

EUROPEAN E-COMPETENCE CURRICULA DEVELOPMENT GUIDELINES

SYNTHESIS REPORT

“ICT CURRICULA IN HIGHER EDUCATION IN EUROPE”

AUGUST 2009

Authors

NILS OLAYA FONSTAD
BRUNO LANVIN

INSEAD eLab

Prepared for the European Commission



And the European e-Skills Forum



INSEAD

Abstract

This report summarizes preliminary insights from a 12 months service contract awarded by the European Commission to INSEAD to design “European e-competence curricula development guidelines” taking into account the crucial role of Universities in developing e-competences of both those entering the workforce (e.g., from Higher Education) and those from the existing workforce. This study started in January 2009.

We have grouped insights into four sections:

1. Defining demand for e-competences;
2. Developing e-competent ICT practitioners, managers and entrepreneurs;
3. The role of Universities in developing curricula for e-competences; and
4. Emerging critical success factors from the formal education sector.

Within each section, in addition to summarizing key findings, we include short descriptions of especially notable examples ("vignettes") and we propose subsequent actions for applying our preliminary findings towards the project's next phase, developing curriculum development guidelines ("action items"). Many of the action items describe how we plan to build on our findings with two surveys: one of Chief Information Officers and the other of Universities.

The results from the service contract will be especially relevant to senior executives who want to increase the strategic value of their ICT investments by having more e-competent managers; Universities that want to tap into the growing demand from firms for e-competences by providing opportunities for developing e-competences; and policy makers and institutions that want to help firms and Universities reduce the skills gap.

Acknowledgements

This synthesis report and 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, Kristine Bitnere, Roberto Bruni and Sonja Ekholm of Roberto Bruni & Partners. David Fr derix of Webropol made it possible to have the surveys available online. Finally, we are very grateful to the many professionals who took time from their important efforts at enhancing ICT capabilities to talk with us (appendix A includes a list of 40 experts who participated).

Table of Contents/Outline

ABSTRACT	2
<i>Acknowledgements</i>	2
TABLE OF CONTENTS/OUTLINE	3
I. EXECUTIVE SUMMARY	4
II. INTRODUCTION	7
III. DEFINING DEMAND: WHAT DOES IT MEAN TO BE “E-COMPETENT”?	13
III.A. NATIONAL EFFORTS TO DEFINE DEMAND	13
<i>Vignette: e-skills UK</i>	13
<i>Vignette: CIGREF (France)</i>	15
III.B. PAN-EUROPEAN INDUSTRY-LED EFFORTS.....	16
<i>Vignette: Career Space</i>	16
<i>Vignette: European Competence Framework</i>	17
<i>Vignette: EuroCIO Competence Matrix</i>	19
SUMMARY OF DEFINING DEMAND FOR E-COMPETENCES.....	20
<i>Action Item 1: Identify Demand Portfolios of Capabilities</i>	21
<i>Action Item 2: Define e-competences for SMEs and government</i>	21
IV. DEVELOPING E-COMPETENT ICT PRACTITIONERS, MANAGERS AND ENTREPRENEURS MANAGERS	22
IV.A. HOW DO FIRMS MEET THEIR DEMAND FOR E-COMPETENT MANAGERS?.....	22
<i>Action Item 3: Learn how firms meet their demand</i>	22
IV.B. HOW DO FIRMS DEVELOP E-COMPETENCES OF EXISTING EMPLOYEES?.....	22
<i>Action Item 4: Learn how firms distribute their internal development investments</i>	23
<i>Vignette: Corporate Universities</i>	23
V. THE ROLE OF UNIVERSITIES IN SUPPLYING E-COMPETENCES	25
V.A. INDUSTRY-LED EFFORTS TO PROVIDE CONTENT	25
<i>Vignette: Microsoft IT Academy</i>	25
<i>Vignette: SAP University Alliance</i>	26
<i>Vignette: IBM and Services Science</i>	27
V.B. UNIVERSITY-LED EFFORTS TO DEVELOP CURRICULA	28
<i>Vignette: it-vest (Denmark)</i>	29
<i>Vignette: CEFRIEL (Italy)</i>	31
<i>Vignette: Innovation Value Institute (Ireland)</i>	34
<i>Vignette: Aalto University (Finland)</i>	35
<i>Vignette: Foundation Degrees and the Information Technology Management for Business degree (UK)</i> 36	
<i>Action Item 5: Identify profiles of effective courses in terms of both content and content delivery</i>	38
<i>Action Item 6: Identify sources of content of effective University offerings</i>	38
VI. EMERGING CHALLENGES AND CRITICAL SUCCESS FACTORS	39
VII. CONCLUSION AND NEXT STEPS	42
APPENDIX A: THE SYNTHESIS REPORTS DRAWS ON A VARIETY OF SOURCES	43
A.1 INTERVIEWS	43
A.2 REPORTS AND DOCUMENTS	45
APPENDIX B: EUROPEAN UNIVERSITIES THAT OFFER OPPORTUNITIES FOR BUILDING E-COMPETENCES - AN EMERGING OVERVIEW	47

I. Executive Summary

This report summarizes preliminary insights from the study on “European e-competence curricula development guidelines” regarding the crucial role of Universities in developing e-competences of both those entering the workforce (e.g., from Higher Education) and those from the existing workforce.

Demand from a range of organizations – including both from firms that provide ICT services and from those who do not, from non-profit and from public sector organizations – for ICT professionals is growing and becoming more diverse for two broad reasons.

- A greater number of organizations are using ICT to support an increasing percentage of operational processes, products, and services – in large part because costs for ICT and ICT services have decreased, ICT vendors have made better and more relevant products and services, and as more organizations use ICT the network value of ICT has increased.
- As ICT becomes more integral to how an organization functions, 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).

Consequently, with the growing demand for ICT professionals, there is growing demand for managers with a broad variety of both technical and business capabilities.

Today, many organizations are struggling to find e-competent managers.¹ 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 report represents the first phase of a study that aims to strengthen the role of Universities in developing curricula that build e-competencies. What follows is a brief summary of the four sections of this report.

Defining demand for e-competences

Over the past several years, a number of multi-stakeholder collaborations have succeeded in developing common understanding with regards to what kinds of capabilities are demanded by large organizations to be competitive in today's global and IT-enabled economy. 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, 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.

In addition, some collaborative efforts are now working with other collaborative efforts to ensure their efforts relate to each other. For example, after EuroCIO developed its own e-Competence Matrix (EuroCIO e-CM) it has worked with other European efforts, such as the

¹ In this study, we define e-competences as technical and managerial capabilities that organizations need to achieve their objectives.

CEN/ISSS Workgroup on ICT Skills (from which the e-Competence Framework was developed) and the e-Skills ILB (Industry Leadership Board). It has endorsed each of these efforts and worked with their leaders to ensure the EuroCIO e-CM relates to and complements their respective frameworks and policies.

Developing e-competent ICT practitioners, managers and entrepreneurs

There is a dearth of data on how firms meet their demands for e-competent managers. The only published examples that we found were a few reports that include some e-competences (e.g., "Skills Gaps in the World's IT Workforce: A CompTIA International Research Study" from February, 2008) and anecdotes from professional and general business publications (e.g., CIO, Harvard Business Review, and McKinsey Quarterly). From the data we have thus far collected from interviews with senior ICT managers and news, journal, and web publications, we have found that firms rely on four general sources to meet their demand for e-competent managers: hire new employees from other firms; hire new employees from University; sub-contracting or outsourcing employees; and enhancing capabilities of existing employees. Firms we have spoken to invest in all four sources to hedge the risks associated with each.

There is also very little data on how firms develop e-competences of existing employees. From our research thus far we have 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.

The role of Universities in supplying 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 in business and ICT management that can lead to a University degree (e.g., a BA or MSc) and courses that may lead 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 that are offered to those entering the workforce and they offer in-house training to companies (e.g., custom program, internal University course) and advanced degree programs designed to accommodate work hours.

There are two general types of curricula development efforts to develop attractive content for these educational options. Industry-led efforts represent efforts led by ICT vendors to develop courses and certification exams that academic institutions can offer – either for free or by paying a membership fee. For example, Microsoft Academy is an annual membership program that enables member academic institutions to deliver training on Microsoft technologies. SAP University Alliance also provides University faculty with tools and resources to teach students about how organizations get value from ERP technology - however their content is not specific to SAP products and services. Similarly, IBM's efforts at develop Services Science represent funding of non-IBM specific interdisciplinary curricula on designing and managing services.

University-led efforts at developing curricula represent efforts led by Universities that involve Universities, industry and government offices to develop curricula that foster e-competences. Two notable examples that we describe in vignettes are it-vest (Denmark) and CEFRIEL (Italy). We also highlight the Innovation Value Institute (Ireland) as an example of

a curricula development effort that started as industry-led (specifically, Intel) and is now university-led. Finally, we highlight two university-led efforts (in Finland and the UK) as important success stories due in large part to the holistic approach taken by participating stakeholder groups.

Emerging critical success factors from formal education sector

We have identified four emerging critical success factors (and we expect to identify several more once we analyze results from two surveys we are conducting). First, developing consensus on definitions of e-competences and developing attractive curricula for fostering e-competences require having third-party organizations that coordinate and mediate the diverse interest of participating stakeholder groups. Second, we found the most popular courses include professionals who have left industry and joined the academic institute providing the course. Third, curricula were developed into components, to avoid becoming dependent on technological changes. Finally, curricula development efforts are 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 the life of learning - from 10-14 year olds (e.g., CC4G) to current professionals (e.g., The Skills Academy for IT). Several experts that we spoke with regarding the impressive track record of successful efforts from Finland (e.g., Aalto University), the United Kingdom (e.g., e-skills UK), and Germany (e.g., Karlsruhe University) noted their holistic approach to building e-competences.

In conclusion, at this stage of the project, we have found that important progress has been made with regards to a fundamental aspect of effective curricula development: developing common definitions of what key capabilities constitute "e-competences" – definitions that are useful to European Universities, policy makers, and organizations (public and private) that rely on e-competent managers. A next step is to better understand the multiple roles Universities currently have in building e-competent managers and to identify different types of effective corresponding curricula (e.g., curricula for week-long executive education courses, curricula for three-month long undergraduate courses, etc.). For each type of role and corresponding curricula, we have identified several isolated yet successful multi-stakeholder party efforts at developing curricula for building e-competences.

For the second phase of the study, drawing on our findings thus far, we are developing two surveys – one of Chief Information Officers and one of Universities. We designed these surveys to address several of the action items that conclude each section of this synthesis report.

II. Introduction

The e-skills gap was worsening before the crisis; it now is an even greater threat

Demand from a range of organizations – including both from firms that provide ICT services and from those who do not, from non-profit and from public sector organizations – for ICT professionals is growing and becoming more diverse for two broad reasons.²

- A greater number of organizations are using ICT to support an increasing percentage of operational processes, products, and services – in large part because costs for ICT and ICT services have decreased, ICT vendors have made better and more relevant products and services, and as more organizations use ICT the network value of ICT has increased.
- As ICT becomes more integral to how an organization functions, 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).

Consequently, with the growing demand for ICT professionals, there is growing demand for managers with a broad variety of both technical and business capabilities.

We define e-competences as technical and managerial capabilities that organizations need to achieve their objectives. E-competences are a sub-set of e-skills, which the European e-Skills Forum (2004) has defined 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.

In September 2007, the European Commission adopted a policy Communication on e-skills proposing a long-term e-skills agenda and five action lines at European level. That Communication opens with the following statement:

The success of the Lisbon strategy, the competitiveness of European industry and social cohesion are dependent on the availability and the effective use of information and communication technology (ICT) and the knowledge, skills, competences and inventiveness of the European workforce and citizens. There is a general recognition since the 1990s that the role of ICT on productivity and living standard is critical.

² In this report, ICT professionals are professionals who can use information and communication technologies to advance organizational objectives.

Shrinking supply

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. In 2008, IDC estimated a gap of close to 500,000 full time people in the ICT industry in Europe, growing by 8-10% per annum in a steady state scenario. Based on a survey they conducted of 717 European organizations, IDC found that about a third of European organizations had postponed projects due to lack of skills. Postponing projects, they pointed out, could lead to increasing costs, less flexibility, and slower reactions to business change - all of which constrain the competitiveness of European businesses (Kolding, 2008).

Research findings from the United States, Canada and international organizations, such as the OECD, illustrate that the shortage of e-competent managers is a world-wide phenomenon. In one of the most recent comprehensive reports on the topic, the Conference Board of Canada (CBC) highlighted at the end of 2007 that businesses were finding it increasingly difficult to recruit qualified ICT workers. In a response, several of Canada's most powerful companies (both in the ICT sector and those for which ICT was critical for achieving their business objectives) formed the Canadian Coalition for Tomorrow's ICT Skills³. At the launch, Mr. Stéphane Boisvert, Enterprise President for Bell Canada, referred to a striking set of facts from the report to underscore the urgency of the coalition (Bell Canada press release, 4 December 2007):

Neglecting to take the necessary steps to significantly grow the pool of IT workers in Canada will have repercussions. Considering that each vacant IT position represents an average cost to the Canadian economy of \$119,000 a year, the Conference Board of Canada determined that failing to fill the 89,000 or so IT jobs that will become available over the next three to five years would represent losses in excess of \$10 billion – and this is a conservative estimate.

Although demographic factors (e.g. an ageing population) are partially responsible, the report found the most significant factor in the decreasing number of qualified ICT professionals was a drop in enrolments in ICT programs in Universities.

In Europe, organizations have responded by forming coalitions between companies, Universities, unions, and government organizations (e.g., chambers of commerce) to better understand and address the situation. For example, the e-Skills Industry Leadership Board (e-Skills ILB) was launched in 2007 in Brussels by leading ICT companies. The e-Skills ILB works in partnership with public authorities across Europe, other industry sectors, SMEs and other stakeholders, building upon the recommendations and other reference initiatives on e-skills (several of which are discussed in this report).

Researches coordinated by efforts such as e-Skills ILB have found the same two general factors contributing to the shortages – both involving Universities.

1. The number of students pursuing ICT-related studies is decreasing.
2. Firms complain that students graduating from ICT related programs lack capabilities to apply their technical skills to business applications.

³ See: <http://www.ccict.ca/>

Declining interest among young people (especially girls)

Fewer numbers of students are choosing careers in ICT. Two recently published studies –one from Europe (Gras-Velazquez et al. 2009) and one from Canada (The Conference Board of Canada 2009), – present strikingly similar results from surveys of students from 9th to 12th grade students. A minority are interested in ICT careers and few consider ICT jobs as interesting, fun and cool. In general, across France, Italy, Netherlands, Poland and the United Kingdom, 50 percent fewer female students are interested in studying ICT in the future compared to the percentage that report liking ICT at school (Gras-Velasquez et al. 2009: 3). Both studies also find significant differences between male and female perceptions, with girls even less enthusiastic than boys. They also both find that the decisions of boys and girls are likely influenced by the knowledge and attitudes of their parents, teachers and counsellors. These adults found ICT jobs even less appealing than kids on average.

Particularly alarming are the especially low participation levels of female students. As Viviane Reading, European Commissioner for Information Society and Media notes in the foreword to the report developed by Gras-Velazquez et. al. (2009:1)

While a shortage of around 300,000 qualified engineers is expected in the EU by 2010, fewer than 1 in 5 computer scientists are women... it is fundamental not only that no one is left behind but that the sector benefits from increased diversity and productivity gains that have been demonstrated to come from a better balance of women in top jobs and technical jobs.

The European report makes evident that the impact of the gender gap represents loss of talent for organizations that need e-competent managers (and subsequent loss of productivity from less talent and less diversity) and loss of opportunity for females.⁴

Universities offering insufficient opportunities to develop e-competences

From our interviews with experts and discussions with Steering Committee members, we heard repeatedly that companies are not happy with the quality of students graduating from ICT-related studies. More specifically, firms argue that those that do enter ICT-related studies are not given sufficient opportunities to develop the kinds of competences that industry is demand because Universities are not updating their offerings with changes in demand for ICT.

Echoing a sentiment we heard in several interviews, Karen Price, Chief Executive of e-skills UK, wrote in an opinion piece in the Financial Times (10 November 2008):

Research by e-skills UK has revealed two main drivers behind this lack of interest [of the younger generation in ICT studies]. First, a negative image of the way in which the subject is taught at school, and, second, widespread misconceptions about the reality of a career in IT. So what can be done about this? In the first instance, we need a radical review of all technology curriculums [sic]. Technology education needs to inform and inspire young people about technology [...] Technology education needs to help young people develop the increasingly sophisticated blend of technical, business and communications skills they will require for an IT professional or business career.

⁴ Similarly, the Canadian report found that more and more young people are turning away from ICT-related studies and occupations. "For example, between 2002 and 2006, enrolments in undergraduate University computer science programs dropped by 30 per cent; and Canadian Universities graduated 2,200 fewer computer scientists, software engineers and applied mathematics majors. The implications for the ICT sector of under-enrolment include significant and growing labour shortages, lost productivity, the underperformance of the sector, and a negative impact on the Canadian economy."

The “European e-Competence Curriculum Development Guidelines” study

In 2008, as part of the European Commission's efforts to implement the Communication on “*e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs*” strengthen the supply of e-skills in Europe, the Directorate-General for Enterprise and Industry launched four initiatives:

- Monitoring supply and demand and developing foresight scenarios
- Designing European e-competence curricula development guidelines
- Supporting e-learning exchange mechanisms and networking
- Promoting Appropriate Financial and Fiscal Incentives

The following synthesis report is the first document deliverable of the study on European e-competence curricula development guidelines. The overall purpose of the work is to develop a set of actions ("guidelines") for enhancing formal European curricula for building e-competences. The study will identify best practices and develop guidelines for strengthening education of ICT practitioners' skills and e-business skills – i.e., "e-competences." It will also consider the role of cooperation between industry and academia.

This report focuses on "the situation of ICT curricula in higher education in Europe," with a focus on ICT practitioners' skills and e-business skills.

We developed this report with three specific objectives⁵:

- Elaborate and define key concepts and items of the core components of European e-competence curriculum development guidelines building on existing definitions and previous work in Europe in the field of e-skills.
- Combine the data collected from desk research and interviews into a clear and complete view of past and current efforts for developing European e-competence curriculum development guidelines that promote e-competences of ICT workers.
- Develop key insights on context and critical success factors regarding relevant curriculum development for e-competences.

This report draws on a variety of sources, several which are listed in Appendix A.

Insights from e-competences relevant to other skill shortages in the EU

European firms are facing skills shortages across several engineering and science related professions.

In a recent background paper that we developed for the European Business Summit in March 2009 and based on research we conducted, we show that e-competences are critical to global competitiveness. To better understand how Europe fared with the rest of the world, and to guide concerted capability-building efforts, we developed the INSEAD eLab Skills Pyramid - a skills pyramid comprising of indicators representing three types of skills: literary and basic skills; occupational skills; and global knowledge economy skills (similar to e-competences). Figure 1, following page, illustrates the INSEAD eLab Skills Pyramid.

⁵ During the Steering Committee meeting, held on 26 May 2009, participants agreed that the synthesis report should focus on these three goals. Committee members agreed that of the goals listed in the study roadmap; these three were the most helpful for identifying critical success factors and developing European e-competence curriculum development guidelines.

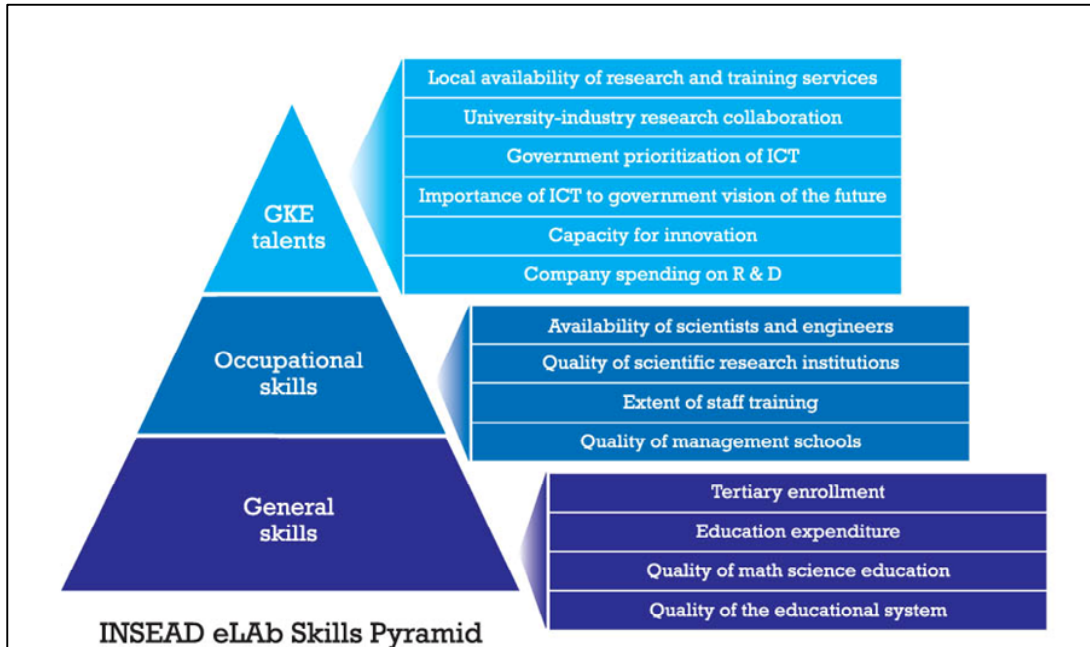


Figure 1: Each tier of the INSEAD eLab Skills Pyramid is represented by a variety of indicators.

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

We found that the indicators that make up the INSEAD eLab Skills Pyramid account for 85 percent of the variation of the World Economic Forum (WEF) Global Competitiveness Index.

We also graded countries based on their relative pyramid score. Figure 2, below, lists the total pyramid score and rank for each of the countries we considered.

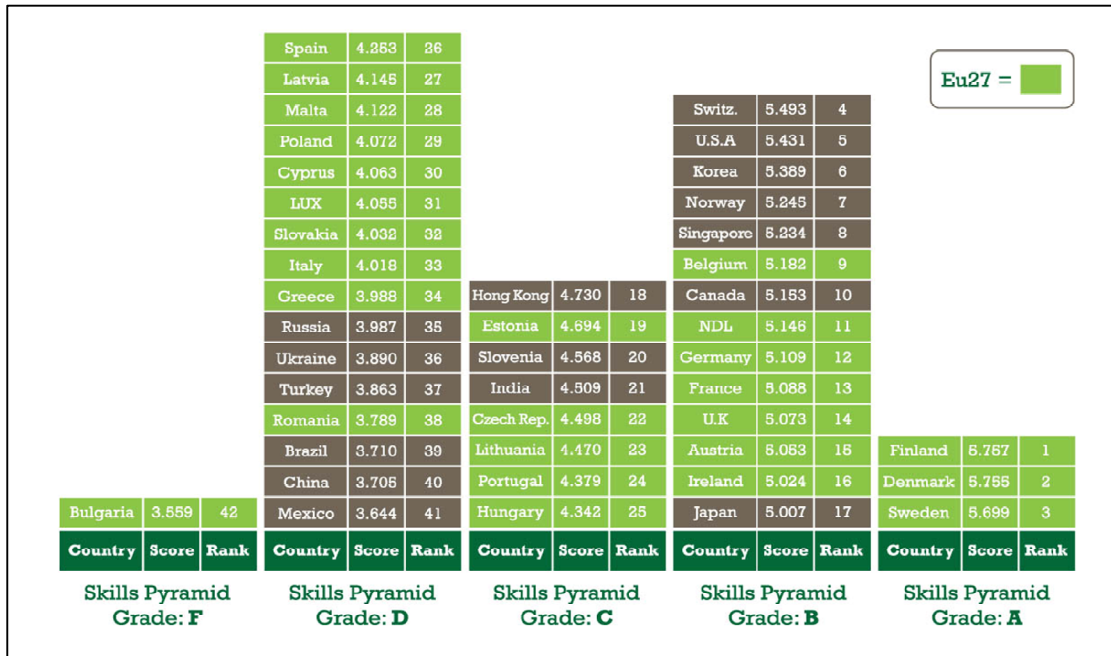


Figure 2: Europe's handicap in the worldwide race for skills

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

We found that while Europe as a whole gets a 'B' grade for literacy and basic skills (i.e., Europe scores one standard deviation above the mean, compared to competing economies), and a 'B-' for occupational skills (i.e., Europe is close to average, compared to competing economies), it scores an alarming 'C' for its global knowledge economy skills (i.e., it is not distinctly better than competing economies), an area in which most European countries trail behind countries such as South Korea, the US, Japan and Singapore (Bruno and Fonstad, 2009).

The insights from this study, although focused on ICT professionals, are relevant to strengthening the role of Universities in building e-competences – competences that are essential not simply for the ICT sector but also for the growing number of sectors that rely on ICT to compete.

III. Defining demand: What does it mean to be “e-competent”?

In response to concerns of an insufficient and shrinking supply of qualified ICT practitioners firms, government bodies, and academic institutions have been organizing themselves into a variety of multi-stakeholder partnerships.⁶ We found two types of multi-stakeholder partnerships were especially salient.

- Nationally-focused efforts are multi-stakeholder partnerships of organizations such as firms, industry associations, Universities, and government departments focused on defining and fostering e-competences within a specific country.
- Regionally-focused efforts are coalitions of organizations such as multi-national corporations, industry associations, Universities, and government departments focused on defining and fostering e-competences within a specific region (e.g., the EU)

Both types have been important to ensure learning from the front-lines and impact at a national and European Union level.

One of the first challenges that these coalitions have tackled is to develop common description of the new set of capabilities that they needed and to coordinate resources to increase awareness of the value of e-competent ICT practitioners and engage with Universities to ensure they were providing options for participants to develop e-competences.

In what follows, we first examine the role of national efforts to define what it means to be e-competent before we then examine industry efforts.

III.a. National efforts to define demand

Since the 1990s, within many European countries, several large companies and government bodies formed coalitions to address skills shortages in the ICT sector. These national efforts produced several capability frameworks that defined what capabilities were key to develop for competitiveness. In Germany, for example, a coalition of employers, trade unions, associations and the government ministry of education and research developed the Advanced IT Training System (AITTS). AITTS consists of 29 specialist profiles, 4 operative professional profiles (IT systems manager, IT business manager, IT business consultant, and IT marketing manager), and 2 strategic professional profiles (IT technical engineer and IT business engineer). These profiles are linked to an integrated system of educational training (vocational training, bachelors, masters, etc.).⁷

Vignette: e-skills UK

E-skills UK is an employer-led, not-for-profit company, licensed by the UK government. More specifically, e-skills UK is a Sector Skills Council (SSC) for Business and Information Technology. It has responsibility for:⁸

- The ICT workforce (the ICT & Telecoms industries and ICT and Telecoms professionals working in all industries);
- The ICT-related skills needs of those in business management and leadership roles;
- The ICT-related skills needs of all who use ICT in their day-to-day activities.

⁶ For a recent overview of multi-stakeholder partnerships, please refer to Korte, W.B., Braun, N., and Gareis, K. (2007). "Benchmarking Policies on Multi-Stakeholder Partnerships for e-Skills in Europe." Executive Summary of report prepared by Empirica for the European Commission and the European e-Skills Forum. December 2007.

⁷ To learn more, please visit <http://www.kib-net.org>

⁸ e-skills UK. (2008). "Creating the IT Nation: The Strategic Plan for England 2009-2014." 2008.

SSCs are key aspects in UK's effort to strengthen UK's "optimal skills mix in order to maximize economic growth, productivity and social justice."⁹ The UK Commission for Employment and Skills (UKCES) - a new body, recommended by Leitch and adopted by the Government - was established in April 2008 "to strengthen the employer voice and provide greater influence over the employment and skills system."¹⁰ In first half of 2009, the National Audit Office reviewed all SSCs for re-licensing. In late July 2009, the UK Secretary of State for Business, Innovation and Skills, Lord Mandelson announced that e-skills UK would be re-licensed. The review rated e-skills UK as 'outstanding' due to the impact e-skills UK had achieved, highlighting in particular its breadth and depth of employer involvement; strategic vision; excellence in research; innovation in standards and qualifications; and the pioneering programmes it leads to address IT skills issues facing the UK.¹¹

To address ICT-related skills, e-skills UK takes a holistic approach, simultaneously addressing a range of issues - from changing perceptions of what ICT professionals do to coordinating efforts between industry and Universities to develop options for building e-competences - for a range a populations - from kids to University students to professionals - to the elderly.

Two skills frameworks are at the core of e-skills UK's efforts to develop "IT Professionalism." The Skills Framework for the Information Age provides a common reference model for the identification of the skills needed to develop effective Information Systems (IS).¹² SFIA describes ICT practitioners' skills along two dimensions. The first dimension consists of categories and subcategories of skills, defined to be easily recognizable in the workplace. For example, within the subcategory "business change management" are such skills as business analysis, program management and project management. The second dimension describes seven levels of responsibility. The lowest level of responsibility is "follow," the highest is "set strategy, inspire, mobilize." SFIA does not pretend to tell organizations what to call their jobs nor what roles or jobs should consist of. Instead, it articulates capabilities that organizations can use to define jobs. This enables employers of ICT professionals to carry out a range of HR activities against a common framework of reference - including skills audit, planning future skill requirements, development programs, standardization of job titles and functions, and resource allocation.

The IT Professional Competency Model (e-skills procom) has become an industry-recognized, internationally relevant training framework for organizing courses and qualifications by the disciplines of the ICT profession. Built on ICT professional National Occupational Standards, and linked to the SFIA, e-skills procom defines knowledge, understanding and competences for seven broad disciplines (and their sub-disciplines) at five levels of progression, incorporating technical, business and personal skills. E-skills procom is the basis for e-skills UK's work to reform and simplify the qualifications map for ICT professionals. It was designed to help ICT professionals achieve recognition for their skills, and employers to plan training and development. It is also helping providers of education and

⁹ HM Treasury. (2006). "Prosperity for all in the global economy - world class skills, Final Report, December 2006." (also referred to as the 'Leitch Review of Skills'). Executive Summary, p.6: 1.

¹⁰ House of Commons (2009). "Re-skilling for recovery: After Leitch, implementing skills and training policies." Innovation, Universities, Science and Skills Committee. First Report of Session 2008-9. Vol. 1. p. 47:133. 16 January 2009.

¹¹ National Audit Office. (2009). "e-skills UK: A review by the National Audit Office." and e-skills UK press release. Both can be found at: <http://www.e-skills.com/About-us/2459>

¹² SFIA is owned by the SFIA Foundation, a non-for profit organization whose members are the British Computer Society, e-skills UK, the Institute of Electrical Engineers, the Institute for the Management of information Systems, and most recently, The IT Service Management Forum (itSMF).

training to develop new courses to meet the needs of different ICT disciplines. E-skills procom is being developed by employers in both private and public sector, with the support of professional bodies and other partners, to create a united approach to help advance the ICT profession across the UK.¹³

Current efforts at motivating "more students to enter careers in IT" and to "enable the influence and support of employers on IT-related learning in schools, colleges, and Universities" include the following two examples:

- CC4G - an online club for 10-14 year olds - particularly girls - established in response to research showing that negative misperceptions were affecting interests in ICT careers.
- The Diploma for ICT - being taught to 14-19 years olds, designed with input from more than 600 employers, Universities, colleges and schools.

=====

Similar to the aforementioned examples from the UK, a few national efforts have sought to bridge effective ICT management practices with HR management practices by developing a common approach to describe what practices effective ICT management consisted of and to map those practices to HR management tools.

Vignette: CIGREF (France)

Founded in 1970, CIGREF is an association of 128 French companies and organizations from all sectors that seek to "promote uses of information systems as a factor of value creation and source of innovation for the enterprise." To accomplish this promotion, CIGREF focuses on three aims:

- To bring together major companies using information systems,
- To support CIOs and help them develop in the exercise of their profession,
- To develop a long-term vision of the impact of information systems and technologies on the enterprise, the economy and society.

CIGREF has long been involved in identifying critical skills the organizations need to enhance the business value from their ICT investments. Since 1991, CIGREF members have met monthly to share their experiences and review the state of affairs of ICT job profiles. Early on, they developed a "job profiles referential" framework, which describes the jobs identified and applied in the large companies' internal ICT departments. In 2002, CIGREF recognized that for effective ICT HR management, companies needed a framework that also described career and qualification pathways and qualifications. Members updated the CIGREF framework accordingly. This simple taxonomy of ICT job profiles is regularly updated at the monthly meetings, incorporating emerging ICT competences and skills. It allows the companies to follow the evolution of ICT jobs in the whole industry and facilitates human resource management.

Recently, CIGREF developed and implemented an HR dashboard. The dashboard, based on 14 indicators, aims, on the one hand, to outline the major HR trends in the community of user companies, and, on the other hand, to provide CIOs with indicators which allow them to see where they are in relation to other companies.

¹³ Source: <http://www.e-skills.com/Skills-Frameworks/1906>

CIGREF has built on and extended its work from France to Europe in two important ways. First, in 2007, CIGREF participated as a European expert in the European e-Competence Framework (e-CF) effort (more on e-CF on page 17). CIGREF considered its participation in the development of e-CF as a significant step towards achievement of effective ICT HR management. Second, CIGREF became a founding member of EuroCIO (more on EuroCIO on page 19). CIGREF's participation in e-CF and EuroCIO ensured that European efforts benefited from CIGREF's experience and that CIGREF's past efforts could now be related to frameworks common across Europe.

=====

III.b. Pan-European Industry-led Efforts

The nature of doing business within the European Union led quickly to demand to relate national efforts to each other. An important early example of a pan-European effort was Career Space.

Vignette: Career Space

In its 7 September 2007 policy Communication on e-skills, the European Commission credits Career Space for setting the foundation upon which it launch and build its e-skills agenda.

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 ICT companies and different stakeholders such as BT, Cisco Systems, IBM Europe, Intel, Microsoft Europe, Nokia, Nortel Networks, Philips Semiconductors, Siemens AG, Telefonica S.A. and Thales. In addition, the European Information and Communications Technology Industry Association (EICTA), the EUREL, NTO, and many more association participated.

The work was divided in two phases. First, the development of the core Generic Skills Profiles identifying the wide range of skills and capabilities required. The second phase then worked with the education sector to devise and develop European e-competence curriculum development guidelines.

The guidelines to the education sector made through the Career Space consortium set up several recommendations to support programs and studies of e-skills learning. These recommendations include a better network between Universities and the industry, regular feedback from the industry to the Universities to understand practical needs, continuous updating of the course, and input from the industry in course development such as through guest lecturing and placement experience for each graduate. Finally, the Career Space consortia emphasized the importance of building and ensuring a network consisting of institutions, Universities, companies and NGOs to exchange information and improve existing programs.

The Universities that participated in the work on the Curriculum Guidelines were: Linköping University, Sweden, University of Oulu, Finland, University of York, United Kingdom, University of Reading, United Kingdom, Aristotle University of Thessaloniki, Greece, Institut National des Télécommunications, Evry, France, Johannes Kepler Universitat Linz, Austria, Universitat Politècnica de Catalunya, Barcelona, Spain, Universidad Carlos III de Madrid, Spain, Universitat – GH Padeborn, Germany, University of Manchester, United Kingdom, ENSIMAG, Grenoble, France, Universität Karlsruhe, Germany, INSA Lyon, France, Trinity College, Ireland, Universidad Politécnica de Madrid, Spain, Technical University, Wien, Austria, Fachhochschule München, Germany, University of Porto,

Portugal, EIMN – ISEN, Lille, France, University of Eagan, Greece, UIMM-FIEEC, Paris, France, Technical University of Denmark, Technical University Pavia, Italy.

=====

While Career Space was focused primarily at a European level, particularly at engaging with the European Commission, several other industry groups worked together to develop common understanding regarding what capabilities were important to them and channel resources towards content development for developing those capabilities.

ICT service providers have been especially well-organized and coordinated with regards to educating Universities about changing and emerging demands for e-competences. However the risk has been that the set of e-competences that Universities believe matter most to firms are limited to those that matter to large ICT service providers.

To ensure pan-European e-competency efforts included the demands of non-ICT service providers, (which did not necessarily overlap with those of ICT service providers) Chief Information Officers (CIOs) organized themselves into groups such as EuroCIO.

Vignette: European Competence Framework

In order to synchronize e-skills 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 Commission's interest in e-skills comes from an understanding that the future of ICT will impact the competitiveness and innovation within the EU. With this in mind, the framework targeted several EU-wide problems with ICT development including the minimal dialogue between the industry and academic world, the decline in skilled ICT practitioners, ICT illiteracy among users and the general lack of a focused long-term EU e-skills strategy.

Stakeholders in the project included members of AITTS, CIGREF, and SFIA that worked under the umbrella of the European Standardisation Committee (CEN/ISSS workshop on ICT skills). Together they developed the framework with the idea of not only promoting better e-skills among users but also to support the inclusion of ICT skills for employability purposes.

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.

European e-Competence Framework overview

Dimension 1	Dimension 2	Dimension 3				
5 e-Comp. areas (A – E)	32 e-Competences Identified	e-Competence proficiency levels e-1 to e-5, related to EQF levels 3-8				
		e-CF levels identified per competence				
		e-1	e-2	e-3	e-4	e-5
A. PLAN	A.1. IS and Business Strategy Alignment					
	A.2. Service Level Management					
	A.3. Business Plan Development					
	A.4. Specification Creation					
	A.5. Systems Architecture					
	A.6. Application Design					
	A.7. Technology Watching					
B. BUILD	B.1. Design and Development					
	B.2. Systems Integration					
	B.3. Testing					
	B.4. Solution Deployment					
	B.5. Technical Publications Development					
C. RUN	C.1. User Support					
	C.2. Change Support					
	C.3. Service Delivery					
	C.4. Problem Management					
D. ENABLE	D.1. Information Security Strategy Development					
	D.2. ICT Quality Strategy Development					
	D.3. Education and Training Provision					
	D.4. Purchasing					
	D.5. Sales Proposal Development					
	D.6. Channel Management					
	D.7. Sales Management					
	D.8. Contract Management					
E. MANAGE	E.1. Forecast Development					
	E.2. Project and Portfolio Management					
	E.3. Risk Management					
	E.4. Relationship Management					
	E.5. Process Improvement					
	E.6. ICT Quality Management					
	E.7. Business Change Management					
	E.8. Information Security Management					

© European e-Competence Framework 1.0, A common European framework for ICT Professionals in all industry sectors, www.ecomptencies.eu

Over the two-year period, the framework identified 32 core ICT competences for practitioners and managers regardless of hardware/software components. The framework classified 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 organised 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 (see table below).

The framework has been welcomed by a large number of stakeholders and the effort to create a common European understanding of e-competences in the ICT sector according to fast moving developments of the market.

As it becomes more universally applied, the framework that was presented at the European e-Skills Conference in 2008 in Thessaloniki, provides a fundamental tool which facilitates development of European curriculum and ICT qualifications and certification development.

=====

Vignette: EuroCIO Competence Matrix

Founded in 2004 by CIOs, EuroCIO provides CIOs with a platform to share their experiences and raise awareness of key ICT issues. In addition to having 43 member companies, EuroCIO coordinates a network of seven national CIO organizations (CIGREF (France); CIO Colloquium (D); CIO Forum Belgium; CIO Forum Sweden; CIO Platform (NL); Corporate IT Forum (UK); and VISZ (H)). Together, EuroCIO and its partner organizations represent around 750,000 ICT professionals in Europe. EuroCIO strives to voice the collective positions of European CIOs vis-à-vis suppliers and regulatory authorities including the European Commission.

A recent core activity of EuroCIO has been to help member firms define, obtain and foster e-competent managers. In January 2008, in response to concerns about the growing shortage of ICT professionals, EuroCIO set up a EuroCIO E-skills Workgroup consisting of member companies, to share experiences meeting demands for e-competences, develop common understanding on fostering e-competences, and identifying areas of common interest that EuroCIO could represent to external bodies, such as the European Commission, Universities and other educational institutions. In its first year, the workgroup conducted a study on the state of e-competences and found that role profiles are becoming more complex and that firms complained of a shortage of “dual thinkers”: employees that understood how to manage both business (finance, commerce etc.) and ICT. More specifically, they found that capability requirements of *dual thinkers* were shifting towards strategy and high-level business linked activities, such as business strategy, innovation, and business and application architecture. They identified several sources of shortages of dual thinking managers: an increasing number of lower level ICT management roles (e.g., ICT infrastructure maintenance), traditionally an important internal source of dual thinkers, were being out-sourced and off-shored; too few ICT students graduating with degrees linking business and ICT management; and low awareness of potential ICT professionals in emerging career possibilities in larger organizations. Finally, they found that in order to meet demand for *dual thinkers*, a number of companies had set-up internal training schemes, started internal academies or were sharing training activities with Universities.

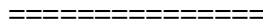
The EuroCIO E-skills Workgroup also developed a EuroCIO e-Competence Matrix (e-CM). Based on a similar framework developed internally by EuroCIO member Philips, the EuroCIO e-CM defines seven main capability areas that are strategic for any organization that relies on ICT to achieve its business objectives. Table 1, below, lists the seven capabilities.

Table 1: The EuroCIO e-Competence Matrix consists of seven general capabilities

<p>1. Strategy and Innovation: Translate or drive business strategy to IT strategic plans with the following activities: function and service improvements, business process improvement, business innovation, and afterwards, determine technical direction.</p>
<p>2. Enterprise Architecture: Define and maintain the information & enterprise architecture, including process, information, applications, and infrastructure.</p>
<p>3. Demand Management: Identify business and automated solutions. Maintain IT portfolio. Define and manage service levels.</p>
<p>4. Global Sourcing Management: Define and maintain sourcing strategy. Manage suppliers and supplier performance. Procure IT resources: people, software, hardware, and licenses.</p>
<p>5. Project Delivery: Specify, build, test and deploy business and IT solutions. Manage change. Educate end-users. Manage projects.</p>
<p>6. IT Support and Execution (IT Infrastructure Services): Manage service delivery management. Manage operations. Control Master Data.</p>
<p>7. Quality, Risk and Compliance: Define IT process, organization and relationships. IT administration. Provide IT Governance. Monitor and control IT performance, internal control and regulatory compliance. Assess and manage IT risks. Manage quality.</p>

Source: Presentation by Peter Hagedoorn, Program Director e-skills EuroCIO.

After developing the EuroCIO e-CM, EuroCIO has worked with other European efforts, such as the CEN/ISSS Workgroup on ICT Skills (from which the e-Competence Framework was developed) and the e-Skills ILB (Industry Leadership Board). It has endorsed each of these efforts and worked with their leaders to ensure the EuroCIO e-CM, which of all the efforts is the most representative of what e-competences mean to CIOs, relates to and complements their respective frameworks and policies. Having developed common understanding regarding what key capabilities represent e-competences, EuroCIO is working with these other efforts to further dialogue with European business schools and Universities and strengthen their capacity to foster e-competences.



Summary of defining demand for e-competences

Defining e-competences is challenging because it requires (1) sufficiently stable consensus across multiple diverse stakeholder groups to enable necessary long-term investments amidst ever-changing technologies; and (2) a sufficiently flexible definition to accommodate emerging key skills enabled by new uses of technologies.

Over the past several years, a number of multi-stakeholder collaborations have succeeded in developing common understanding in Europe with regards to what kinds of capabilities are demanded by large organizations to be competitive in today's global and IT-enabled economy. 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.

In addition, some partnerships are now working with other partnerships to ensure their efforts relate to each other.

Action Item 1: Identify Demand Portfolios of Capabilities

An important way to build on efforts involving large private organizations to develop common understanding regarding demand for e-competences is to survey them to identify whether large firms have different portfolios of demand for e-competence capabilities. For example, do firms from one sector (e.g., financial services) depend on a different mix of e-competence capabilities than firm from a different sector (e.g., food and beverage)? Or do multi-business unit firms that are pursuing one type synergy across their business units (e.g., sharing data to create a single face to customers) depend on a different mix of e-competence capabilities than firms that are pursuing another type of synergy (e.g., business process standardization).

We have developed, piloted, and launched a survey of senior ICT managers (primarily CIOs) to better understand demand profiles of different types of firms; gaps between demand and supply of key capabilities; and how firms address capability gaps. We are using EuroCIO's e-Competences Matrix, which also maps against the European e-Competences Framework.

Action Item 2: Define e-competences for SMEs and government

The aforementioned collaborative efforts have primarily focused on defining the demands of a very specific group of organizations: large private-sector organizations. However, small and medium-sized enterprises (SMEs) and governments (local, national, European, etc.) are also two important types of organizations that increasingly rely on ICT to function and meet their objectives.

E-competences for these two types of organizations are not well understood and additional research (e.g., surveys of SMEs and of government entities similar to the one we are conducting of CIOs of large companies) is critical to understand similarities and differences with demand for e-competences of large firms.

IV. Developing e-competent ICT practitioners, managers and entrepreneurs managers

Firms – whether or not they are engaged in multi-stakeholder coalitions developing common definitions of key capabilities – are pursuing a number of different approaches to meet their demand for e-competent managers. They are tapping into two distinct sources of talent: those entering the workforce and those already in the workforce.

IV.a. How do firms meet their demand for e-competent managers?

There is a dearth of data on how firms meet their demands for e-competent managers.

From the data we have thus far collected from interviews with senior ICT managers and news, journal, and web publications, we have found that firms rely on four general sources to meet their demand for e-competent managers:

- Hire new employees from other firms: The majority of the managers we have spoken with told us they mostly rely on hiring employees from other firms to meet their demand for e-competent managers.
- Hire new employees from University: At this point of our research, this option appears to be the least popular because recent graduates do not have sufficient capabilities yet to be e-competent.
- Sub-contracting or outsourcing employees: The next most popular option for acquiring e-competent managers is to subcontract them or request them from an ICT service provider.
- Enhance capabilities of existing employees: This is also not as popular because of the time it takes to build the capabilities of existing employees.

Firms we have spoken to invest in all four sources to hedge the risks associated with each.

Action Item 3: Learn how firms meet their demand

Based on only a few interviews with CIOs and on a review of academic and sector press, we have identified four general sources that large firms rely on to meet their demand for e-competences. It is important to examine these options across a large sample of firms to better understand what types of firms rely most of which of the four options.

Within the survey we are conducting of CIOs, we ask participants to estimate what percentage of their e-competence capabilities gap was met by one of the four options.

IV.b. How do firms develop e-competences of existing employees?

There is also a dearth of data on how firms develop e-competences of existing employees.

From the data we have thus far collected from interviews with senior ICT managers and news, journal, and web publications, we have 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 (e.g., custom program, internal University course) outcome: certificate of attendance
- In-House Training provided by an external firm (e.g., custom program, internal University course) outcome: certificate of attendance
- In-House Training provided by employees (e.g., custom program, internal University course) outcome: certificate of attendance (please see vignette, below, for more)
- External Business Degree Programs (e.g., MBA) outcome: a University degree/diploma
- External ICT Degree Programs (e.g., ICT Management Masters Program) outcome: a University degree/diploma
- External University Courses (e.g., open enrolment Executive Education Seminar) outcome: certificate of attendance

Action Item 4: Learn how firms distribute their internal development investments

Collect primary data on how firms enhance the e-competence capabilities of employees.

The survey of CIOs includes a set of questions that ask participating firms to estimate how they distribute the total amount spent on building capabilities of employees across the six options we identified. Specifically, for each of the six options, we ask them to estimate:

- a) What percentage of the total amount was spent on each option?
- b) What key skills were developed?

The results from these questions will help firms benchmark themselves and help educational institutions better understand how to design and provide educational options that are useful and attractive to firms.

Vignette: Corporate Universities

Recently throughout the world, an important component of the talent management strategy of several large corporations (e.g., continuous professional development) has been to develop an internal Corporate University. Over the past two decades, the role of Corporate Universities has shifted from simply providing training to changing the organizational culture so that employees are better prepared to manage change, work with ICT and collaborate across boundaries. These changes have been partially in response to growing interests in organizational learning systems, corporate social responsibility and aforementioned changes in the way ICT has become integral to how organizations function and has enabled new ways of working across occupational, organizational and national boundaries.

European Foundation for Management Development (EFMD) is an international non-profit organization based in Brussels that develops accreditation programs for quality assessment and improvement. It established CLIP - the Corporate Learning Improvement Process – as a quality assessment service for Corporate Universities. As of July 2009, 15 Corporate Universities earned accreditation (a process that if successful, costs an organization Euro 40,000). Examples of accredited Corporate Universities include Alcatel-Lucent University, Alcatel-Lucent; Allianz Management Institute, Allianz Group; DaimlerChrysler Financial Services Academy; EDF Corporate University, EDF Group; El Solaruco - Group Santander Corporate Learning and Development Centre; Novartis Corporate Learning, Novartis AG; ST

Corporate University, STMicroelectronics; and Universidad Corporativa Union Fenosa, Union Fenosa.

EMFD (Taylor and Phillips, 2002: 9) proposes one way to distinguish Corporate Universities from other educational endeavours is the following set of characteristics that they aspire to:

- Wholly owned and controlled by a work organization or consortium;
- Capable of significantly contributing to the organization's goals of changing itself as a whole to enhance its competitiveness;
- Principal provider or coordinator of training and development to the organization's employees, customers and suppliers;
- Providing training and development through either electronic or in dedicated building/campus, or some combination of the two;
- Using the title "University" or another term from the educational sector to emphasize the value of learning; and
- Focused on bringing training and development to the core of organizational decision making.

In 1998, the American Productivity & Quality Centre Institute for Education Best Practices (IEBP) developed a "best-in-class" report to identify critical success factors in Corporate Universities that were most admired by peers. Beyond predictable factors, such as the importance of senior management support and benchmarking, the study identified several distinct critical success factors. They found that the most admired Corporate Universities involved business units in all aspects of the learning process (rather than simply during needs analysis at the beginning of the process); kept the learning experience distinct from traditional HR processes (e.g., the Corporate University reports to the Board rather than the HR department); and determine their training goals only after identifying expected outcomes, often tied with business strategy.

Corporate Universities struggle with a variety of challenges including demonstrating their value to the corporation that is sponsoring them and choosing an operating model. For example, it is not clear whether it is better to operate as a cost centre (where the University charges for services at cost) or as a profit centre (where the University charges competitive fees for services, managers are given the option to choose between purchasing services from the internal University or from external providers, and revenues that exceed operating costs become profit for the corporation).

Business schools and other academic institutions have traditionally helped Corporate Universities develop content. Collaborating with business schools is one way that Corporate Universities signal to employees the quality of the courses that they offer and more broadly, the dedication of the corporation to improving the competences of employees.

Although Corporate Universities represent an important means by which firms meet their demand for new competences, they are an option that is mostly limited to large corporations. Small and medium-sized enterprises, and even several large firms, lack the resources necessary to invest in a Corporate University. The following section examines other ways that firms engage with educational institutions to develop e-competences.

V. The role of Universities in supplying e-competences

Universities are a very important type of provider of e-competent talent. We found that they are providing a wide variety of opportunities to develop e-competences for both those entering the workforce (e.g., students in University) and those already in the workforce (e.g., professionals changing careers, executive education).

For those entering the workforce, there are options such as:

- Degree in ICT Management
- Joint-degree programs
- Courses and “design labs”
- Certificate courses

For those already in the workforce, there are options such as:

- Masters programs designed to accommodate work hours
- Executive education - onsite or on-campus; custom or general

As we examined examples of each of these options, it was evident that content for these options were often developed with participation of industry, in a variety of forms. In what follows we describe two common approaches for Universities and industry to collaborate: industry-led efforts at content development and University-led efforts at content development.

V.a. Industry-led efforts to provide content

A popular role of academic institutions is to offer courses and certification exams that are developed by ICT vendors. What follows are examples of three ICT vendor-led programs: Microsoft IT Academy, SAP University Alliance, and IBM's efforts at developing Service Science.

Vignette: Microsoft IT Academy

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.

Students that want to extend their technical skills with Microsoft technologies must seek an academic institution that is a member of the Microsoft IT Academy. Academic institutions have two options ("levels") for becoming Microsoft IT Academy members: Advanced and Essential.

- The Advanced level provides benefits for institutions that teach Microsoft Certification-based ICT professional and developer courses.
- The Essential level provides benefits for institutions that teach Microsoft Office courses

Membership is open to a variety of academic institutions, including primary, secondary, post-secondary, preparatory schools, vocational and trade, military or technical educational institutions, and accredited sources of continuing education. The Advanced level costs about twice as much as the Essential level (e.g., on 1 July 2009, the prices listed on the MS IT Academy website were US\$1,750.00 and US\$900.00, respectively)

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 becoming 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.

To motivate students to take Microsoft IT Academy courses, Microsoft has offered the "Microsoft IT Academy Student Pass," which offers 12 to 22 hours of free e-learning courses. The free courses are the initial courses of each track. To complete the track and do well on a Microsoft certification exam, students would need to take additional courses.

Microsoft IT Academy provides different a variety of benefits to members, such as curriculum (e.g., Microsoft Official Courseware (MOC) and multimedia courses that 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.

=====

Vignette: SAP University Alliance

The SAP University Alliances (SAP UA) Program is a global program that provides University faculty with the tools and resources necessary to teach students how technology can enable integrated business processes and strategic thinking. Now in its third year, the SAP UA Program estimates that over 800 Universities from around the world participate, and that around 170,000 students have participated in associated courses.

To develop curricula, SAP established 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 collaborates 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. Table 1, below, lists examples of curricula associated with each operational process.

Table 1: Example of curricula offered by SAP University Alliance, organized by core operational process

Core Operational Process	Examples of curricula
Financials	<ul style="list-style-type: none"> • financial and management accounting • financial supply chain management • treasury applications • corporate governance
Human Capital Management	<ul style="list-style-type: none"> • workforce analytics • talent management • workforce management (streamline and integrate essential workforce processes on a global platform) • workforce deployment (deploy the right people based on skills and availability)
Operations	<ul style="list-style-type: none"> • procurement and logistics execution • product development and manufacturing • sales and service (manage customer-focused activities)
Corporate Services	<ul style="list-style-type: none"> • real estate management • enterprise asset management • travel management • environment, health, and safety management • quality management • global trade services

SAP has established University Competence Centres (UCCs) around the world to eliminate the need for individual campuses to make large investments in technical infrastructures and operational staffing. 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.

The company’s experience shows that there should be special attention been paid to finding compromise among stakeholders interests (companies and professors). Some professors are focused on very specific issues and sometimes the reason is some have their own research companies.

Furthermore, taking into account that Universities don’t want to be associated with business only, the company has started to cooperate with competitors. This is the reason why the company is not pushing the University to publicize SAP but only ERP.

Nowadays SAP can see that there is big demand for people with the right skills to be hired immediately. The companies were such as IBM, Accenture and Intelligence and they are supporting the curriculum.

=====

Vignette: IBM and Services Science

IBM is the world's largest provider of computer products and services, including hardware, ICT and business services, business software (ranking #2, behind Microsoft) and

semiconductors. In 2008, IBM posted sales of over \$103,000M (USD) and a net income of over \$12,000M (USD). Although best known for its hardware, over the past 20 years, the proportion of revenue from services has growing significantly and now dominates all other segments. In 2008, over 55 percent of IBM's revenue came from either its Global Technology Services or Global Business Services segment (2008 IBM Annual Report).

The growing importance of services within IBM mimics the growth of the service sector in many national economies. This translates into a growing demand for professionals competent in designing and managing services (IfM and IBM, 2008).

In 2004, to ensure a growing pool of service-competent professionals, IBM focused its investments in getting Universities to teach courses and programs on Service Science, Management and Engineering (SSME). According to IBM:

SSME is the application of scientific, management, and engineering disciplines to the tasks (services) that one organization beneficially performs for and with another. SSME has the goal of making productivity, quality, performance, compliance, growth, and learning improvements more predictable in work-sharing and risk-sharing (co-production) relationships. SSME is the study of service systems and it aims at improving service systems.

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.¹⁴ 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, which in created an MBA track for service and a computer engineering degree for services well. 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, Centre for Service Research (UK), Masaryk University, SSSME Master (Czech), Politecnico Milano Services Engineering Master's Program (Italy), and SSMENetUK (a network of UK researchers interested in SSME, funded by EPSRC and actively supported by BT, HP and IBM).

=====

V.b. University-led efforts to develop curricula

In addition to industry-led efforts, another important source of curricula aimed at developing e-competences are University-led efforts. University-led efforts represent efforts where one or more Universities (often more, however the Innovation Value Institute in Ireland, described in greater detail later in this section, is a notable example) take the lead on collaborating with each other and with industry and government bodies to coordinate resources and efforts and develop a series of options for students to develop e-competences. In what follows, we highlight four such efforts: it-vest (Denmark), CEFIREL (Italy), Innovation Value Institute (Ireland), and Aalto University (Finland).

¹⁴ See : <https://www.ibm.com/developerworks/wikis/display/ssme/Universities>

Vignette: it-vest (Denmark)

It-vest, networking Universities, 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 not even consider enrolling in ICT programs as they considered ICT a tool, not something you can 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 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-vest 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.

Three educational opportunities for three different types of learners

Since its formation, 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 2008, 616 students have 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.* The third line of activities is marketing ICT education programs to high school students. Under the headline "Future people" this program is done by it-vest in cooperation with all Danish ICT educational institutions at a University level and in cooperation with the Danish ICT industry.

MSc in IT– an interdisciplinary ICT Master’s degree program

It-vest Universities offer 11 different MSc in ICT programs. They are all two-year full-time masters programs aimed at different types of bachelors. The education programs are positioned in a triangle between technology, design and organization. A few of the programs have their main focus on technology, some on design and some have their main focus on organizational or business impact of it. Most of the programs combine the three.

1364 students have enrolled these programs since 1999, and an increasing number of those are enrolling programs combining it and business.

Table 1: Number of students enrolled in the interdisciplinary IT Masters degree program in it-vest (Denmark).

	Number of students enrolled by year									
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ICT and business	0	28	61	49	69	59	52	53	63	85
Other programs	47	101	96	101	95	93	76	59	77	100
Total	47	129	157	150	164	152	128	112	140	185

The first numbers from 2009 indicates up to 30% increase in enrolment on programs with focus on ICT and business. The MSc in IT, Communication and Organization at Aarhus School of Business has increased the number of applicants from 32 in 2008 to 55 in 2009.

Flexible Masters of IT

This program is intended as a part-time program, similar to an MBA program, for practitioners working with ICT. The program is very flexible, and the students can create their own program, choosing from a number of courses given by the Universities in the network - at their own pace.

A complete Masters program consists of 60 ECTS – or the equivalent to one-year full-time study (one course is 15 ECTS). Almost all the students study as part time students. They are required to finish the study within 6 years if they want the diploma.

Professionals have found the flexible program very attractive. More than half of the students enrol the program without knowing whether they just want one course or they want the full program and a master’s diploma, they enrol because they find the courses interesting and relevant to their carrier and practice. The possibility of ending with a Masters diploma is important to the students, however most decide later whether or not they want to continue in the program and earn an MSc.

Interestingly, with the financial crises, it-vest has started to see its first full-time students, typically professionals who have been laid off and choose to use the unemployment period to qualify themselves for the future.

The program has three specializations: software construction, interaction design and organization. The following table shows the number of students participating in courses.

Table 2: Number of students participating per year in each the three specializations of the Flexible Masters of ICT at it-vest (Denmark).

	Number of students participating per year			
Specialization	2006	2007	2008	Total
Software construction.	41	53	72	166
Interaction design	32	44	69	145
Organization	60	70	116	246
Total	133	167	257	557

The courses are designed by the different Universities, discussed in a forum across Universities headed by it-vest and approved by the board of it-vest. The guiding principle is that a course should be relevant for practitioners and based on the latest research that meets rigorous academic standards. This is reflected in the faculty who are involved with it-vest. The manager of it-vest has 20 years of experience in industry and uses her background and network to promote courses that has sustainable relevance to industry. The courses are designed with a mixture of theory in form of theoretical readings and presentations and praxis in the form of assignments and discussions that relates the theory to the real life experience of the participants. A typical course will conclude with a “research in practice” assignment, where the student analyses challenges from his own organization.

The program with specialization in ICT and organization, and especially courses combining it, strategy and management are attracting more and more professionals – even during the crises. Courses from this specialization starting in the fall of 2009 are at this point fully booked: IT-strategy, The IT-manager, and Work Practice and IT.

Table 3: Examples of courses that have been provided in the Flexible Master of ICT program, grouped by each of the three specializations

Courses in Software Construction	Courses in Interaction design and multimedia	Courses in Organization
<ul style="list-style-type: none"> • IT-security • Distributed real time systems • Database technology • Software reliability and test • XML- and web technologies • Software process improvement • Software architecture in practice • Pervasive computing and mobile services • Foundations of embedded software • Artificial intelligence – decision support and data-mining • Work practice and IT • Knowledge sharing and it in organizations 	<ul style="list-style-type: none"> • Web application development • Usability • Interactive Multimedia • Experience Designing • Interactive physical Products • Digital Aesthetics and Computer Games • User-centred Product design • Digital Storytelling 	<ul style="list-style-type: none"> • Management of enterprise architecture • Design of e-learning • ICT Project Management • Work practice and IT • Knowledge sharing and it in organizations • IT-Media and Communication • IT-strategy • Information architecture • ICT and market relations • e-government • The ICT Manager

=====

Vignette: 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 to companies and professionals.

CEFRIEL is part of the ICT Institute, recently created by Politecnico di Milano to coordinate and promote overall initiatives related to higher education, research and innovation in the ICT sector. CEFRIEL set up cooperative research laboratories whose activities have led to a wide range of innovative software and hardware product and services.

CEFRIEL competences cover all areas of ICT expertise, from microelectronics to software engineering. Moreover, CEFRIEL organization 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.

CEFRIEL consists of 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.

Education

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. 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.

Table 1: Overview of programs developed by CEFRIEL

Program	Date Launched	Target participants	Editions	Participants since launch
Masters in ICT	1988	Recent undergraduates	20	901
ISM	2002	Professionals and Managers	7	200
Executive MBA IT	2005	Managers	4	200
ICT and Design for Innovation Program	2009	Managers	1	13
PMP Certification preparation program	2006	Managers	18	200

Masters in ICT

This 12-month program, delivered since 1988, has the objective of preparing highly skilled technical professionals. Participants learn about state of the art technologies in different fields of ICT, they are called to actively sustain technological development in the sponsoring companies. Teaching activities are held in CEFRIEL’s laboratories. Students work in groups on transversal projects carried out inside CEFRIEL or in companies: Security, E-government, Public Protection, Ambient Intelligence, and ICT for Healthcare. Each group is assigned a project proposed by the area mentors and the project manager inside the company.

Participants are graduates in scientific fields. In the 20 years of activity more than 900 people have graduated and some of them are now successful entrepreneurs and international top managers.

Advanced program in Information Security Management - ISM

This program, launched for the first time in 2002 and organized with MIP Business School, provides participants with a wide understanding of the current state of Information security in a company, presenting and sharing strategies on how to manage it taking into account all the technological, legal and organizational issues arising from a broad and pervasive use of web based applications and storage. The program lasts 8 months and is delivered both in Milan and Rome. Since the start more than 100 participants attended.

Executive Master of Business Administration ICT

Partnership with MIP Business School for the courses related to the ICT area. The program aims at providing advanced competences related to the ICT strategy, governance and management. It also gives a wide vision on new technologies and applications presenting the best implementation examples. Participants are managers enrolling both individually or through company sponsorship.

ICT and Design for Innovation program

Short and flexible program integrating ICT, Design and Management. Delivered to companies active in different sectors and in 2010 within the Nanyang Business School

Executive MBA program.

It is program presented in 2008, designed to address the requests of companies for a multidisciplinary approach to business and innovation. Target are project managers and senior managers.

Short ICT and Management Courses

Proposed jointly by CEFRIEL and MIP Business School in 2009, these courses have the objective of fulfilling the need of companies and managers for education and guidance regarding several emerging issues related to the opportunities ICT offers in every aspect of a company's lifecycle, from governance to outsourcing. Each course has a duration of 2 or 3 days. Participants are self enrolled or sponsored by their company.

Project Management Institute Certifications

Since 2006 CEFRIEL is Registered Education Provider for Project Management Institute (PMI). This means that CEFRIEL may organize courses on behalf of PMI to acquire the Project Management Professional (PMP) and Program Management Professional (PgMP) certifications.

CEFRIEL courses are based on PMI Bodies of Knowledge for Project and Program Management and are enriched by means of case studies in order to practice on the most important tools and techniques described.

More than 200 professionals have followed CEFRIEL courses and the passing rate for the final examination at the first attempt is 94%.

=====

Another example worth noting in detail of a university-led effort is that of the Innovation Value Institute (Ireland). Initially a curriculum development effort by Intel for Intel, it has evolved into a university-led effort that is growing in terms of the number of companies sponsoring the effort and the number of students attending Innovation Value Institute courses.

Vignette: Innovation Value Institute (Ireland)

In 2006, the Innovation Value Institute (IVI), a consortium based in the National University of Ireland, Maynooth (NUI 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.

IVI administers a Professional Diploma and Certificate in the subject area of Managing Information Technology for Business Value. The National University of Ireland accredits both a 1-day certificate and a 3-day diploma. To date, ICT and business executive audiences in over 20 countries have received these courses.

To help participants address the challenge of quantifying the business value of IT, IVI designed two types of courses that describe to participants ways of measuring business value, choosing the best ICT investments, delivering competitive advantage and managing for optimal IT Business Value.

The content of the 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 your ICT budget
- Assess and improve your ICT capability
- Manage and measure ICT for business value
- Manage and run ICT like a business

Professional Certificate in Managing ICT for Business Value

The 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

The 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 organizations 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.

Both the Diploma and Certificate courses are available to other academic institutions for delivery within their education programs.

=====

An important finding from our research is that the most successful curriculum development efforts (in terms of number and variety of stakeholder group support and number of students participating in courses that use the curricula) are university-led efforts that part of broader, more holistic efforts within a country. What follows are two notable examples.

Vignette: Aalto University (Finland)

In Finland, Aalto University represents the next stage of a long history of government, academia, and industry collaborating on a holistic approach to knowledge society challenges and fostering e-competent innovators.

The University

Aalto University 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).

Officially set to start on 1 January 2010 (although classes will begin in the fall of 2009), Aalto University will provide possibilities for multidisciplinary education and research in the fields of technology, business studies and art and design. Initial course will be based on areas in which the three Universities already cooperate. Students will have opportunities to choose different combinations of these fields.

Aalto University is a foundation-based University. The Board of the Foundation started to work in 2008. In addition to the existing funds of the three Universities, the foundation's basic capital is EUR 700 million, out of which EUR 500 million is from the government of Finland, and EUR 200 million from the industry.

Multi-disciplinary Factories

The University has created strong network with companies and developed a specific factory park in which the first ones already established are Design Factory (product development), Media Factory and Service Factory (high-value-added services). 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.

Design Factory is focused on the product development projects that involve academics, companies and communities. Projects done by the Factory tend to be both international and inter-disciplinary. As an example, they are aimed at students of engineering, industrial design, and marketing who are interested in product development of consumer goods. The Design lab has introduced a specialized management program that focuses on problem-based learning. Most of the problems are given and sponsored by manufacturing companies who

are searching for innovative cooperation. Different international companies already have applied for the projects like the Azipod, sponsored by ABB Marine, and Nokia Expand, sponsored by Nokia etc.

Finland's way to lifelong learning and ICT

In the mid-1990's, Finland created a national strategy for becoming an information society and today it is considered one of the (or the – depending on what indicators are used) 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.

The Finnish holistic approach to developing e-competences was based on strong support of the Parliament and its Committee for the Future that urged National Action Plans of the Way to the Knowledge Society in 1998 with main concepts such as: Implementing Lifelong Learning Strategy, Developing National Innovation System, Increasing Investments in R&D, and Operating as an Information Society Laboratory within EU. Finland's size facilitates the pursuit of a holistic approach, as several leaders have had positions in industry, government and academia. Consequently, there are several strong networks of multi-disciplinary leaders. Markku Markkula, for example, director of the Lifelong Learning Institute Dipoli of Helsinki University of Technology, is an academic that was also in the Parliament of Finland in the area of education. This range of leadership roles has helped him develop several international expert networks and endeavours of innovations (e.g., "innovation hubs").

An excellent example of an innovation hub in Finland is Otaniemi, a campus where all the key players of Finnish innovation and research and development collaborate in a unique open synergy. Most of them are also located there forming a community of over 32,000 people that includes 16,000 students and another 16,000 technology professionals. The main actors in Otaniemi include Helsinki University of Technology, Technical Research Centre of Finland VTT, Nanotechnology Research centre Micronova, Technopolis Plc (a company providing operating environments and developing incubator and other services for high tech businesses) and a large number of companies including the Nokia Headquarters.

=====

Vignette: Foundation Degrees and the Information Technology Management for Business degree (UK)

Two important e-skills UK efforts at fostering e-competences for people entering industry and those already working in it include Foundation Degrees and the Information Technology Management for Business degree (ITMB).

Foundation Degree

The Foundation Degree combines 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 industry and those already working in 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 this can count directly towards an Honours degree for those who want to continue with further study. Foundation Degrees 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 FD Framework are now available from a number of colleges and Universities.¹⁵

Information Technology Management for Business degree (ITMB)¹⁶

Information Technology Management for Business (ITMB) degrees are employer-backed undergraduate degrees focused on developing a blend of business and communications skills in addition to deep technical knowledge. These degrees have an impressive track record of success. 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 vs. 17 percent).

There are three aspects that distinguish ITMB:

- 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 including Accenture, BA, BBC, BT, CA, Cap Gemini, Cisco, Deloitte, EDS, Ford, Logica, HP, IBM, ITV, Morgan Stanley, Procter & Gamble, Network Rail and Unilever.
- It is only available at a limited number of carefully chosen Universities to ensure focused interaction with the supporting employers.

Finally, in addition to the aforementioned efforts, e-skills UK is involved in the following three works-in-progress:

- *Catalyst/Revitalize IT* - e-skills UK is working with employers and Universities to promote the capabilities graduates develop from different types of IT-related degree courses and encourage curricula development in areas of industry growth.
- *Back to school Portal* - the 'back-to-school' website is "set to be the first port of call for employers and employees in the IT and Telecoms sector to engage with education. Back to school has been designed to provide businesses and organizations with a unique bank of resources so that they can play a crucial role in shaping the employees of the future."¹⁷
- *Big Ambition* – Big Ambition is a recently launched campaign to give teenagers an insider view of technology careers. It is designed to inspire 14-19 year olds by demonstrating a wide range of IT career options, and how to get into them. The Big Ambition site can be viewed at <http://www.bigambition.co.uk/>.

=====

¹⁵ Source: www.e-skills.com/FD

¹⁶ ITMB is one of the most successful examples we have identified. During the second half of the Study, we will continue to gather more information on ITMB and analyze in greater detail its critical success factors.

¹⁷ Source: <http://www.e-skills.com/e-skills-UK-in-work/2534>

Action Item 5: Identify profiles of effective courses in terms of both content and content delivery.

Two important aspects of engaging prospective and current participants in a course are the contents of the course and how those contents are delivered.

What do the most popular courses consist of in terms of content (e.g., business process management) and in terms of how the content is delivered (e.g., lectures on theory, lectures on case studies, projects, guest lectures, academic journal articles, text books, simulations, etc.)?

In the next stages of this project, we will be develop and conduct a survey of Universities that offer courses the develop e-competences. One of the key aspects of this survey will be to address the aforementioned questions.

A better understanding of content and content delivery of popular courses will provide a guide to Universities keen on designing additional courses.

Action Item 6: Identify sources of content of effective University offerings

Those who design and teach courses that develop e-competences draw on a variety of sources. We have identified two general sources of curricula: industry-led efforts and University-led efforts. For example, as we have noted before, private industry provides content in a variety of ways, such as developing teaching material, participating in case studies, and encouraging executive to guest lecture.

What are source profiles of the most popular and relevant courses? How specific are they do either content or types of content delivery?

A better understanding of this question will enable us to recommend specific types of engagements between Universities and sources of content, such as the private sector.

VI. Emerging Challenges and Critical Success Factors

Although we are still in the process of identifying key challenges and critical success factors, we have already identified several that we have incorporated into the next phase of the project – specifically, the surveys. These have been identified before as "Action Items" and for easy reference, we list them below:

Action Item 1: Identify Demand Portfolios of Capabilities

An important way to build on efforts involving large private organizations to develop common understanding regarding demand for e-competences is to survey them to identify whether large firms have different portfolios of demand for e-competence capabilities. For example, do firms from one sector (e.g., financial services) depend on a different mix of e-competence capabilities than firm from a different sector (e.g., food and beverage)? Or do multi-business unit firms that are pursuing one type synergy across their business units (e.g., sharing data to create a single face to customers) depend on a different mix of e-competence capabilities than firms that are pursuing another type of synergy (e.g., business process standardization).

Action Item 2: Define e-competences for SMEs and government

The aforementioned collaborative efforts have primarily focused on defining the demands of a very specific group of organizations: large private-sector organizations. However, small and medium-sized enterprises (SMEs) and governments (local, national, European, etc.) are also two important types of organizations that increasingly rely on ICT to function and meet their objectives. E-competences for these two types of organizations are not well understood and additional research (e.g., surveys of SMEs and of government entities similar to the one we are conducting of CIOs of large companies) is critical to understand similarities and differences with demand for e-competences of large firms.

Action Item 3: Learn how firms meet their demand

Based on only a few interviews with CIOs and on a review of academic and sector press, we have identified four general sources that large firms rely on to meet their demand for e-competences. It is important to examine these options across a large sample of firms to better understand what types of firms rely most of which of the four options. Within the survey we are conducting of CIOs, we ask participants to estimate what percentage of their e-competence capabilities gap was met by one of the four options.

Action Item 4: Learn how firms distribute their internal development investments

Collect primary data on how firms enhance the e-competence capabilities of employees. The survey of CIOs includes a set of questions that ask participating firms to estimate how they distribute the total amount spent on building capabilities of employees across the six options we identified. Specifically, for each of the six options, we ask them to estimate:

- a) What percentage of the total amount was spent on each option?
- b) What key skills were developed?

The results from these questions will help firms benchmark themselves and help educational institutions better understand how to design and provide educational options that are useful and attractive to firms.

Action Item 5: Identify profiles of effective courses in terms of both content and content delivery.

Two important aspects of engaging prospective and current participants in a course are the contents of the course and how those contents are delivered. What do the most popular courses consist of in terms of content (e.g., business process management) and in terms of how the content is delivered (e.g., lectures on theory, lectures on case studies, projects, guest lectures, academic journal articles, text books, simulations, etc.)? In the next stages of this project, we will be develop and conduct a survey of Universities that offer courses the develop e-competences. One of the key aspects of this survey will be to address the aforementioned questions. A better understanding of content and content delivery of popular courses will provide a guide to Universities keen on designing additional courses.

Action Item 6: Identify sources of content of effective University offerings

Those who design and teach courses that develop e-competences draw on a variety of sources. We have identified two general sources of curricula: industry-led efforts and University-led efforts. For example, as we have noted before, private industry provides content in a variety of ways, such as developing teaching material, participating in case studies, and encouraging executive to guest lecture. What are source profiles of the most popular courses? How specific are they do either content or types of content delivery? A better understanding of this question will enable us to recommend specific types of engagements between Universities and sources of content, such as the private sector.

We will be addressing most of these action items with the surveys of CIOs and Universities. The notable exception is the second action item, on the importance of better identifying what e-competences mean to SMEs and how they are meeting their demands for e-competences. This action item is unfortunately beyond the scope of the study; however it is critical that future efforts correct the dearth of data and resources on SMEs and e-competences.

A few critical success factors (CSF) are emerging from our research, and we look forward to developing these in much greater detail, as well as identifying new ones, once we finish analyzing the survey data. For the moment, the following CSFs are worth noting briefly:

Critical Success Factor 1: The role coordinating organizations

Successful curricula development efforts are the result of multi-stakeholder group efforts that are quite vulnerable to participating stakeholder groups focusing on differences rather than complementarities between themselves and other participating groups. In most cases, these multi-stakeholder group efforts have been led by and moderated by a third-party coordinating organization (a few notable exception are it-vest and Aalto University). 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.

Critical Success Factor 2: Taking a holistic approach

Several experts that we spoke with regarding the impressive track record of successful efforts from Finland and the United Kingdom note their holistic approach to building e-competences. Successful curricula development efforts are part of a broader, more systemic approach at enhancing e-competences. Their efforts target all ages of their population – from children to school and University students to professionals to the elderly. For example, e-skills UK is coordinating and leading a number of efforts aimed at changing perceptions and building skills throughout the life of learning - from 10-14 year olds (e.g., CC4G) to current professionals (e.g., The Skills Academy for IT). Terry Hook of e-skills UK notes that "the

approach to curriculum development must be holistic. The issue of appropriate and relevant ICT education is not independent of national education systems or political decisions. Nor can it be driven by unfounded opinion; solid research and reliable data is required to pursue and inform institutions that changes to curriculum are needed. These infrastructure issues and more including effective marketing of the need for change form part of the problem and also offer routes to the solution."

Critical Success Factor 3: Educators include professionals who have left industry and joined an academic institute

An emerging critical success factor which we look forward to examining with survey data is the importance of having educators with significant industry experience – particularly with experience 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 by either professors that had worked in industry or professionals that we currently industry leaders. In the survey we conduct of Universities, we will examine this issue in greater detail.

Critical Success Factor 4: Developing curricula components, to avoid becoming dependent on technological changes

The practice of developing curricula into components is the final emerging critical success factor we want to highlight at this point. When designed with a very specific situation in mind, curricula is vulnerable to becoming too narrowly relevant to a specific firm, technology, or application. We heard from several people we spoke with that a critical success factor in developing curricula that both remained relevant over time and was adopted by multiple courses and/or Universities was developing curricula into components. The notion of designing by components is a well established one in software engineering, product development, and supply-chain management. The basic idea is similar to LEGOs: 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: 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 losing the efficiencies of reuse) and defining the interface of the component (e.g., the "wrapping" in software). We will examine both aspects further with Universities, in an effort to identify effective processes for defining the right size and interface for curricula components.

VII. Conclusion and Next Steps

This synthesis report provides an overview of several emerging findings thus far in the project. We have reported on the immense amount of progress that has been made with regards to addressing the e-competences gap faced by industry, governments, and academia. This progress is most notable in the fundamental aspect of developing "common currencies" between multiple stakeholder groups from industry (most notably large companies' use ICT to achieve their strategic objectives and ICT vendors), government and academia which define what capabilities "e-competences" consist of. We describe several national and pan-European multi-stakeholder group efforts at defining demand for e-competences. Multi-stakeholder group efforts have also made significant progress in terms of developing curricula for e-competences. We highlight two general types of efforts: industry-led and University-led.

We also highlight areas where additional research needs to be conducted to better understand how firms are meeting their demand for e-competences and to what, more specifically, are the roles that Universities are playing to help firms meet their demand. For example, there is a dearth of data on how firms meet their demands for e-competent managers as well as on how firms develop e-competences of existing employees. At this stage in the Study, we have identified seven "Action Items." Most of these describe the next steps that we will take for developing a final set of recommendations for enhancing curricula for e-competences (i.e., for developing the "guidelines"). More specifically, we describe how we will use two surveys – one of CIOs and one of Universities that currently offer opportunities for developing e-competences – to build on the progress that has already been made and insights we have developed thus far. As we gather additional data on existing efforts, and analyze survey results, we will develop for the final report of the Study a set of action items for industry, academia and government – i.e., guidelines – for developing effective curricula for e-competences.

Appendix A: The synthesis reports draws on a variety of sources

A.1 Interviews

The following is a selection of 40 experts that we have talked with thus far with regards to developing curriculum for developing e-competent managers (listed in alphabetical order).

1. Ida Andersson, Digital Economy and Education Policy, Nokia
2. Jussi Autere, Professor, Software Business Laboratory, Helsinki University of Technology (TKK) (Finland)
3. Cynthia Beath, Emeritus, U. Texas – Austin
4. Fernando Birmna, Chief Enterprise Architect, Rhodia
5. Véronique-Sophie Bounaud, Group Executive Management Director Northern & CEE & Asia Pacific regions, AXA Group
6. Johanna Bragge, Helsinki School of Economics
7. Jutta Breyer, Director of Breyer Publico (led the development of the European e-Competences Framework)
8. Andrea Carrugatti, Professor of Enterprise Architecture course (Denmark)
9. Bob Clift, E-Skills UK
10. Alberto Delgado, Executive Director, Penteo (Spain)
11. Diane Devriendt, Marketing Director, Vacature.com (Belgium)
12. Eppie Eloranta, Finnish Information Society Development Centre (TIEKE) (Finland)
13. Martin Frick, CIO Avis-Europe
14. Peter Hagedoorn, EuroCIO
15. Heikki Hallantie, Aalto University Foundation
16. Tarja Hartman, Economic Information Office of Finland
17. Antonio Herrera, Cisco Systems
18. Terry Hook, e-skills UK
19. Ari Huczkowski, Otaniemi Marketing Ltd. (Finland)
20. Lena Augusta Jorgensen, Aarhus Director for Executive Education and Alumni Relations (Denmark)
21. Jette Lundin, Professor at Aarhus School of Business; Former chief architect of Danish telco (Denmark)
22. Clementina Marinoni, CEFRIEL (Italy)
23. Markku Markkula, TKK Dipoli
24. Gitte Møldrup, Direktør IT-vest (Denmark)
25. Damien O’Sullivan, ECDL Foundation
26. Jeff Pattmore, Head of University Relations, BT (UK)
27. Johan De Prijck, Human Resources Director, Lantmannen Unibake Beleux (Belgium)
28. Simon Pickard, Director General, European Academy of Business in Society (Belgium)
29. Jorn Plor, Head of Management Department at Aarhus School of Business (Denmark)

30. David Roberts, Director of Corporate IT Forum (UK CIO organization)
31. Heino Schrader, SAP
32. Corinna Schulze, IBM
33. Walter Seboeck, Danube University
34. Tormod Skjerve, Cedefop
35. Marianne Tremblay, Marianne Tremblay, Program Coordinator Executive Master in e-Governance, Ecole Polytechnique Fédérale de Lausanne (EPFL)
36. Danny Vanhove, CIO Forum Belgium
37. Bernard Verdier, CIO of Sanofi-Aventis
38. Carlos Versteede, CIONet
39. Peter Weiss, Research Group Software Engineering
40. Peter Weill, Executive Director, MIT Sloan Centre for Information Systems Research (CISR) (USA)

A.2 Reports and documents

The following is a selection of the reports and documents we have collected and drawn on to inform the study.

- Bell Canada press release. «Workforce shortages in the IT sector: Bell establishes coalition to ensure the next generation of IT resources" 4 December 2007. <http://www.bce.ca/en/news/releases/be/2007/12/04/74551.html>
- The Conference Board of Canada. (2009). "Connecting students to tomorrow's ICT jobs and careers: A pan Canadian dialogue with grade nine and ten students, parents, and secondary school guidance/career counsellors." report prepared by The Conference Board of Canada for Bell Canada Inc. and Canadian Coalition for Tomorrow's ICT Skills. May 8, 2009.
- E-skills for the 21st Century: Fostering Competitiveness, Growth and Jobs. Communication from the Commission to the Council, The European Parliament, The European Economic and Social Committee and the Committee of the Regions. COM (2007) 496 final, 7.9.2007, 10 pp. Available at <http://ec.europa.eu/enterprise/ict/policy/ict-skills.htm>
- Goles, T., Hawk, S. and Kaiser, K.M. (2007). "Information technology workforce skills: The software and IT services provider perspective." *Inf Syst Front.* 10:179–194.
- HM Treasury, *Prosperity for all in the global economy - world class skills, Final Report*, December 2006 (also referred to as the '*Leitch Review of Skills*'), Executive Summary, p.6, para 1.
- House of Commons. (2009). "Innovation, Universities, Science and Skills Committee. Re-skilling for recovery: After Leitch, implementing skills and training policies." First Report of Session 2008-9. Vol. 1. p. 47. para 133. 16 January 2009.
- e-skills UK. *Creating the IT Nation: The Strategic Plan for England 2009-2014*. 2008.
- Gras-Velazquez, A., Joyce, A., and Debry, M. (2009). "Women and ICT: Why are girls still not attracted to ICT studies and careers?" White paper developed for European Schoolnet (EUN Partnership AISBL). June 2009.
- Kolding, M. (2008). "The Demand for e-Skills: Assessing the Skills Gap." presentation of IDC research by Associate Vice President, IDC, European SW & Services.
- Korte, W.B., Braun, N., and Gareis, K. (2007). "Benchmarking Policies on Multi-Stakeholder Partnerships for e-Skills in Europe." Executive Summary of report prepared by Empirica for the European Commission and the European e-Skills Forum. December 2007.
- Lanvin, B. (2008). "E-skills, competitiveness and employability." Research paper presented at the EU Conference on E-skills (Thessaloniki, October 2008) based on research conducted in collaboration with Microsoft and the European Union.
- Lanvin, B. and Fonstad, N. (2009). "Who Cares? Who Dares? Providing the skills for an innovative and sustainable Europe." Background paper prepared for the European Business Summit 2009.
- Lanvin, B. and Passman, P.S. (2008). "Building E-skills for the Information Age." in "The Global Information Technology Report 2007-2008: Fostering Innovation through Networked Readiness," S. Dutta and I. Mia (Editors), pp. 77–90, Palgrave Macmillan, April 2008.

CIGREF

Documents and Annual Report (06-07) available from CIGREF website:
<http://www.cigref.fr/>

<http://www.ecompetences.eu/1416,ICT+Framework+stakeholders.html>

The European e-Skills Newsletter. Issue No 4 - Second Semester. 2005. Available at:
http://www.cedefop.europa.eu/eskills/nl/eSkills_NL4.pdf

Curricula Guidelines

Career Space and Cedefop (European Centre for the Development of Vocational Training). (2001). "Curriculum Development Guidelines. New ICT curricula for the 21st century: designing tomorrow's education." Luxembourg: Office for Official Publications of the European Communities. 49 pp. ISBN 92-896-0074-8.

Gorgone, J.T., Gray, P., Stohr, E. A., Valacich, J.S., and Wigand, R. T. (2006). "Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems". *Communications of AIS*. Volume 17, Article 1.

Corporate Universities

Blass, E. (2005). "The rise and rise of the Corporate University." *Journal of European Industrial Training*. 29:1. pp. 58-74.

"The Corporate University: Learning Tools for Success." (1998). A Consortium Benchmarking Study Best-in-Class Report developed by the American Productivity & Quality Centre Institute for Education Best Practices (IEBP). Susan Elliot (Editor).

Fernandez, J.A. (2007). "The future of Corporate Universities in Europe." *Global Focus*. 1:2. pp. 40-43.

Taylor, S. and Phillips, T. (2002). "The Corporate University Challenge: Corporate competitiveness, learning and knowledge." Report of the EFMD CU Learning Group (1999-2001). EFMD, Eindhoven/Open University, Milton Keynes. Available upon request from <http://www.efmd.org/index.php/component/efmd/?cmsid=040929yuch&pub=041103fdxh>

Service Science

Choudaha, Rahul. (2008). Competency based Curriculum for a Master's Program in Service Science, Management And Engineering (SSME): An Online Delphi Study. Executive summary: Doctoral dissertation, University of Denver, USA. Available at: http://download.boulder.ibm.com/ibmdl/pub/software/dw/University/ssme/Rahul_Dissertation_Exec_Summary.pdf?S_TACT=105AGX01&S_CMP=LP

Glushko, R.J. (2008). "Designing a service science discipline with discipline." *IBM Systems Journal*. 47: 1. pp. 15-27.

IfM and IBM. (2008). *Succeeding through service innovation: A service perspective for education, research, business and government*. Cambridge, United Kingdom: University of Cambridge Institute for Manufacturing.

Appendix B: European Universities that offer opportunities for building e-competences - an emerging overview.

The following Table consists of an emerging list of European Universities that offer opportunities for building e-competences. We welcome recommendations of additional Universities and courses to include. For our survey of Universities, we will contact all instructors in this list.

University	College	Course Title	Instructor(s)
Aristotle University of Thessaloniki (Greece), Faculty of Engineering			Komnini Tsinari - Kontou
Aston University	Business school	MSc Business & IT	Dr. Matthew Hall
Aston University	Business school	MSc IT Project Management	Dr Aniko Ekart
Coventry University	School of lifelong learning	IT and Business Management MSc degree	Sue Rivers, Acting Dean
Coventry University	School of lifelong learning	IT and Business Management PgCert course	
Coventry University	Faculty of Engineering and computing	Postgraduate Business Information Courses Information and Systems Architecture MSc degree	Mr Chris Bland - Head of Department - Computing and the Digital Environment
Coventry University		Management Information Systems MSc degree	Mr Chris Bland
Cranfield University	School of Applied Sciences	Management Information Systems MSc degree	
De Montfort University	Faculty of Technology (Computing Sciences and Engineering)	MSc Information Systems Management	Steve McRobb
Ecole National Supérieure d'Informatique et de Mathématiques Appliquées (France)		Master in Communication and Systems Engineering	
Edinburgh Napier University	School of Computing	MSc Business Information Technology	
European University - Industry Network (EU)	University of Transylvania of Brasov		Doru Talaba
Fachhochschule für Technik und Wirtschaft Berlin (Germany)		Business Administration and Engineering - Master of Science	Hartmut Fredrich
Ghent University	Department of Management Information Science and Operation Management	Faculty of Economics and Business Administration	

IBM and University of Karlsruhe	KSRI - Karlsruhe Service Research Institute		Gerhard Satzger
Institut National des Telecommunications (France)	INT Management, a Business School specializing in IT industry	Most of the programmas correlation between bussiness and management studies	Denis Lapert
IT-University of Copenhagen		Masters program IT Management and strategy	Bo Svarre Nielsen
Johannes Kepler University (Austria)			Christian Stary
King's College London	Division of Engineering	MSc Engineering with Business Management	
Kingston University	Kingston Business School	MSc in Business Information Technology	Dr Christopher Reade
L'Institut National des Sciences Appliquees de Lyon (France)	Under the life long learning program	Master with speciality in Informatics and Applications	Guy BAYADA and Michel DESCOMBES
L'Institut Superieure d'Electronique du Nord, (France)	Brest: Masters' Project Manager technology. "		Pierre GIORGINI
L'Union des Industries Metallurgiques et Minières (France)			
Lancaster University	Management School	MSc in Information Technology, Management and Organisational Change	Kerry Fenton
Linkoping University (Sweden)	Engineering and Computer Sciences	Software Engineering and Management	Kristian Sandahl, Vivian Vimarlund
London School of Economics and Political Science	Department of Management	MSc Analysis, Design and Management of Information Systems (ADMIS)	Cheryl Edwardes
Portuguese Catholic University	Faculdade de Ciências Económicas e Empresariais	PAGETTI - Advanced Management Programme for Telecommunications and Information Technology	Catarina Paiva, Sónia Gonçalves
Public Research Centre Henri Tudor		Business Organisation and Management	
Roehampton University	School of Business & Social Sciences	International Management of Information Systems	Professor Yvonne Guerrier, Dean
Rovaniemi University of Applied Sciences		Bachelor Degree program in Information Technology	Aku Kesti
Royal Holloway, University of London	School of management	MSc Business Information Systems	Joanne Barrs
Tallinn University	Informaatika Instituut	Infotehnoloogia juhtimine	Peeter Normak, Heli Tohver, Tiina Mäe
Technical University (Austria)			Andreas Steininger
Technical University of Denmark	MSc in Computer Science and Engineering		Jørgen Villadsen

The National University of Ireland, Galway	The Department of Accountancy & Finance	GY206 B.Sc in Business Information Systems	Tom Acton
The National University of Ireland, Galway	The Department of Accountancy & Finance	M.Sc. Information Systems management	Dr. Michael Lang
The National University of Ireland, Galway	The Department of Accountancy & Finance	M.Sc. Business Information Systems	Dr. Thomas Acton
The Open University	Business and management	MSc in Strategic Management of Information Systems	
The University of the Aegean (Greece)	School of engineering, Department of information and communication systems engineering	Information Systems Management	George A.Vouros
TKK Dipoli – Helsinki University of Technology		EDUCATION AND TRAINING FOR INFORMATION AND KNOWLEDGE PROFESSIONALS *Information Design and Architecture * Geographical Information Systems Design and Management * Knowledge Asset Management * Content Producing (Intranet, Internet)	
Trinity College (Ireland)	School of Computer Science and Statistics	MSc Management Information Systems	Margaret Murray
TUNING Educational Structures in Europe (EU)	ECET - European Computing Education and Training		Prof. Dr. Angel Smrijkarov
Universidad Carlos III de Madrid (Spain)	Faculty of Engineering	Administration and Management of Information Systems	Jesús Carretero Pérez
Universidad Politecnica de Madrid (Spain)	E.T.S De Ingenieros industriales	University Master in Economics and Innovation Management	Gómez Vilda, Pedro
Universidade do Porto (Portugal)			
Universitat Paderborn (Germany)			Eckhard Steffen
Universitat Polytecnica de Catalunya (Spain)	School of Professional and executive development	Informations Systems Management	Monica Celma Meseguer
University of Aarhus	Aarhus School of Business	Practical Approach to Enterprise Architecture Implementation	Drs. Andrea Carugati and Jette Lundin
University of Dundee	School of Computing	MSc Computing with International Business MSc Information Technology and International Business	Dr Keith Edwards

University of Karlsruhe			Christine Ermantraut
University of Manchester	Manchester Business School	MSc Information Systems: Business Information Technology	
University of Manchester	Manchester Business School	MSc Information Systems: e- Business Technology MSc Information Systems: e- Government	
University of Manchester (UK)	School of Computer Science	Advanced Computer Science and IT Management MSc - IT, Information Systems: Organisations and Management MSc - Bussines	
University of Milan	Mathematical, Physical and Natural Sciences	Department of Information and Communication	Goffredo Haus, Danilo Bruschi
University of Nottingham	School of Computer Science	MSc Computer Science and Entrepreneurship	
University of Oulu (Finland)			Pekka Kess
University of Portsmouth	Learning at Work	MA Business & Computer Studies	
University of Reading (UK)	ERASMUS MUNDUS MSc in Network and e- Business Centred Computing		Yvonne Woodward
University of Sunderland, School of Computing and Technology	Faculty of Applied Sciences	Msc Information Technology Management	
University of Surrey	School of Management	MSc in Management Information Systems	
University of Warwick	Warwick Business School	MSc Information Systems & Management	Wendy Curry
University of York (UK)	MSc Social Informatics and Management	Postgraduate studies, Faculty of Sociology	Alison Taylor, Brian Loader