3 Editorial. European Certification of Informatics Professionals — Niko Schlamberger

Monograph: "EUCIP: A Model for Definition and Measurement of ICT Skills" (published jointly with Novática*)
Guest Editors: Renny Bakke Amundsen, Neil Farren, and Paolo Schhör

4 Presentation. Introducing EUCIP — Renny Bakke Amundsen, Neil Farren, and Paolo Schhör (with contributions by Niko Schlamberger)

7 EUCIP General Overview — Michael Sherwood-Smith and Giovanni Franza

12 Exploring the EUCIP Certification Range and Progression Options — Paolo Schhör, Frank Mockler, and Neil Farren

17 Advanced Experiences in Norway — Renny Bakke Amundsen

20 Advanced Experiences in Italy: The University Approach to EUCIP — Marco Ferretti and Nello Scarabottolo

27 Advanced Experiences in Italy: EUCIP as a Shared Model in the ICT Community — Roberto Bellini, Franco Patini, and Antonio Teti

32 Ireland Implementation Model — Mary Cleary

34 Estonia Implementation Model — Jaan Oruaas

36 Spanish Implementation Model: Current Situation — José O. Montesa-Andrés, José-Maria Torralba-Martínez, and Manuel Rodenes-Adam

39 A Web-based Computer System as a Main Tool of Certification Processes Automation in EUCIP Poland — Grzegorz Szyjewski

44 Implementing EUCIP IT Administrator in Romania — Ana Dulu

46 An Overview of Recent Adoption in Croatia — Kristijan Zimmer and Enola Knežević

49 CISCO and EUCIP Co-operation in ICT Professional Competencies Development — Fabrizio Agnesi

52 EUCIP Services for Organizations — Roberto Bellini

55 E-Learning Tools and Projects on EUCIP Core — Marco Ferretti and Juan Oruaas (with contributions by P. Prinetti, A. Chianese, P. Salomoni and Lily Loidap)

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"Innovation Driven by ICT Users"
(The full schedule of UPGRADE is available at our website)
Thinking Ahead on e-Skills in Europe: Matching Supply to Demand

Consortium Team led by CEPIS

This report offers a framework for long-term thinking on the development of Information and Communication Technology (ICT) as the engine of Europe’s knowledge economy. Core information is drawn from the findings of "Thinking Ahead of e-Skills for the ICT Industry in Europe", a report published for the European Commission by a consortium led by the Council of European Professionals Informatics Societies (CEPIS).

Keywords: e-Skills, European Policies, Future Scenarios, ICT Industry, ICT Workforce, Knowledge Economy.

1 Findings
The rate of ICT innovation, the economic climate and off-shoring are likely to have the greatest impact on future demand for IT practitioner skills by the ICT industry in Europe. A consortium composed of CEPIS, Manchester Institute of Innovation Research (formerly PREST) and Eurochambres estimated supply and demand levels for IT practitioners in 2010 and 2015, having created six foresight scenarios based on quantitative evidence. They believe that the ICT industry could be facing shortages of up to 70,000 IT practitioners per year in Europe, as supply falls short of demand. A fall-off in ICT activity is seen as very unlikely, but should this occur the EU could be facing an oversupply of 1,000 IT practitioners per year.

2 ICT as Infrastructure
We live in an ongoing technological revolution in both hardware and software, one where our lives are more and more dominated by the pervasiveness of ICT, where sophisticated software has fused with telecommunications to conquer the limitations of geography, where we can deliver unique and imaginative solutions to our customers and access business-critical information when we need it and where we need it.

Behind the progress of this hardware and software is an ICT industry whose innovations are led by speculative curiosity, by market demand forces and by anticipation of our wider needs and desires; and behind this industry are people: the creative professionals who make it possible, the customers who use its applications and the enterprises who conduct business across the marketplace of the Internet.

ICT has become the cornerstone of the modern European economy. It is vital to homes and indigenous businesses across the EU – and is a requisite for attracting foreign direct investment. ICT systems are the “bridges, roads and railways” of the highly evolved economy, and the means by which modern states compete to put themselves on the global map. And just as previous innovative infrastructures have required people with the vision to design and build tunnels and skyscrapers, ICT is nothing without a supply of creative and excellent people to design and build new hardware, to write and continually extend and enhance software, and to dream up the imaginative interfaces that can link previously disconnected technologies.

Europe is evolving away from heavy industry and gearing its resources more towards becoming a matrix of knowledge economies. To ensure its own continued success, our ICT industry must be equipped with professionals who have both the knowledge and the experience to produce the services and products we need. In Europe, we must plan and

ICT Workforce
Europe’s ICT market is worth in excess of 500 billion euros per year and employs 4 million people, with the software and IT sector alone accounting for 2.8 million workers. In the decade to 2005, 1.7 million of these jobs were created. Any shortage in the supply of ICT professionals would limit the sector’s development.

Figure 1: ICT Workforce Figures.
monitor our policies to ensure that our supply of ICT professionals will meet our future demand: we need the right number of people with the right levels and mix of skills. Anything less and Europe’s member states will lag behind the rest of the world technologically and therefore slip economically. To avoid being relegated to playing a smaller international role, Europe must ensure that it has a supply of appropriately skilled ICT practitioners (see Figure 1).

3 e-Skills Pool: Supply and Demand

The ICT workforce needs are supplied in a variety of ways. Primarily, people enter the sector having studied courses at certificate, diploma or degree level. These employees choose to study computing for various reasons – including personal interest, desired career path and, crucially, response to national educational strategies. Typically, computing (informatics) students follow third-level courses with the goal of taking up lifelong employment in the ICT sector. Their decision to follow such syllabuses is influenced by the availability of courses, perceived job satisfaction and security, likely levels of remuneration and their response to the overall image of the ICT industry.

In times of boom, people will be enthusiastic to commence and complete computing qualifications. A recent example was the dot-com boom, when the Internet appeared to offer endless potential in terms of creativity, mobility and financial reward. Preparation for the “Y2K bug” and the computer implications of adopting the euro all captured the imagination of people and drew them into ICT. In less certain times, people are more reluctant to embark on specific courses of study – we only have to look at what happened when the dot-com bubble burst in 2000 to see how a workforce can move away from what was once so attractive.

The danger is that such extreme (and unforeseen) swings of interest in ICT can leave the skills market short of qualified people – this is most likely to happen when the market has recovered, is growing fast and is in most need of a specialist workforce. Central to this problem is the time lag between study and qualification. Academia generally moves slowly; national educational policy is cautious in responding to estimates of future workforce needs; and serious attempts to study the possible shape of the future take time. It is of limited use to respond to a take-off in an industrial sector after it has started – it requires years for policies to be developed and implemented, and years again for educational courses to be devised and filled. By the time the much-needed graduates eventually come on stream, the industry may have stopped growing, be less buoyant or have gone into decline – in each case starved of the skilled people it needed to prosper and reach the next level. One thing is clear: demand for IT practitioners must be professionally forecast and policies must be developed and implemented to ensure their timely supply. This report by CEPIS meets those requirements by modelling potential supply and demand scenarios for IT practitioners using a mix of quantitative and qualitative analysis (see Figure 2).

In modelling the future supply of and demand for IT practitioners, CEPIS took into account demographic decline and the expected fading interest by students in IT and technology courses, estimating for its scenarios a fall-off in graduations of 30 per cent between now and 2015. Across the EU, there must be compensation for this drop. Otherwise, we will suffer more serious adverse impact of competition from outside the EU, as we falter within the global economy made possible by ICT technology and skills.

4 Study

To shed light on the future personnel needs of the ICT industry, a model of the overall environment was devised. Ninety stimulants or "change

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Innovation Rate</th>
<th>Economic Growth</th>
<th>Off-shoring Pace</th>
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</thead>
<tbody>
<tr>
<td>A: Renaissance</td>
<td>Rapid</td>
<td>Positive</td>
<td>Moderate</td>
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<tr>
<td>B: Steady Climb</td>
<td>Moderate</td>
<td>Positive</td>
<td>Moderate</td>
</tr>
<tr>
<td>C: Global</td>
<td>Rapid</td>
<td>Positive</td>
<td>High</td>
</tr>
<tr>
<td>D: Fight Back</td>
<td>Rapid</td>
<td>Turbulent</td>
<td>Moderate</td>
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<tr>
<td>E: Dark Days</td>
<td>Moderate</td>
<td>Turbulent</td>
<td>Moderate</td>
</tr>
<tr>
<td>F: Decline</td>
<td>Moderate</td>
<td>Turbulent</td>
<td>High</td>
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Table 1: Future Scenarios for the ICT Industry in Europe.
Figure 3: IT Practitioner Supply and Demand, ICT industry 2010.

Figure 4: IT Practitioner Supply and Demand, ICT industry 2015.

**Figure 5:** News on European Commission Policies on e-Skills.

drivers" likely to impact on the development of the industry in the years up to 2015 were identified. These included social, technological, economic, environmental, political and other forces that together could shape the demand for IT practitioners. Overall, they yielded three dominant influences or "core drivers":
- ICT innovation rate;
- Economic growth; and
- Off-shoring pace.

A number of permutations of the positive and negative roles played by each of these three core drivers are possible – the results give rise to various future scenarios (see Table 1). Six of these scenarios were isolated to help clarify thinking about the level and type of e-skills needed in the years up to 2015. These scenarios were labelled as follows: Renaissance, Steady Climb, Global, Fight Back, Dark Days, and Decline.

Arising from detailed workshop discussions held in November 2006 with expert EU member state representatives and feedback from leading ICT industry players, expected values of the core drivers (innovation, economics and off-shoring) were deemed most likely to produce the first three scenarios: Renaissance, Steady Climb and Global. This is based on a detailed consideration of all six scenarios and of detailed figures for the years 2010 and 2015.

Important to the CEPIS analysis is the strong evidence of close correlation between investment in software and the level of employment in the ICT industry. The availability of figures for software investment in EU member states facilitates modelling of the ICT future in each of the scenarios.

For the purposes of modelling the future, overall economic conditions of 2.5 per cent GDP growth per annum are described as "positive"; and conditions of 1.5 per cent GDP growth per annum are described as "turbulent".

Figures 3 and 4 summarise ICT practitioner labour market imbalance estimates for 2010 and 2015.

5 Positive Scenarios (deemed "more likely")

The first set of scenarios (Renaissance, Steady Climb and Global) is based on a future where the economic climate is positive. In the context of high levels of growth, ICT becomes an increasing element of many educational courses. While there is an increased interest in IT careers by women, and people will generally tend to remain longer in the workforce, shortages of staff lead to a surge in off-shoring to lower-cost regions outside the EU.

These scenarios reveal that, in 2010, annual supply will reach only 180,000 in a market requiring 250,000 IT practitioners.

By 2015, overall demand is seen as falling to a potential low of 129,800 with a shortfall of as many as 51,000 IT practitioners.

6 Negative Scenarios (deemed "less likely")

The second set of scenarios (Fight Back, Dark Days and Decline) is based on contexts where economies grow turbulent, where geopolitical instability increases and where business cycles become erratic. There would be a tail-off in investment confidence and reluctance to adopt new technologies. Off-shoring would initially decrease due to volatility and poor international relations. Eventually, the situation within the EU would be as unstable as the rest of the world and off-shoring would become more attractive on the grounds of cost and a pragmatic acceptance of political instability overseas.

By 2010, the net result of such negative scenarios would be a marginal oversupply of IT practitioners.

By 2015, demand could fall to as low as 38,000 with continuing shortages; or, in a Fight Back scenario, there could be a shortfall of as many as 30,000 IT practitioners.

7 A Call for Action

Having created various future scenarios based on quantitative evidence, and having estimated supply and demand levels in 2010 and 2015, CEPIS believes Europe could be facing shortages of up to 70,000 IT practitioners per year, as supply limitations fail to satisfy high demand.

The figures suggested by these future scenarios make it clear that the ICT industry must not be allowed to develop "organically" – as this could lead to a situation where the industry had an inadequate workforce, with too few people, and not the right depth of skills. Challenges would also arise if there were too many people – this could lead to unemployment and start a cycle where IT careers would appear unattractive, leading ultimately to a shortfall of skills in the industry as students avoid IT courses.

To get the balance of supply and demand right, policymakers in education, in regional and national governments and at EU level must be very attentive to likely workforce needs (see Figure 5). At a policy level, this extends to research and development and to immigration policy; and it requires professional bodies and trade unions to work with policymakers to ensure a greater supply of IT professionals. The ICT industry itself has a key role to play in coordinating these efforts.

8 What Must We Do to Avoid a Future e-Skills Shortage?

To reduce the risk of running short of IT practitioners with the right degree of excellence in a range of e-skills, all relevant ICT stakeholders must work to:
- Create better awareness of the threats and opportunities in the growth of globalisation of ICT activity.
- Promote improved understanding for both the industry and public
bodies of the current quantitative and qualitative levels of e-skills in Europe.

- Foster public-private initiatives to develop understanding of likely estimates of e-skills needs at the European level. This would need investment by ICT industry players and the European Commission, and cooperation in estimating future levels of demand. Such collaboration between industry and policymakers would lead to better understanding of the impacts of cyclical market effects on the supply of and demand for practitioners.

- Train more consistently and steadily over time. E-skills must be imparted more evenly throughout all phases of the business cycle. The pressures of business often make it difficult to allocate enough time to training, while in slack phases, industry is cautious about investing in training.

- Collect comprehensive and reliable data on e-skills at EU level. We also need to improve the quality of cross-coding of national labour force survey data for submission to Eurostat.

- Benchmark EU e-skills against competitor economies.

- Focus on the quality aspects of skill shortages, not just the quantity. The ICT industry needs skills elites and a growing pool of capable people with the right level and mix of technical competence.

- Minimise mismatches between university and industry. More collaborative work between the two is required, along with the introduction of competence frameworks as goals within higher education. Bridges should be built between ICT industry-based certifications and formal education and vocational training courses. At the same time, students should not be moulded just for the immediate needs of the workplace.

- Cultivate a positive public image of the ICT industry. State and industry must work to attract people to study computing courses and pursue ICT careers. Positive coverage of ICT activity and active recruitment drives must do more than counteract "bad news" such as redundancies in specific companies. The industry must be portrayed as dynamic and rewarding, exciting and desirable. Students contemplating the study of ICT must be helped understand that it is the market environment when they graduate that counts.

- Clarify employment levels as they evolve and use them to continuously gauge the future requirements. Common indicators and measurement criteria must be agreed on and actively sought as part of a process of constant monitoring.

It is hoped that the work and conclusions presented in this report will be found of value by interested parties; CEPIS looks forward to continuing to engage with the European Commission and stakeholders to further advance the understanding of e-skills in Europe and to supporting measures that will help improve the position of e-skills throughout the EU.