.e., strategy and innovation).

The learning process reflects e-competences (e.g. it requires students to work across boundaries, to articulate the value of IT in non-IT terms) and involves putting rigorously developed research into practice (i.e. testing the relevance and business value of such research)

Rather than take a traditional didactic and memory-based approach to learning, successful courses take advantage of situations in which many students are also professionals, and include projects that apply lessons from the classroom to their work environment. They also include projects that require students to work across traditional boundaries (e.g. through mixing business, engineering and design, like Aalto University in Finland).

Success Factor 2
Life-long learning is embraced and rewarded

The learning process accommodates working schedules

The e-competences that firms need most urgently (e.g. enterprise architecture, strategy and innovation) require several years of professional experience. Thus the best candidates for developing those skills are already employed. Successful university curricula are often those that have best adapted the process of teaching to accommodate the work schedules and demands of working professionals. An example of such an approach is that of the program entitled 'Flexible Masters of IT', it-vest (Denmark).

Thinking beyond IT

Successful curricula development efforts are also often part of a broader, more systemic approach at enhancing e-competences. For example, e-skills UK is coordinating and leading a number of efforts aimed at changing perceptions and building skills throughout life-long learning - from 10-14 year olds (CC4G) to current professionals (Skills Academy for IT).

Success Factor 3
Academia, business, and public sector engage regularly

Regular opportunities for academic researchers and private sector practitioners to engage have proved a key success factor in curriculum development.

Focusing on complementarities rather than on differences has generally been a key to such success.

In most cases, these multi-stakeholder group efforts have been led and/or moderated by a third-party coordinating organization. The success of coordinating organizations, such as e-skills UK, EuroCIO, and CEFRIEL, strongly suggests the value of having a third-party mediate and negotiate the interests of participating organizations.

Success Factor 4
Curricula are stable yet flexible, and vendor neutral

IT professionals are involved on the teaching side

Some of the most popular courses/curricula encountered in the present research include educators with significant industry experience – particularly with experience in leading ICT and business change. In several examples of University courses or programs where attendance has grown, about a third or more of the content was taught either by professors that had worked in industry or by professionals working for industry leading firms.

Courses do not favor any specific tool

E-competences must be developed in a way that will allow them to remain of value, whatever the changes that may affect technology tomorrow. In this context, vendor neutrality has been considered both by universities and by industry as a source of value.

Curricula are developed into components, to avoid becoming dependent on technological changes

When designed with a very specific situation in mind, curricula are vulnerable to becoming too narrowly relevant to a specific firm, technology, or application. Many of the stakeholders we met stressed that a critical success factor in developing curricula was their continued relevance across time. A modular approach to curriculum building is critical in this regard.

The notion of designing by components is a well established one in software engineering, product development, and supply-chain management. Similarly, if curricula can be designed into components that can be "plug-and-played" then the usefulness of each component increases. Two key challenges emerge when designing by components: first, identifying the right size of the component (e.g. a component that is too large risks becoming too generic and insufficiently adaptable to a specific situation; a component that is too small risks loosing the efficiencies of re-use) and second, defining the interface of the components to maintain their compatibility and substitutability across time (e.g. the "wrapping" in software).

Petroleum Learning Centre at Tomsk Polytechnic University (Russia)

In 2001, two universities, Tomsk Polytechnic University (Tomsk, Russia) and Heriot-Watt University (Edinburgh, UK), established the Petroleum Learning Center in Tomsk to provide opportunities for those from the region to earn a Masters in Science (MSc) degree in ether Petroleum Engineering or Reservoir Evaluation and Management, and to provide short courses for oil companies. Uses of ICT feature prominently throughout the curricula of the Petroleum Learning Center's courses, as ICT is now integral to many key operations and innovations in the oil and gas industry (particularly in the development of more effective and efficient ways to collect, analyze, and map huge amounts of data for evaluating and managing reservoirs). The Petroleum Learning Center is an excellent example of how a university is developing e-competent professionals – even amidst economic crises – by grounding its curricula in specific functions within a specific industrial sector and providing students with opportunities both inside and outside of the classroom where the can learn, apply and develop an integrated set of technical and business skills.

Over the course of a four-term year, the curriculum for an MSc consists of two terms of theoretical knowledge development (e.g., multidisciplinary lectures on petroleum geology, petroleum economic, reservoir simulation, etc.), one term on a Field Development Project where students work in teams in the field and practice using special software and technology; and one term on an Individual Project, where a student conducts research on real problems of an oil company.

The curriculum is developed and controlled primarily by Heriot-Watt University (exams are even sent to Scotland, graded by Heriot-Watt, and sent back to Tomsk). However, the content is tailored to the specifics of Russia. For example, in addition to the curricula developed by Heriot-Watt, the Petroleum Learning Center provides students with a three-week intensive Petroleum English course, additional training in mathematics, introduction to governmental regulations for oil and gas industry, and modern methods of mature field development.

The partnership between Heriot-Watt and the Petroleum Learning Center is an excellent example of how well developed curricula can be extended and applied (with slight yet important adaptations) to other contexts and help generate additional e-competent professionals. In addition, rather than aim to develop ICT skills, the curricula at the Petroleum Learning center are focused first on developing the best professionals in petroleum engineering and reservoir evaluation and management. In the case of the petroleum industry, these types of professionals must be e-competent.

Part II: Avenues for action

Guidelines for Developers of e-Competences Curricula

Guideline 1: create appetite for potential students

- Link curricula to career prospects, job opportunities and personal development opportunities
- Make curricula attractive to people looking for jobs/careers in other fields of interest ('smart planet' approach, clean tech, etc…);
- Highlight female leaders in organizations that have earned their respect with e-competences (e.g., female CIOs that are part of the senior management team);
- Market curricula as advanced, up-to-date vehicle to acquire knowledge in 'activities of the future', stressing the involvement of industry and potential employers in curriculum design and curriculum delivery (see guideline No 2 below)

Guideline 2: create relevance for industry and potential employers generally

- Involve industry and potential employers early in the process of curricula design
- Design curricula as a combination of (1) the most advanced generic knowledge on information technologies and tools, knowledge economy and innovation, and (2) the most up-to-date learning vehicle for acquiring the views of industry and practitioners on how such knowledge is being applied concretely, and how it links to competitiveness and innovation.

Guideline 3: design curricula as a set of modules, making them easy to combine with other curricula, fostering multi-disciplinary approaches to e-competences

- Modules of the curricula need to be designed along the traditional sequence of pre-requisites/advanced courses, but with a high degree of selection 'à la carte' for students wanting to specialize in one particular area while acquiring specific 'e-competences' (e.g; in a major/minor approach to specific degrees)
- Those modules should also imply some degree of 'compulsory multi-disciplinarity' by offering students the ability to combine a set of basic fields of interests with a minimum number of modules in each of such fields. In addition, ways should be offered to 'e-competence students' to combine relevant areas of learning with the curricula (e.g. changed management, multi-cultural management, etc…). This would reflect the successful 'service science' approach, in which areas like engineering, business and design were meshed.
- Specify and clarify what integrated set of technical and business skills will be developed by the curricula (e.g. develop a competences matrix similar to the INSEAD e-competences matrix and use it to describe whether the curricula will develop a row and if so, what columns).

IBM and Service Science

In 2004, to ensure a growing pool of service-competent professionals, IBM promoted university programs on Service Science, Management and Engineering (SSME, or Service Science for short). In 2007, US Government legislation supported this approach, defining Service Science as:

"curricula, training, and research programs that are designed to teach individuals to apply scientific, engineering, and management disciplines that integrate elements of computer science, operations research, industrial engineering, business strategy, management sciences, and social and legal sciences, in order to encourage innovation in how organizations create value for customers and shareholders that could not be achieved through such disciplines working in isolation." (2007 United States Bill H.R.2272).

An aspect of SSME that makes it both attractive and challenging for Universities is its interdisciplinary nature. As a result, a variety of departments have pursued SSME, including marketing sciences, operations management, business schools, and computer science departments. As of April 2009, over 45 Universities from around the world offered SSME courses and programs.

For instance, Arizona State and University of Maryland have been offering sources in SSME for over two decades. More recent examples in the US include UC Berkeley, which created an SSME program in 2006 consisting of faculty from computer science, industrial engineering, and social sciences (Glushko 2008), and North Carolina State University. In all cases, the schools draw on an interdisciplinary set of resources (e.g. faculty, content) to support their SSME programs. In Europe, some schools that have developed SSME courses and programs include Karlstad University (Sweden), Hanken Swedish School of Economics and Business Administration (Sweden), Manchester Business School's Centre for Service Research (UK), Masaryk University, SSSME Master (Czech), and Politecnico Milano's Services Engineering Master's Program (Italy).

In March 2009, leaders from academia, industry and government who had been involved in Service Science efforts met at Aalto University in Helsinki, Finland to assess their progress and identify key steps forward. They developed the following five key recommendations for making Service Science a mainstream concept and academic discipline:

1. Develop a common understanding of service science skills
2. Make service science a recognized, viable career path
3. Establish structures to facilitate collaboration
4. Highlight practical applications of service science
5. Respect the distinction between pure and applied research.

A pioneering approach in its own time, Service Science has proved generic and adaptable enough to remain a strong basis for many multi-stakeholder efforts to build and develop e-competences around the world.

Guideline 4: design curricula in a way that allow graduates to maximize their ability to keep their knowledge up-to-date throughout their professional lives

- Link the content and structure of curricula to the known and anticipated relevant life-long learning opportunities (e.g. in firms); involving industry in curriculum design (see Guideline 2 above) will allow mutual benefits in creating such continuity. For example, enterprises may be interested in developing learning programs on 'innovation through IT' or 'e-health recent developments' while linking them to certain modules of existing university-based courses (possibly involving the same professors, terminologies and/or references)
- Design curricula to allow individuals already employed to acquire e-competences. This will require in particular a special attention to the times/days at which the courses are delivered. Mixing students with professionals (of different disciplines) will add much to the inter-disciplinary nature of such curricula, and to the way in which they are translated into applicable learning experiences (see guideline 3 above)

Guideline 5: monitor the curricula design/delivery process with a view to constantly improve on them

- Maintaining curricula up-to-date will be central to their success, and to their appeal to potential students and learners. This is true both for university-based programs and for vocational training efforts. In both cases, collaboration between academia and businesses should be organized on a continuous basis. Feed-back from students and alumni should also be considered as a source of ideas for improving curricula.
- The main guidelines already contained in the Career Space approach remain fundamentally valid, and will need to be considered as a strong basis for further improvements.
- Sustainability of similar and future efforts to build better curricula to produce e-competent graduates will benefit from being 'European from the start' (as opposed to being formulated in various national contexts, which would have to be harmonized later on). In this respect, full advantage needs to be taken of the accepted Bologna process and framework: making e-competence degrees and curricula recognized across Europe will increase both their attractiveness (to potential students and employers) and the future mobility of graduates.
- Best practices in building better e-competences curricula should be gathered, documented and imported (with necessary adaptations) from the world as a whole, with a few to their continuous improvement.

Guideline 6: create relevance for industry and potential employers generally

- Success of new e-competences curricula will not result from their content only. It will also largely depend on how such curricula are marketed and delivered. For younger generations of learners, it will be important that such curricula are delivered through the most advanced and high-performing technological and learning tools. For students who were 'born digital', social networks (Web 2.0) applications are the most natural and convenient way of accessing and sharing knowledge. This should be reflected in e-competences curricula.
- In many cases, the use of such advanced ways of delivering curricula will require additional training for trainers and educators; related costs should be considered (and factored in) at the very early stages of curriculum design.

Innovation Value Institute (Ireland)

In 2006, the Innovation Value Institute (IVI), a consortium based in the National University of Ireland at Maynooth was co-founded by NUI Maynooth and Intel. Since then the consortium has grown to more than 30 members, including industry, consulting, not-for-profit, and academic organizations, such as The Boston Consulting Group, Microsoft, Chevron, SAP, Northrop Grumman, British Petroleum (BP), and Ernst & Young.

The content of the IVI courses is based on the IT Capability Maturity Framework (IT-CMF) – a framework developed by Martin Curley, Director of IT Innovation at Intel and Adjunct Professor at NUI Maynooth. Based on years of research and experience, Curley created the IT-CMF to help firms and organizations get more value from ICT using four structured inter-related strategies to:

- Manage ICT budgets
- Assess and improve ICT capability
- Manage and measure ICT for business value
- Manage and run ICT like a business

Professional Certificate in Managing ICT for Business Value

This 1-day certificate course is designed to introduce the basic concepts of IT Business Value and provide practical guidance to those working in the public, private and community/voluntary sectors to help improve an organization's ability to deliver value from IT. The course provides an overview of the IT-CMF and is designed to help both ICT and Business executives manage the conflicting challenges of ICT cost cutting, pressure to deliver business value, demand for ICT enabled Innovation and many of the other challenges which CIOs face, for example; security, compliance, etc.

Professional Diploma in Managing ICT for Business Value

This 3-day diploma explores the content of the 1-day certificate in a much more detail and shares a mixture of in-class practical and case studies. It places greater emphasis on the tools that help to elucidate how the IT-CMF can help improve an organization's ability to deliver value from IT.

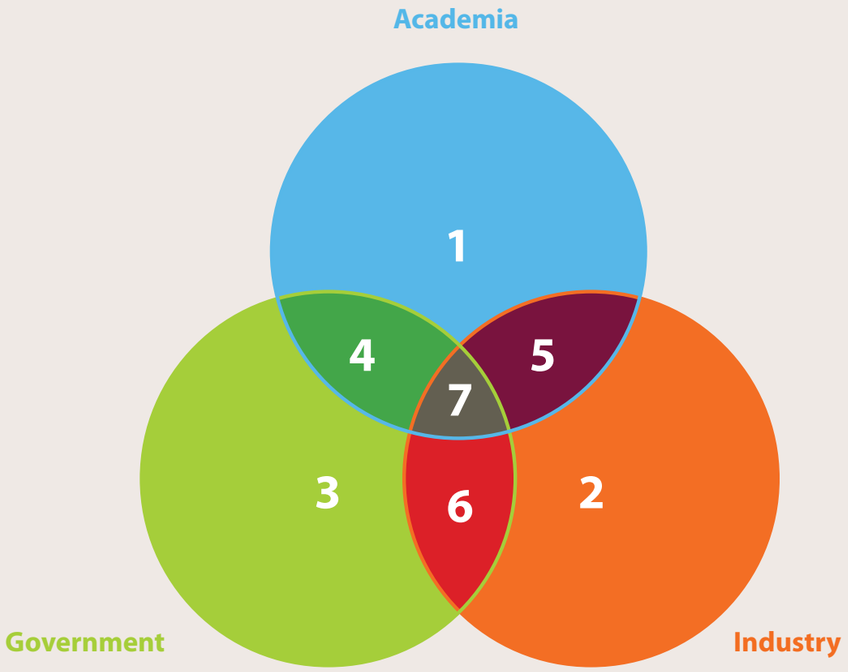
Professional Diploma in Measuring the Business Value of Information Technology

This 3-day diploma is designed to help participants understand the practical requirements of identifying what business value means to individual organizations and review operational components required to systematically quantify the business value of IT. The course outlines a step by step approach to establishing a business value program and review emerging trends on ICT value management from leading Industry and Academic researchers.

Building e-competences requires concerted efforts between Academia, Industry, and Government

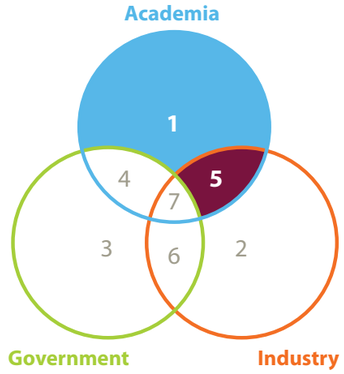
Most of the critical success factors identified earlier require regular engagement between at least two of the three major stakeholder groups engaged in the design and delivery of e-competence curricula: namely universities (academia), firms (industry) and government. The diagram below provides a simplified representation of how the respective areas of competence/responsibility of those three groups intersect.

The first three areas (numbered 1, 2, and 3) refer to actions that respective stakeholder groups can take to motivate their respective members/representatives to engage with other stakeholder groups to implement any of the critical success factors identified above. The next three areas (numbered 4, 5, and 6) refer to actions that two respective stakeholder groups can take together to foster any such critical success factor. Finally, area 7 refers to actions that involve concerted engagement between all three of the stakeholder groups.



Action Point 1

The new curricula should help generate e-competences, not just IT skills



E-competences enable professionals to bridge a variety of boundaries, such as functions, occupations, customer groups, products, and geographic. Effective curricula provide participants multiple opportunities to engage in and critically reflect on cross-boundary collaborations and innovations – both in the classroom and outside of it. In the process, participants develop in parallel technical, personal and business skills.

Who should lead ?

Universities have a key role to play in formalizing and implementing this action point. They should do so in close cooperation with business to guarantee the relevance and durability of the approach taken to re-shape their curricula, and link them to sub-sequent life-long learning efforts.

How to do it ?

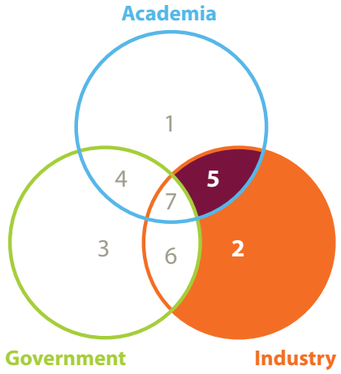
As stressed in this document and other recent studies, the e-competences that Europe needs cover a much broader range than that of just IT competences. If Europe and its enterprises want to keep their edge in the global knowledge economy, they need to be able to rely on the men and women with the skills necessary to develop and use the latest knowledge tools, and use them to innovate and create jobs and value in all sectors of activity.

In addition, for the development of e-competences, it is important to develop the scientific and technical skills in parallel with personal and business skills (rather than separately). Our CIO survey findings underscore the fact that matrix-designed firms demand professionals that can work with business colleagues and apply their technical and systems expertise to specific business situations. In this report we have identified several mechanisms that are effective for simultaneously developing this broad range of skills, such as medium-term projects where students work in multi-disciplinary teams developing an ICT-enabled product that addresses a real (rather than theoretical) need (e.g. Aalto Factories); internships; and exercises that require students to critically apply theory learned in class to their work environment.

As illustrated earlier, a number of good practices have been identified in Europe whereby such approaches have been taken. It is now essential that all European universities should re-visit their existing curricula in at least two ways: (1) systematically introduce IT-related and e-related modules across all types of training (e.g. for educators/teachers in the area of e-learning); and (2) broaden their curricula in IT-specific and e-specific areas to encompass all major dimensions of a knowledge-based, innovation-driven global economy (e.g. by introducing specific modules on change management, risk financing, or cross-cultural management). Moreover, cross-fertilization between various areas of learning and research should be stimulated through the creation of inter-disciplinary campuses (physical or virtual) and the rewarding of cross-sector approaches (through joint inter-disciplinary research programs, and multi-diploma curricula).

Action Point 2

Make life-long learning an incentive and a basis for performance rating



It is now broadly accepted that, in about any area of knowledge, the formal education system (schools, universities) can only offer the structural bases on which educative processes will be constantly updated in a life-long context. This is of course particularly true in areas directly affected by technological change, which has become faster and more continuous.

To keep its competitive edge, Europe and its enterprises will need to face the growing challenges of attracting, growing and keeping the right people. In such a context, life-long learning has to be a core component of any efforts to enhance the validity of e-competences curricula. They can also constitute a strong incentive for new recruits and e-competent workers already on board.

Who should lead ?

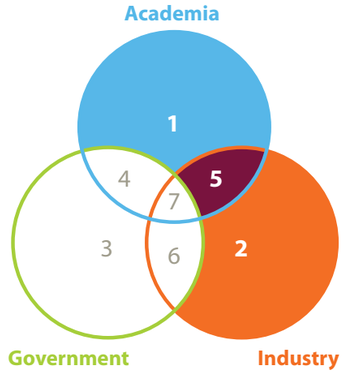
Enterprises clearly have a leading role to play here. However, universities should accept to share this leadership, since a growing number of courses and trainings will also have to be delivered by universities to individuals who are already part of the workforce.

How to do it ?

Enterprises should strengthen the component 'personal development' in career plans developed for their staff. Such component should include specific modules related to the e-competences most needed in the organization. Trade unions and other staff representing organizations should be invited to work closely with HR Departments to identify ways to reward staff for successfully acquiring such competences. Internal arrangements should be found to accommodate working schedules to maximize workers' ability to acquire such skills. The relevant modules could then become part of life-long curricula for the continuous acquisition and updating of e-competences.

Action Point 3

Engage academia and business to educate together and each other



A number of successful efforts (including e-skills UK, Aalto, EuroCIO, CEFRIEL, ILB) have grown and multiplied across Europe to allow universities and businesses to engage with each other, and better define common objectives in education and training for IT and e-skills.

One of the greatest challenges when engaging academic with industry leaders is to ensures their different objectives complement each other. Academics tend to focus on developing long-term insights based on observing what stay constant over time and across different situations. Industry leaders, on the other hand, tend to focus on what's new and different now in their situation. Regular engagement between academics and industry leaders enables participants to develop a common understanding and learn to identify and exploit complementarities.

Who should lead ?

Universities have to take the lead on this issue, since their governance, branding and academic standards will be the potential limiting factors to such efforts. Based on well documented and accepted rules and principles (independence and neutrality of universities e.g.), a large array of joint curricula-related efforts should be launched and strengthened to increase the quality and quantity of e-competences in Europe. Companies have a crucial role to play by allowing their staff to be involved in teaching activities.

How to do it ?

Companies can significantly contribute to such efforts through financial support of relevant education activities, e.g. by financing e-competence chairs in universities of their choice. They can also contribute to the funding of university-based research centers and specific research projects.

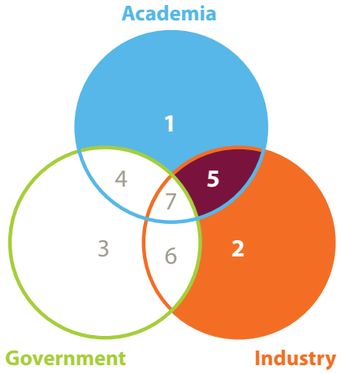
Companies can also provide time from their most education-competent workers schedules, e.g; by allowing some of their IT professionals to be involved in the formulation and teaching of relevant e-curricula. Two main categories of IT and e-professionals have successfully contributed to making e-curricula more relevant and enhancing the interest of potential students for related courses, namely (1) individuals who moved along from an IT or e-related career and developed an interest for education, and (2) professionals in activity able to devote some of their time to education.

As underlined earlier, the individuals called to contribute to this effort should not be limited to the IT sector. A number of other sectors and occupations requiring e-competences should be mobilized. In leading such an effort, universities would not only increase the relevance of their e-curricula for industry, but also stimulate the interest of potential students by broadening their employment horizons. Universities should also host more visiting scholar programs where senior-level decision makers can take a sabbatical at a university

All other ways to maximize interaction between academia and business to build better curricula should be explored and encouraged - e.g. universities hosting events for industry, and companies offering 'open doors' days for interested students - as a way to increase their knowledge about related occupations and professional opportunities.

Action Point 4

Extend the life expectancy of the new curricula by making them both flexible and vendor neutral



Because of the rapid pace at which technology develops in all sectors (and even more so in ICT-related ones), curricula need to remain flexible enough to retain their validity across a reasonable amount of time. Unless this is done, potential students will hesitate to invest a crucial part of their lives into what could become a rapidly devalued currency. Employers, on the other side, need a guarantee that the curricula in which they would be asked to invest will provide them with the talents they will require to-morrow, even if they are difficult to define with precision today.

Who should lead ?

Universities have to lead those efforts, for the reasons mentioned earlier (see Action Point 2), and because such efforts need to be shielded from possible pressure from industry to lock future human resources into any particular type of technological paradigm.

How to do it ?

Efforts should focus in including the following elements in new and existing curricula:

- Generic elements on how to use technology to produce and share knowledge across and between organizations, and generate innovative products and solutions.
- Cross-platform and cross-technology knowledge elements, allowing students and learners to acquire strategic and adaptable skills, remaining of value in the face of (often predicted) future technological changes.
- Build curricula in modular ways, allowing sub-components to be changed or replaced as new technological environments may require, without challenging the overall purpose or architecture of the curricula in question.

This last point will require continuous and narrow cooperation between universities and industry, since the later will often remain the in the best position to identify upcoming technological shifts. Such cooperation should be organized as a continuous, open and multi-vendor process.

SAP University Alliance

The SAP University Alliances (SAP UA) Program provides University faculty with the tools and resources necessary to teach students how technology can enable integrated business processes and strategic thinking. Three years after its launch, over 800 Universities from all over the world participate in SAP UA and around 170,000 students have enrolled in associated courses. Most of the students are from Europe, the Middle East and Asia (EMEA), where 116,000 students from 614 institutions have participated.

To develop curricula, SAP established a task force with professors from all over the world and put them together in curriculum development groups. An objective is to develop content that will be useful for courses that are part of a University education rather than training for certificates. These groups have developed curricula for a variety of courses. SAP has also collaborated with competitors such as Oracle to develop curricula. A key aspect of the curricula is that it be vendor-neutral. The principal objective of the curricula is to develop capabilities that will make the most of ERP technology rather than develop skills that are specific to SAP technologies. In Europe, SAP UA does not want participating Universities to mention SAP and forbids them to use SAP's logo (in contrast, in the United States, participating Universities use SAP's logos).

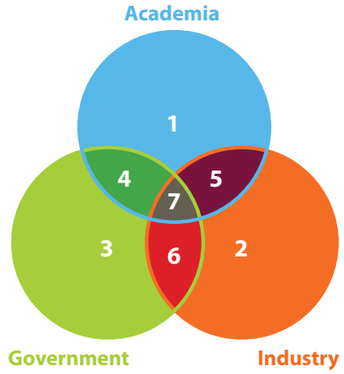
Courses are organized around core general operational processes supported by SAP's enterprise resource planning (ERP) technology. Processes include financials, human capital management, operations and corporate services.

To support such a large number and variety of users around the globe, SAP has set up a network of University Competence Centers (UCCs). SAP UCC's are service providers hosting and supporting a wide range of different SAP systems for educational purposes. They eliminate the need for individual campuses to make large investments in technical infrastructures and operational staffing. University Alliances member schools from around the world access the full suite of SAP software through one of five University Competence Centers (UCC's). Connections to SAP software systems at each UCC are made through Internet browsers or the SAP graphical user interface. Program members can easily access SAP software systems via a browser or the user interface from anywhere and at any time. In addition for the EMEA region, Academic Competence Center's (ACC) provide applications support in the local language.

Collaboration among stakeholders, (even competitors) has proved a key success factor of SAP's University Alliance, both from the point of view of curriculum design and from that of their delivery.

Action Point 5

Make the new curricula a vivid illustration of what they are about: use advanced knowledge tools



In curricula as in many other areas, the medium is very much the message. European schools and universities are still remarkably under-equipped in terms of interactive teaching tools (e.g. few white boards and networked-PC class rooms, not to mention video-conferencing). Very often, a roadblock to the effective use of such equipment lies in a lack of training (and hence of interest) on the educators' side. Although this issue goes far beyond the scope of the present report, it needs to be flagged as a priority for governments (as the main source of funding of European education systems) to make e-competence curricula more relevant. Beyond equipment and educators' education, however, universities can make significant strides in improving their curricula by enhancing their use of new communications tools, and thereby be seen as doing what they are preaching.

Who should lead ?

This is an area in which all stakeholders have much to gain and much to offer. The recent emergence of social networking as the preferred way of communication of the new generation is a fact to be acknowledged, and a force to be used.

To a large extent, this effort will be lead by users, i.e; students and learners. Curricula should offer the room necessary to allow optimal and inventive uses of new tools, including social networks. At the same time, they should provide the necessary background knowledge (including legal, ethical and technical) to encourage students and learners to use such tools with the appropriate degree of selective trust.

How to do it ?

Governments, business and academia can all set attractive examples by contributing to spread and support the use of multi-stakeholder efforts to improve curricula, and to identify the e-competences that will be needed to-morrow. For example, digital brainstorms across social networks can be organized regularly, at the initiative of any of those stakeholders. such as social networks in universities, businesses and governments. Specific courses and trainings should also include 'exchange platforms' by which students, educators, employers can provide feedback, reactions and suggestions on how a specific course is progressing, and how its value can be improved.

Aalto University (Finland)

In Finland, Aalto University represents the latest stage of a long history of government, academia, and industry collaboration to promote a competitive knowledge society and generate e-competent innovators. Officially inaugurated on 1 January 2010, it is a newly created University resulting from the merger of three Finnish high level Universities: The Helsinki School of Economics (founded 1911), the University of Art and Design (founded 1871) and the Helsinki University of Technology (founded 1849). Aalto University provides students with possibilities for multidisciplinary education and research in the fields of technology, business studies and art and design. Initial courses are based on areas in which the three Universities already cooperate and students can choose different combinations of these fields.

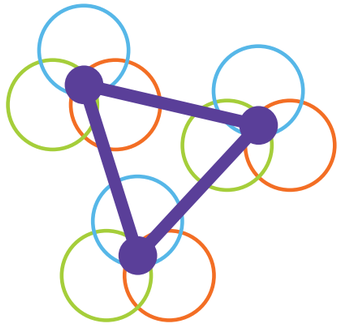
Aalto Factory Park is an early example of how Aalto University leaders put into practice their belief that innovation is achieved from cooperation between academy, industry, and society. Factories strives to "orchestrate real-case operations using and integrating forefront research, learning and innovation activities through multi and interdisciplinary themes." They provide physical and virtual facilities, coaching and facilitation to increase collaboration between academia, industry, and society. They provide collaborative spaces for academic teams and projects as well as encourage interaction between teachers, students, companies, the public sector, and other stakeholders. Projects are organized as multidisciplinary programs and workshops where academic teams and companies are interacting to find a better approach for teaching, learning, and innovating. Projects are designed to encourage participants to share knowledge and experiences, to co-create, to experiment, to work, and to learn together. They strive to act both as catalysts and facilitators to stimulate collaboration and co-creation.

In the mid-1990's, Finland created a national strategy for becoming an information society and today it is considered one of the most advanced information societies in the world. Key components were structural reforms to support lifelong learning. These included efforts to develop content and working methods, international cooperation in the area of education and research, and Universities cooperation with private sector. An important outcome to emerge from these early efforts was the introduction of an ICT driver's license. This program served as a model for the European Driver's Licence, now an international success story.

Another important aspect of Finland's approach has been to change the style of teaching, by making it more comprehensive where knowledge and skills are acquired through different disciplines.

Action Point 6

Make all of the above a true Europe-wide joint effort



European institutions have already played a key role in increasing awareness about e-competences issues. This recognized intellectual leadership should now be leveraged to encourage and guide national governments to further align their policies and actions with the objectives of building the right curricula for the right competences.

Who should lead ?

The Commission can definitely be expected to pursue and extend its role in calling attention to e-competences issues[6], and provide guidelines and policy signals to member governments (as through the present report for example). It will also have key roles to play in providing the proper education-specific background through the provision of normative instruments (such as those of the Bologna process), but also benchmarking and evaluation tools and indicators (e.g. related to students' achievements, performance and employability). Finally, the Commission (through the relevant Commissioners and Directorates) will also have to exert a visible role in stimulating interest and support for addressing e-skills challenges, both through organizing high-level events (such as March 2010's e-skills week), launching and supporting policy initiatives and themes (e.g. 'new skills for new jobs'), and financing state-of-the-art research and analyses on e-skills related topics.

In the end however, action will largely remain in the hands of national governments and local stakeholders. It will hence be essential that the five action points described earlier be brought to the attention of individual governments of the Union, and discussed with local stakeholders such as trade unions, foundations, business federations and educators.

How to do it ?

1. Encourage governments to include funding for skills in economic stimulus packages; mobilize their support to allow the Commission to do it at its level (eg through re-allocating FEDER and/or structural funds to e-skilling, research and innovation funding, and building relevant curricula)[7]
2. Sponsor regular 'skills assessments' across Europe, and identify priority needs with regards to curricula and education programs (in universities and in enterprises)
3. As an integral part of the development of clusters of innovations, provide opportunities for regular engagement between government, academia and industry.
4. Maintain and re-developing a strong consensus (across governments and stakeholders) on how to define e-competences and how to develop attractive curricula.
5. Learn from efforts beyond Europe – The challenges Europe faces regarding e-competences are global in nature and shard by other countries. The United States, Canada, Latin America and Asia offer many lessons from successful and unsuccessful competence building efforts.

[2] See the points made above about defining e-skills, Career Space, the Thessaloniki conferences, and related Declarations., as well as – in March 2010 – the EC 'e-skills week'.

[3] Recommendations have been made along such lines in the recent report 'Who cares? Who dares ?', presented at the 2009 European Business Summit They could be used as a basis fir further action in this domain.

Foundation degrees and the Information Technology Management for Business degree (UK)

For a number of years already, significant efforts have been launched in the UK (though e-skills UK) to foster the e-competences of both people entering industry and those already working. Among such efforts, Foundation degrees and the Information Technology Management for Business degree (ITMB) are of particular interest for this report, because of their approach to curricula.

Foundation degrees

The Foundation degrees combine academic and work-based learning through close collaboration between employers and program providers. The courses are explicitly designed to be equally suitable for people entering the workforce and those already part of it. To accommodate a range of learning situations, Foundation degrees offer employers and students full time, part time and distance learning courses. A typical full time Foundation degree takes two years, and can count directly towards an Honours degree for those who want to continue with further study. Courses are designed and supported by businesses keen to ensure that graduates develop the skills and knowledge they need to be effective, valuable employees. The higher and further education sectors are also involved to ensure that their programs are current and appropriate to the industry. A range of Foundation degrees that have been approved by e-skills UK as meeting the requirements of the appropriate Foundation degree Framework are now available from a number of colleges and Universities.

Information Technology Management for Business (ITMB) degree

ITMB degrees are employer-backed undergraduate degrees focused on developing a blend of business and communications skills in addition to deep technical knowledge. By 2009, thirteen UK universities offered ITMB degrees. These degrees have an impressive track record of success. By October 2009, there were over 750 students on the program. Universities have reported up to four times as many applications for the ITMB course as for traditional IT-related courses. In addition, the gender balance for ITMB degrees is double that for traditional IT-related degrees (32 percent of female students vs. 17 percent). From a curriculum point of view, there are three aspects that distinguish ITMB degrees:

- It is the first IT undergraduate degree to be designed by some of the largest employers in the industry to provide graduates with the specific skills that the employers believe are essential. The degrees are marketed as ensuring "ITMB graduates have all the tools they need to excel in and lead the industry in the future."
- It is actively supported by many of the UK's leading employers, such as Accenture, BA, BBC, BT, CA, Cap Gemini, Cisco, Deloitte, EDS, Ford, Fujitsu, HP, IBM, ITV, Lehman Brothers, Logica, Morgan Stanley, Network Rail, Norwich Union, Procter & Gamble, or Unilever. By 2009, 54 employers provided an unprecedented level of involvement in design and delivery and contributed over ?620,000 of in-kind support per year.
- It is only available at a limited number of carefully selected Universities, to ensure focused interaction with the supporting employers.

CEFRIEL (Italy)

In 1988, CEFRIEL was founded as a not-for-profit organization in Milan, where academic expertise and industry know-how could meet and integrate. CEFRIEL shareholders are Universities (Politecnico di Milano, Università degli Studi di Milano, Università degli Studi di Milano Bicocca, and Università degli Studi dell'Insubria), Public Administration (Lombardy Region), and 15 leading multinational companies in ICT and Media sectors. CEFRIEL primary objective is to strengthen existing ties between the academic and business worlds in the innovative ICT sector at national and international levels. CEFRIEL pursues this objective through leading research activities, development projects of innovative products and services, post-graduate master programs, and advanced educational programs for companies and professionals. A wide range of innovative software and hardware products and services have come out of CEFRIEL's cooperative research laboratories.

CEFRIEL covers all areas of ICT expertise, from microelectronics to software engineering, and addresses multidisciplinary research and development of innovative services and solutions in crucial application sectors, i.e. e-Government, e-Health, Information Security, Public Protection, Media and Communication, Pervasive ICT, Infomobility, Green ICT, Usability and Augmented Interaction, Semantic Web, Data Governance and Analysis, addressing both technological and project management issues. It brings together more than 140 professionals who collaborate with academics, industrial residents, visiting researchers and post-graduate students. Faculty from member Universities act as scientific mentors for the development of competences inside the centre and scientific guidance in research initiatives.

CEFRIEL offers a range of courses – from master courses to post-graduate students as well as educational programs to professionals for the development of their knowledge on emerging ICT technologies as well as their competences on managing complex ICT innovation projects.

CEFRIEL offers a wide array of courses and programmes, including a master in ICT, an advanced program in Information Security Management – ISM, an Executive Master of Business Administration in ICT, an ICT and Design for Innovation program, an Executive MBA program, as well as short ICT and Management Courses, and Project Management Institute certifications.

These courses are taught by a combination of professors from member Universities, practitioners and CEFRIEL managers teach the courses. Since 1988 over 10,000 students and professionals have attended CEFRIEL's educational courses.

Conclusions and next steps:
From e-competences to innovation competences

1.

Building more e-competences

Europe has made important steps forward towards strengthening its supply of e-competent managers and thus strengthening its innovation platform. Our research of firms and successful university programs has identified several actions that leaders from academia, the private sector and governments can take to build Europe's supply of e-competences. The next step is for these leaders to implement them.

2.

Applying lessons from building e-competences to building innovation competences

Our research findings also provide insights into how leaders can work together to strengthen other competences that are fundamental to innovation. Innovation requires a variety of important competences, including e-competences, communication and collaboration competences, etc. - what we term "i-competences." Like e-competences, building e-competences requires concerted collaborations between stakeholders from academia, the private sector, and governments – collaborations which also require the mediation of third party organizations. Orchestrating a new set of i-competences is essential for Europe, however very difficult. The accomplishments of building e-competences represent both a step forward in building i-competences and offer important insights for building additional types of i-competences.

Building e-Competences to Strengthen Innovation in Europe: The Roles of Industry, Academia and Government (13-14 January 2010 on INSEAD's Fontainebleau campus)

Participants included (in alphabetical order): Robert Austin, Copenhagen Business School; Peter Baur, European Commission, DG Education and Culture; Frank Brown, INSEAD; Gianluigi Castelli, Eni; Martin Curley, INTEL and Innovation Value Institute; Hendrik Deckers, CIOnet International; Nils Fonstad, INSEAD eLab; Alfonso Fuggetta, Politecnico di Milano; Peter Hagedoorn, EuroCIO; Bruno Lanvin, INSEAD eLab; Jette Lundin, It-vest, networking universities; Markku Markkula, Aalto University; Jasmina Misljencevic; Independent ICT services consultant; Jan Muehlfeit, Microsoft; Martti Raevaara, Aalto University; André Richier, European Commission, DG Enterprise and Industry; Richard Straub, IBM EMEA; Roland Strauss, Knowledge4Innovation/Lisbon Forum; Andreas Tegge, SAP EMEA; Žiga Turk, Reflection Group on the Future of Europe; Godelieve Van den Brande, European Commission, DG Education/Culture; and Graham Vickery, OECD.

Learning More: References and Links

- **Aalto University**
  http://www.aalto.fi/
- **Catteneo, G. et al. (2009). "Anticipating the evolution of the supply and demand of e-skills in Europe (2010-2015)"**
  http://www.eskills-monitor.eu/
- **CEFRIEL**
  http://www.cefriel.it/
- **CIOnet**
  http://www.cionet.com/
- **Digital Literacy Report**
  http://ec.europa.eu/information_society/eeurope/i2010/digital_literacy/index_en.htm
- **E-Skills for the 21st Century, European Commission, DG Enterprise and Industry**
  http://ec.europa.eu/enterprise/sectors/ict/e-skills
- **e-Skills UK**
  http://www.e-skills.com/
- **EuroCIO**
  http://www.eurocio.org/
- **European e-Competence Framework**
  www.ecompetences.eu
- **European e-Skills Week (1-5 March 2010)**
  http://eskills-week.ec.europa.eu
- **European e-Skills 2009 Conference (20 November 2009, Brussels)**
  http://www.eskills-pro.eu
- **European e-Skills and Careers portal**
  http://eskills.eun.org
- **E-Skills Industry Leadership Board**
  http://www.e-skills-ilb.org
- **Europe's Digital Competitiveness Report 2009**
  http://ec.europa.eu/information_society/eeurope/i2010/key_documents/index_en.htm#EDCR
- **E-Inclusion policy**
  http://ec.europa.eu/information_society/activities/einclusion/index_en.htm
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- **Innovation Value Institute**
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- **INSEAD eLab**
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- **it-vest**
  http://www.it-vest.dk/
- **Microsoft Academy**
  http://www.microsoft.com/education/msitacademy/
- **Petroleum Learning Center at Tomsk Polytechnic University (Russia)**
  http://hw.tpu.ru/en/center/
- **SAP Academy**
  http://www.sap.com/services/education/certtraining/academy_program.epx
- **Service Science**
  http://www.ibm.com/developerworks/spaces/ssme
- **Women and ICT initiative**
  http://ec.europa.eu/information_society/activities/itgirls/index_en.htm

To remain a leader in innovation, Europe needs to build its supply of managers who are both IT and business savvy – i.e., it needs to build its supply of e-competent professionals. Inside, we report on how leaders from academia, industry and government are working together to build Europe's supply of e-competent professionals and recommend additional ways they can extend those successes even further.

e-competences matter to firms from all sectors – ICT and non-ICT

Today, e-competences are critical for organizations to operate more efficiently, innovate more effectively, and compete on a global scale. This is true for a range of organizations, including both firms that provide ICT services and those who do not, as well as non-profit and public sector organizations. However, many Europe-based organizations are struggling to find e-competent professionals. This trend is not specific to Europe, and - even before the current economic crisis - companies all over the world were finding it increasingly difficult to identify and attract people who were competent in both information technology and business management. Yet, the e-competence challenge is particularly acute in Europe, where it conflicts directly with the Lisbon Agenda objective to make Europe a world leading knowledge economy.

Universities, firms, and policy makers are jointly responsible for strengthening curricula that foster e-competences

This document consists of findings from the final report of the European e-Competences Curricula Guidelines Project – a European Commission-funded project led by INSEAD eLab to improve curricula and generate e-competences in Europe.