

**eEurope - IT Skills:
Challenging Europe's Economic Future**
Workshop Proceedings



eChallenges e-2003 Conference
22 October, Bologna, Italy

Edited by

Wolffried Stucky
Workshop Chairman
CEPIS Council of European Professional Informatics Societies

and

Peter Weiß
Workshop Co-ordinator
*Institute for Applied Informatics and Formal Description Methods – AIFB
University of Karlsruhe, Germany*



Council of European Professional Informatics Societies
<http://www.cepis.org>

© 2004 CEPIS and the authors mentioned in the table of contents

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without prior written permission from the publisher.

ISBN 3-00-013499-9

Publisher & Distributor

Council of European Professional Informatics Societies (CEPIS)

Stresemannallee 15

60596 Frankfurt am Main

Germany

Email: secretary@cepis.org

Phone: +49 (69) 6308 393

Fax: +49 (69) 9631 5233

Print

Heinrich Fischer Rheinische Druckerei GmbH

Mainzer Straße

67547 Worms

Germany

Phone: +49 (6241) 4253 0

Fax: +49 (6241) 425399

Acknowledgements

The editors are pleased to be able to acknowledge the contributions of all authors and workshop participants to carry out this workshop. Special thanks belong to the eChallenges e-2003 Conference, who invited CEPIS to organise this workshop in Bologna. In particular the editors are pleased to acknowledge the support of the following organisations to produce this book:

eChallenges e-2003



Conference Secretariat
Mireille Edin
ADERA Service
BP 196 - 33608 Pessac Cedex – France
Internet: <http://www.echallenges.org>

European Certification of Informatics Professionals



EUCIP Ltd
1 Sanford Street,
Swindon SN1 1HJ,
United Kingdom
Email: info@eucip.com
Internet: <http://www.eucip.com>

European Computer Driving Licence Foundation



The ECDL Foundation Ltd.
Third Floor
Portview House
Thorncastle Street
Dublin 4, Ireland
Email: info@ecdll.com
(Please include your country location details in your query.)
Internet: <http://www.ecdl.com>

Introduction

The existing European IT skills gap is one of the biggest challenges for IT industry during the next years. CEPIS (Council of European Professional Informatics Societies) sets out to reduce the European IT skills gap bringing industry, academia, public and governmental bodies together to define objectives, exchange experiences and agree on appropriate future activities. Appropriate measures and activities have to be accepted European wide and should be based on an agreed standard.

CEPIS organised this workshop on Wednesday, 22nd October 2003 during the eChallenges e-2003 Conference taking place this year in Bologna, Italy. The workshop has been a networking event and has targeted to kick-off a series of similar events to bring together industry, academia and European Commission, to exchange experiences made and to define future steps and related necessary future activities to close the current IT skills gap across Europe.

eChallenges e-2003 is the thirteenth in a series of annual conferences, which regularly attract over 500 delegates from commercial, government and research organisations around the world. Focusing on e-Business, e-Government, organisational knowledge, e-Work and knowledge work and e-Europe 2005, the goal of e-2003 is to stimulate rapid take-up of Research and Technology Development (RTD) results in Europe and to help open up the European Research Area (ERA) to the rest of the world. This conference series is recognised as an important event in the international research calendar, attracting delegates and speakers from around the world. Formerly known as the e-Business and e-Work Conference and supported by the European Commission under the Information Society Technologies (IST) programme, the scope of eChallenges has evolved with the transition from Framework Programme Five (FP5) to Framework Programme Six (FP6).

Such workshops as held in Bologna are crucial to tackle the existing European IT skills gap. The workshop did show, we are on the right track but future workshops and activities should follow to set up the required private-public partnership. CEPIS is looking forward to working closer with the European Commission and the workshop participants, to tackle the current situation on the IT labour market. In future, all participants should join forces and are encouraged to intensify their collaboration and to actively contribute to the already built partnerships, established working groups and upcoming events and conferences in 2004.

I would like to acknowledge the valuable contributions of all authors and workshop participants to carry out this workshop. Special thanks belong to the eChallenges e-2003 Conference, who invited CEPIS to organise this workshop in Bologna.

Frankfurt, December 2003

Wolffried Stucky
CEPIS Past President

Table of Contents

Wolffried STUCKY, CEPIS Filling IT-Skills Gap and Shortage	9
Marina MANZONI, European Commission EU Initiatives, Policies and Research Programmes in the Area of ICT Skills	21
Francesca BORGA, AIP – Politecnico di Milano DIGI-Q project, an Innovative Approach to Introduce ICT Skills to SMEs	31
Matthew DIXON, CEPIS Information Technology Practitioner Skills in Europe	39
Henk de VRIES, Career Space Fostering ICT skills is Crucial to Europe’s Development. Based on Trends in Markets and Technology	63
Burkart SELLIN, Cedefop European ICT skills and training needs on sub-degree and vocational levels	69
Stig ARFF, DND EPICS - market validation for pan-European Certification of Informatics Professionals	79
Finn KRISTENSEN, Inter Service ApS DynamITe Dynamic ICT-training of SMEs	87

Filling IT-Skills Gap and Shortage

Wolffried STUCKY^{1,2}, Peter BUMANN¹, Peter WEISS², Ralf TRUNKO²

¹CEPIS COUNCIL OF EUROPEAN PROFESSIONAL INFORMATICS SOCIETIES

Stresemannallee 15, D-60596 Frankfurt am Main, Germany

Tel: +49 69 6308 392, Fax: +49 +49 69 9631 5233, Email: secretary@cepis.org

²AIFB Institute of Applied Informatics and Formal Description Methods,
University of Karlsruhe, Englerstrasse 11, D-76128 Karlsruhe, Germany

Tel: +49 721 608 3227, Fax: +49 721 608-6582,

Email: {stucky, weiss, trunko}@aifb.uni-karlsruhe.de

The existing European IT skills gap is one of the biggest challenges for ICT industry during the next years. Industry, governmental bodies, and educational bodies have to intensify their co-operation and join forces to narrow the existing IT skills gap and to reduce the IT skills shortage in industry. Especially small and medium-sized enterprises (SMEs) mostly feel the increasing pressure on their future business due to a lack of available IT practitioners with the needed skills to enhance their electronic business, products and services. In this paper we discuss the terms IT skills gap and shortage and introduce an IT Competence Maturity Model as a mean to discuss and plan identified present and required future activities and measures. The model differentiates between existing qualification and certification schemes by qualification levels. The model intends to foster the understanding and to facilitate a more precise discussion of the current IT-skills situation in Europe.

1. Introduction

While the significant loss of confidence – and associated downturn – in the Information and Communications Technology (ICT) sectors have resulted in substantial levels of personnel lay-offs by high-tech companies, this does not reduce the fundamental importance of these business sectors to future deployment, and the continuing demand for large numbers of people with relevant skills in the forthcoming years [7]. Even where industrial structure is only changing slowly, employers of ICT practitioners¹ rarely find it easy to articulate their current and particularly future needed skill precisely. Consequently, experts see the existing European IT skills gap as one of the biggest challenges for ICT industry for the next years. In this context, the terms IT skills gap and IT skills shortage are discussed and used by many initiatives, although often misleadingly used in a common sense. We see a need to distinguish the terms as focused measures and activities are needed to solve the competence shortfall in industry. In order to reduce the shortage by narrowing the gap, we see the need for immediate action. Appropriate measures and activities have to be accepted European wide by the stakeholders and thus should be based on a common agreed standard. In this paper we report about past, present and future activities already launched by CEPIS and its member societies. CEPIS sets out to reduce the European IT skills gap by bringing together industry, academia, public and governmental bodies to define objectives, exchange experiences and views and to agree on appropriate future

¹ The term IT practitioner is used referring to [3], page 34f.

activities. *CEPIS* is a non-profit organisation for improving and promoting high standards among informatics professionals in recognition of the impact that informatics has on employment, business and society.

2. Contribution

In this paper the existing IT skills gap and IT skills shortage are discussed. First, the current situation in Europe is described. Next, we precisely define the terms IT skills shortage and IT skills gap as both terms are often used in a similar and sometimes confusing meaning. The paper introduces the IT Competence Maturity Model using five different IT-skills qualification levels to visualize and categorise the different qualification and certification schemes available on European and national markets. The proposed model is seen as a mean to understand and simulate effects of existing measures and to design and plan future activities and initiatives to resolve the current situation. CEPIS uses experiences made and lessons-learnt from recent and current activities like the ECDL² (European Computer Driving License) and EUCIP³ (European Certification for Informatics Professionals).

3. Motivation – changes on labour market

Due to the fact that CEPIS was concerned about the situation of IT skills labour in Europe, a study on IT labour market situation was initiated by and carried out on behalf of CEPIS [3]. The study identified a demand for “new IT practitioners” over the coming years. With reference to existing studies and reports [4], [5], [6], [7], [8], the demand for employees with skills in informatics has increased enormously in recent years and will significantly increase during the next years [13].

The situation on the labour market has changed during recent years and will face further changes in the future. The technology life cycles in IT industry are getting shorter. Consequently, IT practitioners and experts are required to follow the paradigm of life long learning to keep their personal market value. The current situation is that the demand side could not be supplied with appropriate IT experts and practitioners. This may have tremendous effects on the future business activities of many companies, and may jeopardize current and future endeavours especially of smaller companies [12], [13].

As a result, industry faces today a so called *skills shortage*. The skills shortage is partly due to the fact that many people on the labour market show deficits in required informatics skills. A problem summarised and discussed under the term *skills gap*. As a consequence, employers are complaining at the same time about an existing *skills mismatch*. Besides, today's labour markets have become more and more international requiring increased flexibility and mobility from the IT workforce. An international labour market requires increased mobility and thus a harmonisation and, where appropriate, standardisation across national boundaries. What is needed is a range of available qualification and certification schemes which allow to cover the present and future demand of IT skills in European industry. Consequently, a certification of informatics skills is needed making skills comparable across countries. Further,

² For further information please visit the Internet: <http://www.ecdl.com> or <http://www.cepis.org>.

³ For further information please visit the Internet: <http://www.eucip.com> or <http://www.cepis-epics.org>. The market validation (project EPICS) of EUCIP was co-funded by the TEN-Telecom Programme of the European Commission. Please visit the Internet: <http://www.ten-telecom.org> or http://europa.eu.int/information_society/programmes/eten/text_en.htm.

guidelines how to design today's and future training and education in informatics are needed. CEPIS is already addressing these issues with activities like ECDL and EUCIP, mentioned in the section before.

First, it is crucial to precisely define and understand market demand, thus what is really needed by industry. Secondly, after having assessed the market demand, stakeholders have to discuss and design measures and activities, how the current situation might be improved. But to discuss the situation properly, stakeholders involved having different backgrounds need a common vocabulary to communicate. Therefore we introduce and propose in this paper a model to describe and demonstrate effects of present and future measures. The model introduced in section 8 depicts the structure of the IT-skills shortage and gap. The *IT Competence Maturity Model* is a mean to visualize and describe ideas and aims of our recent, current and future initiatives. The overall goal of CEPIS is to actively contribute to resolve the quantitative and qualitative imbalance in the supply of skilled labour.

4. Who is CEPIS?

CEPIS – the Council of European Professional Informatics Societies – is the umbrella organization of the European informatics societies. The idea to create CEPIS originated in 1988 in the course of an IFIP⁴ congress in Rio de Janeiro, Brazil. CEPIS has steadily increased the number of its national member societies, which are now numbering to 35 from 30 European countries. So CEPIS is representing more than 200,000 individual IT professionals all over Europe. In the middle of the 1990s CEPIS member societies developed a vendor independent educational programme known as the European Computer Driving License (*ECDL*). The ECDL, represented by the ECDL Foundation located in Dublin, has reached more than 3 million students by July 2003. *CEPIS* understands itself as an umbrella organisation responsible for establishing standards for sophisticated educational IT programmes and taking care of the certification without getting directly involved in the actual training activities. The objectives of CEPIS are as follows:

- CEPIS wants to be the European IT professional network for its member societies,
- CEPIS intends to become the European IT certification organisation, working together with educators, industry and other certification organisations,
- CEPIS is working towards being recognised by EU/ European institutions as the leading independent IT professionals organisation,
- and last but not least CEPIS aims to help ensure an adequate supply of competent IT professionals.

5. Aims of CEPIS in Lifelong Learning & Certification

First of all, against this background the aims of *CEPIS* in Lifelong Learning & Certification are described. CEPIS is concerned that the growth and development of European business and manufacturing will be hampered by IT skills shortage and IT skills gap, which have received enormous publicity across Europe and which have triggered EC-initiated working groups and conferences, e.g., the *eSkills Monitoring Group* or the *e-Skills Summit* in Copenhagen. Secondly, a special focus has to be according to the question on how to attract women into advanced ICT study

⁴ IFIP International Federation for Information Processing, <http://www.ifip.org/>.

programmes. It seems that we have created an image of ICT as being for techno-geeks and not primarily for normal human beings. This is a prime matter of concern: ICT is as much about people and soft skills as it is about “hard” or technical competencies, but this message has to be more strongly transmitted into the minds of people. This is something that we are discussing across Europe and we intend to take it up with the European Commission. Perception and attitudes are created in the schools and in initial education. If teachers and career guidance officers see IT as being for nerds, then it is hardly surprising that many people looking for enjoyable and demanding career are missing in the ICT field and are opting for other choices. We would like to see a situation where a student with high marks sees ICT as being an as rewarding career as, say, medicine. Finally, and possibly most important, CEPIS wants to ensure that accessing high quality professional qualification is at the top of everybody’s list of priorities. It is only a question of time before a poor-quality ICT system and applications (probably on the World Wide Web) or a system with an inappropriate architecture causes an enterprise to fail and to go out of business. And the quality of an ICT system depends as much on the software and hardware as on the qualification and skills of its developer or administrator.

6. Activities of CEPIS in Lifelong Learning & Certification

As mentioned before the first step of CEPIS in Lifelong Learning activities was the ECDL. Currently, CEPIS implements another important activity called EUCIP (European Certification of Informatics Professionals). The impact and aims of these initiatives are depicted in figure 3 and 4 in section 8 below. To promote these concepts, CEPIS relies on its unique large European member societies network with nodes covering nearly every country in Europe. In all concepts for professional IT training the participating CEPIS member societies have concentrated on developing the major elements as:

- a syllabus structured in one core level and two elective levels,
- testing facilities (with automatic testing systems),
- requirements for certification and,
- a web-based delivery system.

Concerning EUCIP, learning providers who will provide for the actual learning content and services at national level could grow into hundreds per country throughout Europe, if we refer to the achieved enormous impact by the ECDL. The start and basic development of the EUCIP product was financed by CEPIS. Moreover, CEPIS has participated in the IT Skills Gap Workshop as part of the eLearning Summit⁵ preparation. The summit was a collaboration between the European Commission and a number of partners from industry, government and the education sector to define a set of key priorities and strategies to exploit the potential of eLearning. The results are captured in ten recommendations. Furthermore, CEPIS has taken part in the eSkills Summit.⁶ And in 2003 CEPIS contributed and participated in several activities in the context of Career Space⁷ and Cedefop⁸. CEPIS is a full member of Career Space.

⁵ For further information please visit the internet: <http://www.elearning-summit.com/>.

⁶ For further information please visit the internet: <http://www.e-skills-summit.org/> or http://europa.eu.int/comm/enterprise/ict/policy/ict-skills/cph_summit.htm.

⁷ For further information please visit the internet: <http://www.career-space.com/>. Career space is a consortium of eleven major IT companies, EICTA, the European Information, Communications and Consumer Electronics Industry Technology Association, and other public/private partners.

Moreover CEPIS participates in a CEN/ISSS Workshop on IT-Profiles and Curricula⁹ and in the European e-Skills Forum¹⁰.

7. E-Skills

After having depicted the changes on the labour market and having described the aims of CEPIS in life long learning and certification, now in this section the terms skills gap and skills shortage are introduced and defined. First, we explain fundamental terms of our model introduced in the next section before presenting definitions for the two terms. The expressions shortage and gap are often misleadingly used in the same meaning and context. They will therefore be distinguished and discussed in this section.

Currently, there is no common definition available of the types of skills covered under the banner of “IT and E-business skills” [6]. In general, skills may be defined as the “learned power of doing something competently”. In the context of work and employment, [...] skills are the ability to conduct a certain activity with particular means and a certain speed [14]. The demand for IT skills consists of demand for IT specialists and demand for IT skills of non-specialists. However, data on IT-skills in not directly IT-related professions is scarce. Skills may be measured by appropriate certification schemes, but latter lack today the availability and harmonisation across European countries. Currently, no such schemes are available, although the ECDL and EUCIP initiatives are working on this goal [14]. In Germany until the 1990s as much as 80 per cent of skilled IT workers were lateral entrants without relevant training due to a time of rapid expansion.

An IT worker is anyone doing work conceiving, developing, planning, implementing, operating or maintaining information technology as his primary work. The term *IT practitioners* includes both IT (“Informatics”) professionals and non-professional dedicated IT workers [3]. The latter do not have formal IT-related academic credentials and come from a very broad and diverse background, but they understand how to apply computing-based technologies to work processes [15].

IT professionals have the necessary key qualifications to cope with the rapid pace of change by means of sufficient process, problem solving and self-learning competencies to deal with product and technical innovations without requiring a great deal of specific training. Finally, we introduce the term e-skills (or IT-skills) on a professional level in three different categories. IT-skills comprise the following categories of competencies:

- IT professionals: support and develop technological environments in the industries that use IT (or services vendors selling their IT professional resources times).
- E-business professionals: focus on supporting business strategies related to the Internet
- Call centre professionals: provide sales and support activities in the emerging phone channels

IT Skills Shortage

The IT skills shortage has been defined as a quantitative lack of IT skilled people in the labour market. Skills shortages are defined as being where an employer is unable to

⁸ For further information please visit the internet: <http://www.cedefop.eu.int/>. Cedefop stands for Centre Européen pour le Développement de la Formation Professionnelle (in English: European Centre for the Development of Vocational Training).

⁹ For further information please visit the internet: <http://cedefop.communityzero.com/cen-ict>.

¹⁰ For further information please visit the internet: <http://cedefop.communityzero.com/esf>.

recruit new suitably skilled people to fill a business need [16]. The IT skills shortage may be more precisely defined according to EITO [6] as follows:

The ICT workers shortage is the number of competent ICT workers required in all segments of the economy less the actual number of competent workers engaged in ICT work.

As a formula, the resultant shortage or demand can be expressed as:
(ICT shortage) = (the number of workers needed to do ICT work) – (the number of workers actually doing ICT work).

The IT skills shortage includes the IT skills gap in present jobs. It states implicitly that the demand for certain IT skills can not be served by the market due to missing IT workers with the required professional profile and experience. Thus, the IT skills shortage is about the gap between demand and supply side. It is addressing the issue that not enough IT workers in numbers and with certain skills are available on the market. The shortage of qualified IT professionals is now generally recognised as a serious handicap for the European economy. Furthermore, a skills shortage does not necessarily mean new employees with new skills, but also re-training of existing staff and other measures to face the challenge of new technological developments. The skills shortage is particularly acute in the world of e-Business [6], [7]. Although discussion about skills shortages has fallen off in recent months due to the current weakness of the economy, the underlying problems remain unchanged.

IT Skills Gap

The skills gap is a competence shortfall between the current and needed competence levels of the staff within companies or other organisations. Due to the growth in the take-up of IT, the rapid rate of technological evolution, and the changes in activities and markets engendered by the diffusion of e-business are at the root of the skills gap. The imbalance originates mainly from the mismatch between industry requirements and the supply by the education system of adequate up-to-date skills. The skills gap is partly caused due to the situation that while the demand for skilled IT professionals has increased, the number of science and computer graduates in some Member States has declined. Consequently, today the IT skills gap has become a prominent political issue [6]. Thus it is important to build up key qualifications that equip employees to cope with the rapid pace of change [15]. The term skills gap may be summarised in a definition as follows [16]:

The IT skills gap refers to IT skills which existing employees do not possess and which consequently can hamper business productivity and growth.

According to this definition, the IT skills gap is not just about the quantity of skilled people needed, but more important about quality. The current and future roles of IT require not just technical skills across converging technologies, but also commercial and interpersonal skills to match services and products to customers' needs [6].

Skills Mismatch

The skills mismatch is a mismatch between the competence imparted by education and the competence expected by the employers. This mismatch is assumed to arise from course curricula misalignment.

8. Introduction of the IT Competence Maturity Model

On the basis of the definitions and results of the section before, we now finally introduce our model helping to shape and plan future activities and to demonstrate the expected impact of present and future measures and activities. In analogy to the well known software Capability Maturity Model (CMM), CEPIS has elaborated a model named Competence Maturity Model. This model includes five levels of qualifications as depicted in figure 1 below. The first level is named the “*IT Awareness Level*”. This means people at this level will only have some basic IT experience and understanding. The second level is called the “*IT Literacy Level*”. Individuals at this level should have the knowledge to operate a PC, for instance, and should have knowledge of basic office software such as text processing, spreadsheets, simple database access. A third knowledge level may be identified as the “*IT Expert User Level*”. Experts on this level have some special knowledge, like for example the application of informatics in certain business areas. The next level shown is the first professional level - the “*Professional Entry Level*” and finally on the last (fifth) level there are the “*IT Professionals*” who also – amongst other capabilities - should be able to widen their own knowledge base by self improvement. University graduates in informatics for example belong to this group.

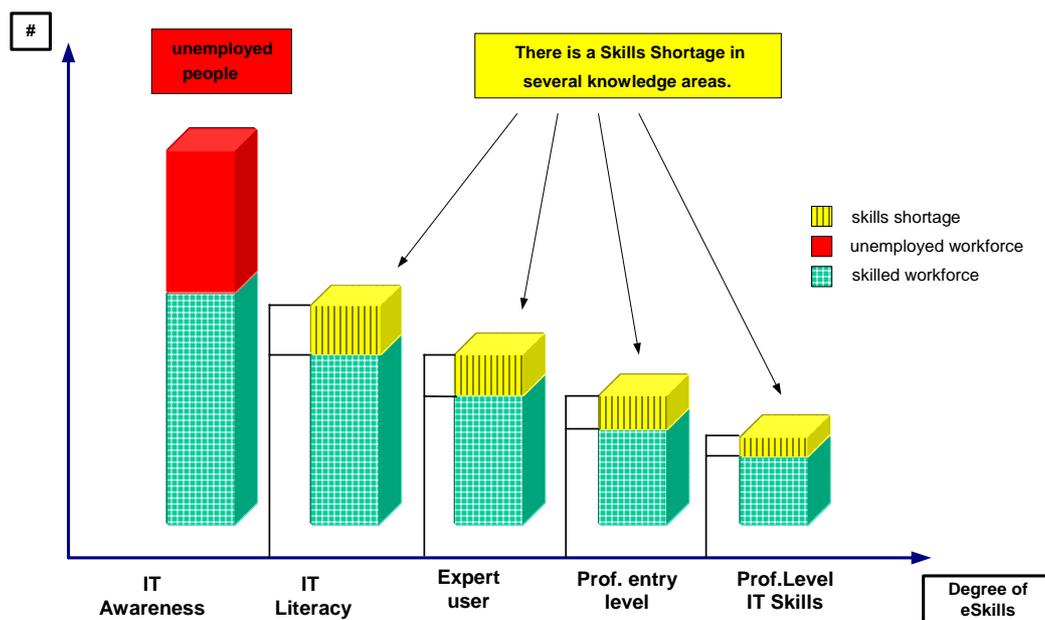


Figure 1 – CEPIS IT Competence Maturity Model

The model is based on three dimensions. In a first step only two dimensions are introduced and explained in detail. The dimension ‘*degree of e-Skills*’ is part of the continuum. The presented categories like for example “*Professional Level IT Skills*” are more or less idealised categories to develop a kind of typology. In reality, a classification of the workforce strictly according to the depicted categories is not possible. Consequently, the borders between categories are understood as fluent and entities can be positioned in between different categories. Additionally, social skills [6] like communication capabilities or leadership qualities should be taken into consideration by an appropriate model. The model works as follows.

We may regard the personnel in employment in each of our said categories. As shown, there are many people on the “*IT Awareness*” level, less people on the “*IT Literacy*” level and so on. Of course, the scaling in this diagram is simplified, but this fact is not of importance for the understanding of our model. In addition to the personnel in employment there are many people on the first level who are unemployed at the moment. On the other hand, a *skills shortage* is identified - as defined in the section before - in the higher knowledge categories: there are vacant positions requiring a certain knowledge level.

The skills shortages are indicated for each column. In this situation, first education is of course able to reduce the skills shortage on all levels (figure 2). Thus it is important to analyse which skills are needed and what kind of education we need on each level. An important initiative on the professional level is the CEN/ISSS Workshop on IT-Profiles and Curricula.¹¹ Another way to reduce the skills shortage on the second level is to implement training in IT literacy to those possessing IT awareness (figure 3). By means of this, on the one hand, it will become possible to make the shortage smaller and on the other hand the unemployed workforce can be engaged to help filling the shortage which is created by personnel being promoted to a higher level.

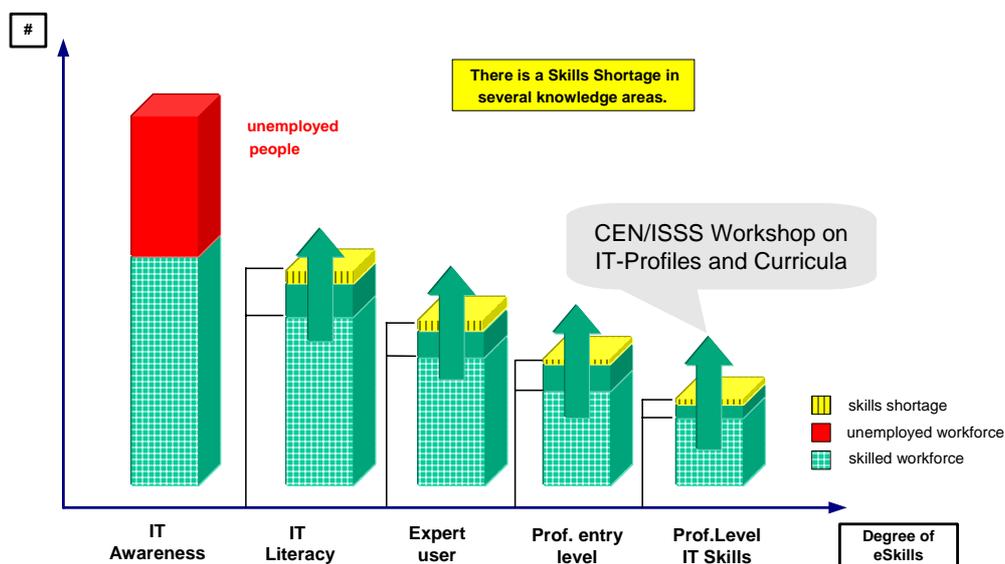


Figure 2 - first education can reduce the skills shortage

Obviously, there is not only the step from “*IT Awareness*” to “*IT Literacy*”, but there are also opportunities at all the other steps towards higher knowledge levels. Consequently, it is possible to ascend from the “*IT Literacy*” to the “*Expert user*” level with special training.

In reference to our model this will enlarge the skills shortage at the second level in the first instance, but reduces at the same time the skills shortage at the third level, being the expert users. In figure 2 in third instance the implicated steps are shown from level 3 to level 4 and from level 4 to level 5. At this step, the effect of upgrading expertise is the same as in the previous steps. The result after having performed the several steps of training can be concluded as follows:

- less unemployed people on the “*IT Awareness*” level and

¹¹ This workshop is a common initiative of Cedefop and Career Space.

- reduced skills shortages at all other higher levels.

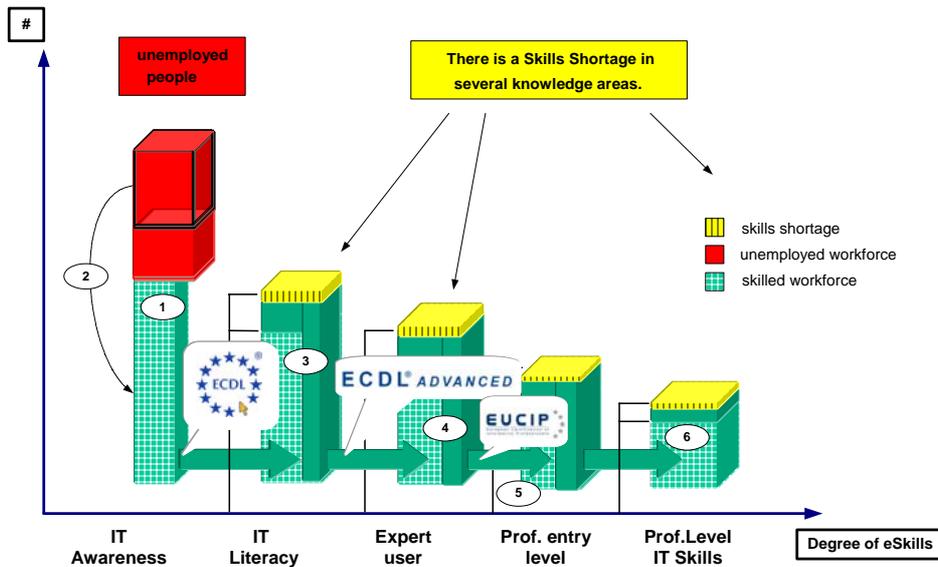


Figure 3 – Initiatives addressing to reduce the skills shortage

Of course, in reality all these process steps will be processed in parallel. For all these different steps and levels of training, appropriate qualification and certification schemes are needed. A variety of existing schemes is already available on the market and offered on different levels.

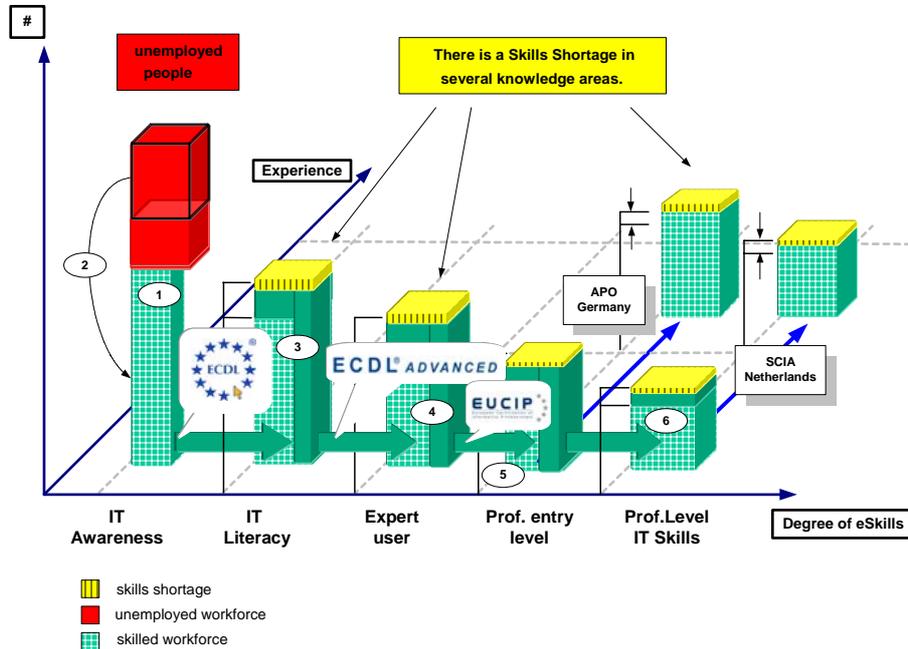


Figure 4 – Experience as third dimension of the IT Competence Maturity Model

Thus it is difficult for students to choose the right offer out of this multitude of different schemes (like APO in Germany or SFIA in the United Kingdom as two examples). It can be observed, that many of those schemes only have a national and very narrow focus.

Another dimension is required to be able to better distinguish between and discuss the available schemes. Evidently, some of these schemes are covering another

dimension – the third dimension - that should be considered here: the *experience* of the personnel with a certain degree of IT-skills. Figure 4 expands the introduced model by an additional third dimension “experience”. Even if employees have basic knowledge for an appropriate and reasonable application of learnt methods practical experience is very important.

And after “learning by doing” starting from some basic knowledge also the gained experience should be certified. Activities which should be mentioned in this context are APO in Germany on the professional entry level and SCIA in the Netherlands on the professional level.

And finally, the figure shows which of these steps in the training and certification process are currently supported by CEPIS initiatives and activities. As depicted, CEPIS offers three different qualification and certification schemes: ECDL at level 2, the so-called ECDL ADVANCED at level 3, and EUCIP at level 4. EUCIP is a new initiative launched and co-ordinated by CEPIS. EUCIP’s ambitious goal is to harmonise different qualifications of IT professionals and to make them (to a certain degree) comparable across Europe.

9. Conclusions

In this paper we discussed the existing IT skills gap and IT skills shortage. The current situation of the IT skills gap was described. The paper introduces the IT Competence Maturity Model using five different IT-Skills qualification levels to visualize and differentiate between the different qualification and certification schemes available on European and national markets. The model is a mean to demonstrate the impact of present and future qualification schemes. Our model allows to design and identify appropriate measures and to categorise the multitude of available qualification and certification schemes on the European market. CEPIS wants to contribute and join forces with other initiatives to increase the mobility of the European IT workforce and to narrow the existing IT skills gap. This could only be achieved if all key players and stakeholders intensify their co-operation and help to harmonise the multitude of available qualification and certification schemes establishing quality standards in Europe.

10. Target audience

Industry, academia, learning service providers, public and governmental bodies, EC representatives.

11. References

[1] Please visit EPICS web site: <http://www.cepis-epics.org>

[2] CEPIS has successfully implemented the European Computer Driving License (ECDL) and will use available experiences and lessons learnt to implement EPICS qualification schemes for informatics professionals (please visit website to find additional information about ECDL and CEPIS <http://www.ecdl.com/>).

[3] Information Technology Practitioner Skills in Europe. Study of the Labour Market position in particular for Germany, Ireland, Sweden, and the United Kingdom. CEPIS Council of European Professional Informatics Societies. Author: Matthew Dixon. May 2002. <http://www.cepis.org/download.html>

[4] Benchmarking Report following-up the "Strategies for jobs in the Information Society" with the support of the High Level Group "Employment and Social Dimension of the Information Society" (ESDIS).

- [5] Overall Market Review EPICS (European Professional Informatics Competence Services), Deliverable D4.1, Workpackage 4, Contract Number C27978, distribution level: confidential, author(s): Peter Weiß, <http://www.cepis-epics.org>, contact: secretary@cepis.org.
- [6] European Information Technology Observatory, page 17ff. – <http://www.eito.org>, year 2001.
- [7] Synthesis report, e-business and ICT skills in Europe, ICT Skills Monitoring Group, June 2002, <http://europa.eu.int/comm/enterprise/ict/policy/ict-skills/wshop/synthesis-report-v1.pdf>, last visited 08 December 2003.
- [8] European Information Technology Observatory – <http://www.eito.org>, year 2002.
- [9] Strategies for jobs in the Information Society - Report European Commission by : Employment and Social Affairs DG, Information Society DG, Enterprise DG, Education and Culture DG; ISBN 92-828-3008-X, 2000. http://www.europa.eu.int/comm/dg05/socdial/info_soc/.
- [10] The Bologna Declaration on the European space for higher education: <http://europa.eu.int/comm/education/programmes/socrates/erasmus/guide/bologna.pdf> ; last visited 04th December 2003.
- [11] Go Digital Progress Report 2001-2002, Commission staff working paper, Brussels, 13.5.2002, SEC (2002) 566, http://europa.eu.int/comm/enterprise/ict/policy/doc/sec_2002_566.pdf, last visited 8th December 2003.
- [12] The European e-business report, a portrait of e-business in 15 sectors of the EU economy, http://www.ebusiness-watch.org/marketwatch/resources/E-Business-2003_SUM.pdf.
- [13] E-business and ICT skills in Europe benchmarking, Member State Policy Initiatives, ICT Skills Monitoring Group; Synthesis Report E-Business and ICT Skills in Europe, <http://www.e-skills-summit.org/>; 18 December 2002.
- [14] Benchmarking Work, Employment and Skills in the Information Society in Europe and the US, SIBIS project and European Communities, empirica GmbH, Oxfordstrasse 2, D-53111 Bonn, sibis@empirica.com.
- [15] Systematic Continuing Education in IT, Federal Ministry for Education and Research, 53182 Bonn, year 2002.
- [16] Skills 99 IT skills summary report, published by ITNTO (www.itnto.org.uk) and AISS (www.aiss.org.uk).

EU Initiatives, Policies and Research Programmes in the Area of ICT Skills

Marina MANZONI

European Commission DG INFSO – D5 (eBusiness),
BU 29, B-1049 Brussels - Belgium
Tel: +32-2-2968028, Fax: +32-2-2968387,
Email: marina.manzoni@cec.eu.int

Information and communications technology and on-line business are set to play an increasing role in securing Europe's economic growth. Success depends on having a workforce with the necessary e-skills. Despite the economic downturn and the structural changes in the ICT sector, studies still estimate that Europe may need to import or train as many as 1.5 million IT specialists in the next year. How could governments and industry go about filling the gap? The objective of the paper is to provide an overall view of activities, initiatives, policies and research programmes currently running at European level and describe a number of European led initiatives supported by different European Commission Services, such as DG Information Society (INFSO), DG Enterprise (ENTR), DG Education and Culture (EAC) DG Employment (EMPL) as well as eEurope 2005, a joint initiative between the Member States and the European Commission to promote and foster an "Information Society for all".

1. Introduction

The strong growth of broadband Internet access in European homes and work environments is a clear sign that European participation in the digital economy is advancing rapidly. However, if we are to create an Information Society for all, then everyone needs access to ICT skills training through education systems. This means connecting schools and Internet-related education, updating curricula and training teacher to ensure all pupils are ICT literate when they leave school. We also need to consider how ICT skills can be acquired by those who have already finished formal education. One of the biggest concerns of European enterprises remains that of finding employees with ICT and E-business skills. People can only benefit from the opportunities offered by the knowledge society and new technologies – including e-learning - if they have basic ICT skills and the digital literacy required to use it fully in the creative processes associated with human endeavour. And yet a recent survey showed that only 4 Members States (Belgium, Germany, Spain, UK) have initiatives underway to improve digital literacy [1].

Globalisation and technological revolution bring rapid change to working life. Most people will have to adapt to a change of job or career during their working life, almost certainly involving acquiring new skills. However, because of the flexible labour market, employers are more reluctant to invest in staff training because competitors may benefit from this investment. As a result, only one in three workers has access to supportive training, although this kind of training is key in the knowledge society, where "soft skills" are ever more important. In addition, integrating learning and working is paramount for ensuring Corporate Social Responsibility by training

managers and employees to appreciate the social, environmental and ethical values and equip them to take informed decisions.

Information and communications technology (ICT) and on-line business are set to play an increasing role in securing Europe's economic growth. Success in this regard requires a workforce with the necessary e-skills. Despite the economic downturn and the structural changes in the ICT sector, current trends suggest that the 10 million IT jobs that Europe provided in 2001 will rise to about 13 million by 2003. As many as 1.7 million of these jobs may be impossible to fill by 2005. This lack of experts could hinder the spread of digital technology, with adverse effects on the entire European economy. Regional disparities could worsen, as most of the training projects are found in the northern part of Europe and the fewest in the south. SMEs bear the worst of the problem as they can rarely support an in-house IT department, and the regions also lose out against the large cities.

2. Background to ICT Skills related EU initiatives, policies and research programmes

The e-Economy and the Internet have been a high priority for the EU since the Lisbon Summit in March 2000, where EU leaders set the ambitious goal for Europe to become the world's most competitive and dynamic knowledge-based economy within ten years. To reach this goal, the Commission devised a comprehensive strategy known as the eEurope 2002 Action Plan, which was adopted at the Feira Summit in June 2000.

eEurope 2002, as part of the Lisbon strategy, was complemented by the eEurope+ initiative [2] launched by the candidate countries in reply to the invitation of the European Council to take on board the Lisbon strategy. Many of the objectives of eEurope 2002 have already been achieved and the remainder will largely be completed by the end of this year. However, much more work needs to be done to reach Europe ambitious goals.

The Barcelona European Council called on the Commission to draw up an eEurope 2005 action plan focussing on: "the widespread availability and use of broadband networks throughout the Union by 2005 and the development of Internet protocol IPv6 and the security of networks and information, eGovernment, eLearning, eHealth and eBusiness".

ICT Skills were paid due attention throughout this process, and the following examples focussing on ICT skills, illustrate actions proposed to meet eEurope 2005 goals.

3. eEurope 2005: Proposed actions to foster ICT skills adoption

3.1 eLearning Programme

By the end of 2002, the Commission intends to adopt a proposal for a specific eLearning Programme. It will focus on the implementation of the objectives of the eLearning Action Plan from an educational perspective and run from 2004-2006. The Commission will also publish an analysis of the European market for e-learning, including the private sector. It will review the market situation and analyse legal, economic and social issues with a view to identifying obstacles to the development of the e-learning market in Europe and where necessary make proposals to remedy them.

Virtual campuses for all students: By the end of 2005, Member States, supported by the eLearning and eTEN programmes, should ensure that all universities offer on-line

access for students and researchers to maximise the quality and efficiency of learning processes and activities.

By the end of 2003, the Commission will launch research and piloting actions to enable the deployment of Europe-wide computer-supported networks and platforms, based on high performance computing infrastructures and GRID technologies. They will allow collaborative work addressed at solving complex problems and virtual access to, and sharing of learning resources, and computational power across Europe.

3.2 Re-skilling for the knowledge society

By the end of 2003, Member States, where appropriate using structural funds and supported by the Commission, should launch actions to provide adults (e.g. the unemployed, women returning to the labour market, etc) with the key skills needed for the knowledge society, to improve their employability and overall quality of life. These include basic computer skills and higher-order skills such as teamwork, problem solving, project management, etc. These actions will take advantage of the possibilities offered by e-learning.

3.3 SMEs

By the end of 2003, the Commission intends to establish an European e-business support network, federating existing European, national and regional players to strengthen and co-ordinate actions in support of SMEs in the field of e-business. The Commission will foster geographical and sectoral clusters of SMEs working online to encourage innovation in e-business, sharing of good practice and promotion of guidelines and standards.

3.4 e-skills

By end 2003, the Commission, in close co-operation with Member States, will publish an analysis of the supply and the demand for e-skills in Europe. The Commission and Member States should foster public-private partnerships and the co-operation of stakeholders with a view to developing European-wide e-skills definitions.

The communication on the e-Economy [4] emphasised the urgent need to tackle the ICT and e-business skills shortages and, in this context, to promote the development of e-learning solutions. The e-Skills Summit also called for greater investment in lifelong learning supported by e-learning [5]. There is a growing demand for individuals to take greater responsibility and control of their own learning. Employers are moving from a system of centrally delivered standardised training, to one in which they invest in the self-learning of their employees. E-learning facilitates this process, thus contributing positively to the development of human capital and to an improvement in the quality of work [6].

4. eLearning Action Plan

The eLearning Action Plan [7] was drawn-up to help modernise Europe's education and training systems through the effective use of ICT, in response to the goals of the Lisbon summit of 2001 and the objectives of the eEurope 2002 Action Plan [8]. One of the objectives of the plan is to "help promote the employability and adaptability objectives under the European Employment Strategy [9], rectify the shortage of skills associated with new technologies, and improve social inclusion through the use of e-learning.

E-learning is seen as important facilitator for continuous lifelong learning, as it provides opportunity for people to learn where they want, when they want. In the work place, emphasis has been placed on cost savings and on flexible, just-in-time education and training, which is integrated into the worker's environment. In a context where new skills and competencies have to be upgraded for rapidly changing business and labour-market needs, e-learning is proving to be very popular as a cost-effective solution:

- c. 15% of the EU labour force receives work-related training via e-learning [10]
- in some ICT companies, up to 60% of the training needs are provided by e-learning
- in a recent IDC [11] survey of over 600 individuals with purchasing responsibility for training, 81.3% have adopted e-learning; the majority of these within the last 24 months "Corporate universities" are amongst the most advanced players in this field, especially in the IT sector.

While there are obvious advantages for SMEs to use e-learning, further effort is required to allow small companies to understand, shape and use e-learning tools and methods according to their own requirements. In addition, corporate e-learning solutions often require significant investment in infrastructure, content and services, and are therefore only cost-effective with a critical mass of users. Therefore new approaches are required to help SMEs achieve the critical mass necessary for cost-effective e-learning solutions. Such approaches may involve innovative Public-Private Partnerships between regional councils, chambers of commerce, industry and training providers, for example.

The eLearning Programme will strengthen work carried out under the eLearning Action Plan and help to ensure that we achieve the political objectives of modernising Europe's education and training systems through the integration of ICT. In turn, modern education and training systems will contribute to Europe's Employment Strategy by supporting the lifelong acquisition of skills and competencies needed by a modern workforce.

5. EES Guidelines and key messages from ESDIS

The new European Employment Strategy (EES) guidelines for 2003-2006 outline lifelong learning as one of the 10 key priorities for labour market reform, and set a series of EU or Member State level targets to benchmark performance. The European Social Fund will invest at least €12 billion in lifelong learning between 2000-2006.

This approach is supported by a range of policies including a recent Communication on 'Making a European area of lifelong learning a reality'; a High Level Task Force report on Skills and Mobility, which stressed the role of improving skills to ensure mobility; and a report on 'Increasing Labour Force Participation and Promoting Active Ageing' which emphasised the key role of training as part of a comprehensive approach to active ageing.

In addition, the High Level Group ESDIS (Employment and Social Dimension of the Information Society of Member States) issues regularly reports on the impact of the information society on employment and social cohesion and based on an exchange of practices, identified the quality drivers of Information Society jobs and has drawn policy conclusions, set out in the report – Commission staff working paper SEC(2002) 372 of 3.4.2002 'Information Society jobs – quality for change : Exploiting the Information Society's contribution to managing change and enhancing quality in employment'. Key messages from ESDIS [12]:

- Basic ICT usage increased by 20% in the EU (Nov 2000-Oct 2001). There are insufficient ICT and e-business experts and it is difficult to accurately forecast demand.
- Survey results highlight the positive impact of the Information Society (IS) on the quality of jobs – particularly in terms of increased responsibilities, adaptable skills, new forms of work organisation, additional opportunities for flexibility and work-life balance as well as for e-Inclusion facilitating access to the labour market.
- However, this quality potential is still far from being exploited. Less than a third of the EU labour force has ever received any ICT training. Only a small share receives continuous up-dates. Furthermore, there is still too much focus on technical applications – training in contextual skills, necessary for effectively benefiting from IS workplaces, is limited.
- At the level of IS experts, more emphasis should be put on vocational training: re-skilling workers and unemployed to take up vacancies in high quality ICT and e-business jobs. Targeting women for these jobs is particularly important: their share of ICT jobs is less than a quarter, and still lower at higher levels. Encouraging girls and women to choose scientific / technological studies during formal education is a key aspect.
- Job quality is much higher if the introduction of ICT is combined with organisational changes and worker consultation – conditions experienced by only 25% of EU workers.
- The report stresses the advantages for holistic approaches to changes in work organisation.

6. Genesis and focus of European e-Skills Forum

As a follow-up of the eEurope-GoDigital initiative, the Enterprise Directorate-General of the Commission has established in September 2001 an “ICT Skills Monitoring Group”, composed of representatives of all Member States, in charge of carrying out an analysis on demand for ICT and E-business skills in the EU and to monitor the policies and the actions designed to match demand with supply. EITO has strongly contributed to this debate, as the figures published in the EITO Yearbook 2001 became a point of reference for the discussion on the ICT skills shortage. One of the conclusions resulting from the ICT Skills Monitoring Group was that there is lack of a commonly agreed methodology to define and measure ICT and e-business skills. In addition, the Group highlighted the need to identify best-suited policy and strategies and the need to assess their results against pre-defined benchmarks.

The process started by the ICT Skills Monitoring Group strongly suggests broadening the debate and including the social partners and other key players into further discussions on these issues. To this purpose, DG Enterprise has taken the initiative to establish a "European e-Skills Forum", bringing together stakeholders of the field: representatives of the Commission, Member States, Candidate Countries, Industry, and Social Partners.

The aim of the European e-Skills Forum is to provide an open platform to further promote consensus building on issues, such as the measurement of the e-skills gap and the resulting policy challenges. The issues discussed by the Forum will be:

- Supply and demand aspects of e-skills, taking into account recent ICT developments;
- Managing social change and sustainability to avoid a “digital divide”;

- International aspects of e-skills including mobility of IT experts and cross border cooperation. Special emphasis will be given to the situation in the candidate countries;
- Public-Private Partnerships. Good examples of public-private partnerships, e.g. between universities and the ICT industry and in the field of IT training, shall be identified.

The main deliverable of the European e-Skills Forum will be a Final Report in 2004, providing a clear vision of the challenges ahead and identifying a number of actions to be taken at national and European level to address the e-skills issue.

7. SME focused initiatives

The 'digital economy' is now an important challenge for SMEs, despite their high contribution to the employment and value added generation. The introduction of ICTs can provide an opportunity to develop new management methodologies and to access new markets. SMEs face more problems than larger companies in introducing and effectively using these new technologies. Traditional constraints still condition their development: difficulties in accessing the financial markets, informal R&D activity and limited co-operation with research centres or universities, difficulties in introducing formalised management tools, difficulties in accessing specialised staff and competencies, etc.

One way to remedy the ICT skills gap is through retraining. The useful life of learned skills is increasingly shorter as the pace of technical development advances, making continual learning increasingly important. E-learning will play a growing role in keeping skills updated, although the infrastructure has yet to be set up in some regions. For SMEs, which make up 99.8% of EU enterprises and employ 66% of the workforce, the solution may be outsourcing. However this solution suffers from two main disadvantages: firstly, outsourcing is too costly for small enterprises. Secondly, besides the risk of imposing an undesirable technology push, recourse to it would lead Europe's SMEs to side-step the need to bring their own workforce into the digital age and the digital divide would persist.

As part of the eEurope-GoDigital initiative, the Directorate General Information Society of the Commission launched in 2001 a pilot scheme to help Europe's SMEs gaining the e-business skills they need to enter the digital economy.

The "S2S: Students-SMEs exchange programme" applies the principle of "knowledge exchange" to give European students hands-on experience of the business world, along with better employment prospects, while giving SMEs a source of free, unbiased expertise in ICT to enable them to leverage the benefits to be derived from advances in Information and Communication Technologies and contribute to accelerating technology transfer to the SME community throughout Europe. Funded under FP5, the DIGI-Q project has been chosen as the first European best practice project in e-business skills for SMEs.

Within eEurope 2005, as a follow on of the GoDigital initiative, the IST Programme will support activities stemming from successful proposals submitted to the calls of 6th Framework Programme (FP6) which would aim at promoting the transfer of ICT skills and eBusiness knowledge to SMEs throughout Europe. An example of possible activities could be the establishment of European-wide Thematic Network federating and building upon existing EU projects (e.g. DIGI-Q), as well as National and Regional, projects, activities and players in the field of ICT Skills and eBusiness knowledge transfer to SMEs. This could be done with the support of European, national, regional and local networks of technology transfer centers, universities, sectorial associations

and small businesses. The ultimate aim is to strengthen the European Research Area (ERA) by the co-ordination, promotion, exchange and dissemination of Best Practice in ICT Skills and eBusiness knowledge transfer to SMEs, and the promotion and development of human resources, mobility and employment. These activities could also provide input to the work on ICT skills and profiles definition undertaken by the e-Skills Forum driven by DG ENTR.

8. Challenges Ahead and Recommendations

8.1 Key challenges and recommendations identified by ESDIS

To provide all workers with the appropriate training to effectively benefit from IS workplaces, and stressing in particular the need for:

- mainstreaming ICT related skills in vocational training activities;
- promoting the up-take of EU-wide basic ICT skills accreditation including, for example the European Computer Driving Licence (ECDL);
- combining technical ICT literacy with contextual skills
- continuously up-dating IS skills with technological and organisational change;
- enhancing support to workers of small enterprises which lag behind in IS skills;
- encouraging the usage of appropriate e-Learning facilities at the workplace

To facilitate the retraining to high-quality ICT and e-business expert jobs, with the dual objective of enhancing the adaptability and employability of workers and reducing skills shortages in particular by:

- targeting conversion courses with widely recognised certificates;
- enhancing incentives for people at risk in the labour market, e.g. older ICT experts;
- considering the conversion to IS job opportunities in cases of mass-redundancies;
- fostering the co-operation with industry in this context
- To integrate the development of ICT at workplaces into an holistic approach to changes in work organisation, and stressing in particular the need for:
 - consulting workers on the ICT development at their workplace;
 - providing training on new working methods due to ICT induced reorganisation;
 - exploiting ICT for transforming workplaces to pro-active learning organisations;
 - networking workplaces for sharing and applying best practices
- encouraging the cross border exchange of ICT skills and on-line services supporting employment mobility, recommended by the High Level Task Force on Skills and Mobility;
- To overcome the significant gender inequalities in IS training and jobs and especially the under-representation of women in high quality IS expert jobs, in particular by:
 - increasing the attraction to women through awareness raising and curricula review;
 - encouraging the up-take of women across all IS training activities preparing for quality jobs, starting with a strong focus on technological subjects in secondary education;
- making working conditions in ICT industries more attractive.

8.2 Key challenges and recommendations “ eBusiness and ICT Skills in Europe”

The “eBusiness and ICT Skills in Europe” synthesis report [13] issued by the ICT Skills Monitoring Group, presents an overview of national EU and US policies as well as industry-led initiatives which equip the workforce and enterprises with the necessary skills to compete in the knowledge-based economy. The goal of the report is to provide an overview of the types of schemes available, help Member States to assess their policies, put them into a European perspective, identify and promote good practices and, finally, identify a set of policy recommendations, targets, priorities and challenges ahead of us. The report outline some general findings based on the data collected and the analysis carried out so far. Recommendations and Priority for Action:

- There needs to be a better understanding of how industry takes part in the University system to transfer skills needs. The majority of schemes that are focused on education and training present no evidence of being responsive to changes in skills needs in the workforce or that there are links between work and education.
- The national governments with forecasting mechanisms in place, to a greater or lesser extent, have their own methods of tracking demand and there is a substantial need for reliable surveys and analyses of the use of information technology within organisations and individuals, to serve as a basis for possible actions. Furthermore, there is also a need to make comparisons between organisations, sectors and countries.
- Immigration is used in a few Northern European Countries to create a short-term supply of skilled labour. There is little evidence on its impact or whether is a an option for SMEs
- Work undertaken by corporate universities to ensure that staff gain the right skills
- Information on the use of eLearning in the UK and the Nordic countries may not be representative, as much of the use of eLearning is company specific rather than country specific (i.e.40 - 60% of eLearning is being undertaken through a multinational). This will also allow development of new work opportunities in other Member States.
- Better staff development strategies, career changes, lifelong learning and on-the-job training; A wide range of measures are needed to ensure that staff have the opportunities for skills acquisition, not just through availability of courses but through flexibility in areas of wages, working time etc. There must be collaboration between Government and employers to identify training needs and to ensure that skills acquired on the job are meaningful and transferable. Employees should be encouraged to participate in training programmes and access new learning opportunities. Growing workplaces demand information, instruction, and training resources when and where needed and this can be delivered, amongst other schemes, through e-learning which should be encouraged as a tool for training delivery.
- Tap into underrepresented labour market sources. Non-traditional workers can make a valuable contribution to the supply of skilled labour. In order to exploit a large untapped labour resource across Member States, barriers to joining formal education systems need to be lowered and training and incentives put in place which nurture the available talent and allow it to be developed. This recommendation should aim to increase training and retention of older workers, women, disadvantaged or minority groups.
- A Common Classification for skills and occupational roles in ICT and e-business, creation of an e-skills observatory. If more training courses are being established, the information base needs to be accessible and comparable on the flow of skills in and out of education and training, about employers needs, recruitment and use of IT

qualifications. This includes the need for a common classification of skills and occupational roles in ICT.

- The recognition of non-formal learning including work force development
- Understanding of the economic dimension of education and employment.
- A responsive supply side, involving an increased dialogue between employers and universities and training systems and new approaches to course curriculum development.
- Coherence in immigration policy; a common immigration policy would ensure an even-handed treatment of migrant workers and contribute to geographical mobility in Europe.

9. Conclusion

The E.U. has set itself the goal of becoming the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. This can only be delivered by substantially increasing investment and efforts in ICT skills learning and training. Providing access to training is the key to raising productivity, improving quality in work and delivering social cohesion. As outlined in summary by this paper, all actions and initiatives undertaken by the E.U., and the recommendations put forward by the Commission, are with a view of helping industry, particularly European SMEs, young people, women, elderly, disabled and peripheral regions in accessing and acquiring the appropriate ICT and e-business skills in order to benefit in full from the advantages brought forward by a knowledge-based society. It is critical to remember however that such ambitious goals cannot be achieved without the endorsement, help and support of the Member States, their national and local authorities, industries, educational establishments and the social partners. The key message being that the EU and the Member States must work in close collaboration to achieve better coordination and synergy of efforts. Only in this way will the EU be able to speak with a single voice to fight the digital divide.

10. References

- [1] Statistical Indicators Benchmarking the Information Society (SIBIS) – WP5: Topic Report No. 5 Work Employment and Skills, IST-2000-26276
- [2] http://europa.eu.int/information_society/international/candidate_countries/action_plan/index_en.htm
- [3] Barcelona European Council, Presidency Conclusions, paragraph 40
<http://ue.eu.int/en/Info/eurocouncil/index.htm>
- [4] COM(2001)711 final (29.11.2001)
- [5] European e-Skills Summit Declaration, 16-18 October 2002, Copenhagen, Final Draft
- [6] COM(2001)313 final of 20.6.2001
“Employment and social policies: a framework for investing in quality”
- [7] COM(2001) 172 final, 28.3.2001, “The eLearning Action Plan – Designing tomorrow’s education”
- [8] eEurope 2002 Action Plan – An Information Society for all, 14.6.2000
- [9] http://europa.eu.int/comm/employment_social/empl&esf/ees_fr.htm
- [10] Yogesh Malhotra, Knowledge Management of The New World of Business.<http://www.brint.org/JQP.pdf>
- [11] IDC Special Report, italdata SIEMENS, 2002
- [12] http://europa.eu.int/comm/employment_social/knowledge_society/background_en.htm
- [13] <http://www.e-skills-summit.org/docs/finalreport1.pdf>

DIGI-Q project, an Innovative Approach to Introduce ICT Skills to SMEs

Francesca BORGA¹, Daniela GUARNIERI², Alberto SAVOLDELLI³
AIP – Politecnico di Milano, P.zza L. da Vinci 32, 20133, Milano, Italy
Tel: +29 02 2399 2796, Fax: + 29 02 2399 2720, ¹Email: francesca.borga@polimi.it,
²Email: daniela.guarnieri@polimi.it, ³Email: alberto.savoldelli@polimi.it

The importance of SMEs in the European business economy is widely recognised, together with the importance of using ICT instruments for increasing competitiveness and performances of companies. At the same time the existing gap between SMEs and the large companies in using ICT in their business processes is still relevant. There are multiple reasons for this difference, but effective training actions could significantly contribute to reducing it. The objective of this paper is to analyse the requirements and the problems for developing specific training actions to bring SMEs closer to e-business, and to propose a possible approach on the basis of the experience of the DIGI-Q project.

1. Introduction

Even if the importance of using ICT instruments for increasing competitiveness and performances of companies is widely recognised, in the last few years the growth of e-business in the European Union has been less than expected, especially in small and medium enterprises (SMEs).

SMEs play a major role in the European business economy, accounting for approximately two-thirds of employment and 60% of value added [1]. For this reason the involvement of SMEs in the so called “digital economy” is a critical task to make the European Union “the most competitive and dynamic knowledge-driven economy in the world”, as envisaged by the Lisbon European Council of March 2000.

In spite of this, the gap between SMEs and large enterprises in the usage of ICT tools is still relevant. Even if 83% of SMEs declare they had Internet access in 2002 (compared with 99% of large enterprises), already at the next step of e-business evolution, i.e. having their own web site, the gap between smaller and larger enterprises becomes substantial and the diffusion of e-commerce solutions for purchase and sales among SMEs is just half of the rate registered in large enterprises [2] [3].

There are many reasons that explain these differences, but an important one is surely the lack of specific professional figures for supporting SMEs to properly and effectively implement e-business solutions. In this context, the purpose of the DIGI-Q project (a co-funded project within the IST work-programme 2002) is to increase SMEs capabilities to become more competitive in the digital economy, through the development of specific training and awareness actions aiming at providing the skills and professional figures SMEs need.

The first part of the project was dedicated to analyse the users’ requirements and to start the design of the training course. The aim of this paper is to present these

preliminary results of the project as a possible starting point for discussion and, most of all, for the design of specific and more effective training actions addressing SMEs.

2. The SME context: needs and opportunities

The starting point for the design and development of proper training actions is, of course, the analysis of SMEs' requirements and specificities concerning, on the one hand, ICT and e-commerce usage and, on the other hand, training activities. The main findings of this study, based on literature review, partners' experience and direct interviews with SMEs and associations, are hereby summarised.

2.1 SMEs and e-business

Considering e-commerce and ICT usage, recent studies underline that the real problem for SMEs (and not only for them) is probably not to establish a website or some form of e-commerce solutions, but to do this in a profitable and sustainable way [3], [4]. This means that it is not enough to "be present" on the web, it is necessary to do it in a effective and high quality way.

According to the same studies, the main obstacles that prevent SMEs from a complete exploitation of e-business opportunities can be grouped in three main categories (tab. 1):

- financial and economic obstacles: even if the initial investment for setting up a web site or an electronic catalogue can be quite low, the costs for an effective promotion and for the management of selected instruments in the long-run are still too high when compared to returns;
- consumers confidence and trust: on-line transactions require confidence between the two actors and security in data exchange. If customers doubt the security of data exchange, the continuity and the quality of offered services, and/or the supplier itself, they use the Internet just for information and then complete the transaction using traditional channels, highly reducing, the advantage of "being on-line" for the seller [5];
- organisational difficulties: the last problem to be considered is represented by organisational and managerial difficulties. For being really effective, the e-business solution should be deeply integrated and coherent with all internal processes and with the overall strategy of the company. This means that an e-business project is not just a technological problem but also an organisational one, and companies (mainly SMEs) often do not have the required internal skills for properly implementing and managing the organisational aspects of these projects.

Similar results comes from IQNet experience on e-business certification in SMEs. IQNet is an international network of certification bodies that is a partner in the DIGI-Q project together with some of its members. From the beginning of 2002, they have developed a certifiable standard for e-business processes (Qweb) that, up to now, has been applied to about 60 companies in different countries.

The IQNet experience in assessing e-business processes, both front-end and back-end, confirms the importance and criticalness of company internal structure and processes management for providing a sure and high quality e-business service. Moreover, they highlighted a lack of competencies and attention of companies to such aspects as customer relationship management, information security and privacy that, on the contrary, have high impact on customer satisfaction and trust. Finally, an aspect explicitly indicated as critical by companies (mainly small and medium size ones) is the need of specific internal competencies for effectively control and manage e-business

solution update (and continuous improvement) and relationships with services providers.

Table 1: Obstacles for conducting electronic business

Financial bottlenecks	Customer confidence issues	Organisational issues
<ul style="list-style-type: none"> • increased pressure on margins as a result of increasing competition and price transparency • e-business technology too expensive compared to economic potential / underestimation of launching costs • marketing expenditures to establish brand name • little or no decrease of transaction costs 	<ul style="list-style-type: none"> • product not suitable for online-purchase • B2C-commerce concentrated in few product categories • data security concerns • attainability of new customers • no implementation of customer relationship management • supply of adequate services 	<ul style="list-style-type: none"> • difficulties with the technological implementation and integration of online processes into “normal” operating procedures • lacking qualification of own staff • skills shortage • inexperience of management • lack of co-operation of smaller enterprises, e.g. for online procurement

With reference to this last aspect, it could be important to underline that for SMEs, due to the limited dimensions of companies, it is particularly important that the person in charge for e-business solution development and management integrates both technical and managerial competencies. As already mentioned, an effective e-business project requires a good integration between the two aspects, but the dimensions of these enterprises normally do not justify the creation of a large, multidisciplinary team of persons. Thus they require specifically skilled staff, where a single person is able to interact with all required functions and/or external experts for coordinating and driving the project.

In general, both literature and IQNet experience confirms that effective training actions would have a tremendous impact in diffusing and improving e-business usage among SMEs. Training would not only respond to organisational issues but, if properly defined, it can help SMEs to respond also to financial and confidence problems. Concerning the first point, the capability to properly select the adequate instruments and technologies and a professional approach towards their usage enables SMEs to optimise e-business investments and to gain the maximum return from them. Similarly, specific competencies about quality and security of e-business processes and some notions on Customer Relationship Management theories and instruments will allow SMEs to increase customers’ confidence and transaction value.

2.2 SMEs and training

At this point, the problem is how to involve SMEs in proper training activities, aimed at increasing their capabilities and awareness toward e-business. Recent studies confirm that participation in training activities of employees from small and medium enterprises is significantly lower than among employees from large ones [6].

There are multiple reasons for this. First of all there is the lack of time: SMEs are normally characterised by limited staff and high employees’ workload. In these conditions, it can be a problem to leave the workplace to participate in training activities. In addition to this, the lack of financial and time resources, makes SMEs more economically vulnerable than large enterprises. For this reason they normally

prefer to invest time and money in activities with immediate, visible returns, instead than long-term and “abstract” improvement projects, as training can be considered. Thirdly, SMEs are normally concentrated mainly on practical aspects: this is a typical approach of small-medium entrepreneurs that often influence the whole company. Attention is paid above all to practical, concrete aspects, while theoretical models and lessons are considered less relevant to working activities. Finally, since small and medium enterprises have specific characteristics that differ from those of large enterprises, a training activity, that is really appealing to these subjects, must be focused on their own needs and characteristics, while a relevant part of training proposals are actually based on large companies condition.

As a consequence, training activities addressed to SMEs are normally limited to very short and very specific seminars, one or two days long, often organised by category or trade associations. The problem is that similar activities are not enough to provide SMEs with the complex and multidisciplinary competences required for a complete exploitation of e-business potentialities, so it is necessary to find other, alternative instruments to introducing proper ICT skills in the SMEs context.

3. The DIGI-Q approach: collaboration and integration

3.1 The DIGI-Q project

The aim of the DIGI-Q project is to increase SMEs participation in e-business activities through the development of ad hoc training and awareness actions. The project commenced in October 2002 for a two year duration. Commencing in October 2003, five parallel editions of a common training course will be supplied in five different countries (Italy, Portugal, Greece, Slovenia and Czech Republic), with about 100 trainees involved.

The DIGI-Q consortium includes two technical universities (Polytechnic of Milan and Polytechnic of Porto), a research centre specialised in training, and five certification bodies, one from each involved country. This allows the consortium to integrate technical and theoretical competences coming from academic partners, their experience in training courses design and provision, with the direct knowledge of SMEs and e-business problems provided by certification bodies, among which those who developed the Qweb standard for e-business certification now adopted by the whole IQNet network.

There are at least two benefits of this approach:

- to underline the importance of quality, security and certification in e-business processes, as a mean to increase customer confidence and avoid improper or low-value use of ICT instruments;
- a complete view of the requirements to be matched by the training course and the possibility to better integrate academic and practical experience both in the design and in the implementation of the course.

In addition, the project will be the vehicle for non-academic partners to promote and refine the Qweb standard, with the aim to make it as more responsive as possible to SME needs.

3.2 Course structure

Coherently with the results of the users’ requirements analysis described before, the proposed training course will cover different macro-areas, in order to ensure a complete, multidisciplinary preparation and to enable trainees to really integrate e-business into

companies traditional activities. It is possible to distinguish four main macro-areas (managerial, technological, legal, and models) plus a special transversal area dedicated to skills improvement. Moreover, the course structure is composed by four different parts that follow the same rationale of a real certification project, in order to enable participants to easily apply theoretical lessons to concrete situations, with an immediate benefit for companies (Figure 1).

The Managerial area wants to give participants instruments and competencies for recognizing and managing organisational repercussion of e-business (and business certification) projects. This part is very critical in the sense that, without a correct evaluation and management of organisational impacts and required changes, any e-business project is destined to fail, thus large space is given to these aspects.

The Technological area aims to give participants a general knowledge of the most relevant tools and methods for the management and protection of information assets and e-transactions. The objective is not to prepare technicians to develop e-business or security platform by themselves, but to enable participants to effectively interact with technicians and/or ICT providers and to correctly analyse and evaluate different proposals.

The Legal area aims to provide a general overview of principal legal aspects related to e-business and data privacy, with particular attention to European legislation.

The Models area will provide the knowledge about reference standards and certification modalities related to quality, security, privacy and e-commerce, with a particular focus on implementation aspects. This part is particularly relevant considering the impact of customer confidence in e-business diffusion and the importance, for SMEs, to implement secure, high quality e-business solutions.

The content of each area has been defined keeping in mind the obstacles and problems for effective e-business actions emerged during the preliminary analysis, plus some contributions coming directly from SMEs and associations and the experience of partners in training. The total duration of the course will be about 200 hours spread over a period of 11 months, plus the project work carried out in parallel with lessons.

The project work represent an important and specific part of the DIGI-Q course structure. They are a sort of “compendium” of all the training activity, essential both for trainees and for the SMEs. Project work will be carried out in real companies and with the support of proper tutors, with the aim to:

- integrate theoretical lessons with real experience in a company, giving trainees the possibility to immediately experiment in practice the competences provided during the course, thus improving and completing their preparation;
- produce immediate and visible benefits for SMEs, which could use this project work for implementing or certificating their e-business processes;
- produce best practice and case studies to be used for disseminating and exploiting project results.

Possible examples of project work could be: to re-design a specific process of the company, to prepare the company for the e-business certification, to produce a detailed business plan for an e-business investment, to re-design the data and information management system of the company. Of course, the real contents of each project will be defined case by case together with the company and the trainee, the success of the project and the satisfaction of the company will be considered in the final evaluation of each participant.

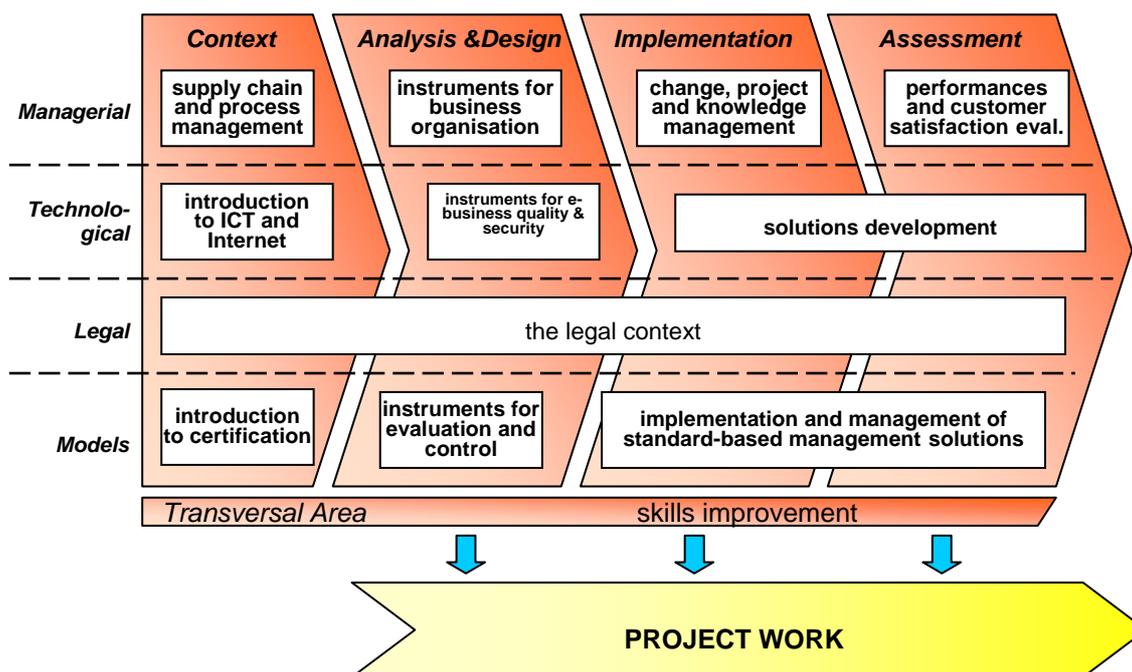


Figure 1: DIGI-Q training path structure

At the end of the training course, participants will receive the certificate of “quality business processes enablers” recognised by the whole IQNet network, and will have all the competencies for coordinating the development or managing with success an e-business process in a SME.

3.3 Course addressee

The professional figure coming from this course is an “enabler” of qualified business and e-business processes, thus a person that, inside a SME, has the competencies for coordinating and managing an improvement project involving e-business, certification or business process redesign. Due to the SME structure, this person will probably not be a senior-manager or a CEO, as experience demonstrates that such figures do not have time and/or will to participate in long training activities. On the contrary, the perfect participant would be a staff member, perhaps in the organisation or quality area, with an “intermediary” role inside the company and about 2-3 years of experience. This person could become the enabler of an improvement process, coordinating the activity of the different subjects, like ICT experts, service providers, external consultants and/or assessors, etc.

A second class of potential trainees is represented by consultants and persons from associations, whose role is normally very relevant in supporting SMEs in “going on-line”. Moreover, the activity of these subjects reaches a higher number of SMEs than those that could be directly involved in the project, thus they would act as “multiplier” for project results.

Another opportunity that is being considered is to propose the course to post-graduate, unemployed persons. This would probably meet the needs of both SMEs with high workload and no “free” employees and young persons looking for a really formative experience; trainees would indeed carry out their project work in a SME

combining a training period with a working experience and a real benefit for the company.

3.4 Expected benefits and future plans

The project is still in its initial phase and the training courses will be only be implemented in October 2003, thus all assertions about results are just estimations. Nevertheless the first tests related to course acceptability and former similar experiences (mainly for what concerns the project work) demonstrate a good response by both SMEs and single individuals. On the whole the main benefits of the DIGI-Q approach can be summarised as follows:

- it will give SMEs the required skills for correctly choosing, implementing and managing an e-business project and for really transforming ICT opportunities into enabling factors for enhancing business processes and performances;
- both the didactical methodologies and the contents of the course are specifically customised based on SME requirements, for facilitating the participation of SME employees (concerning didactical methodology particular attention will be put in combining theoretical lessons with practical exercises and case study related to the SME environment, interventions of persons and experts from the SME context, in order to make them more interesting and immediately applicable for persons coming from SMEs);
- also being addressed to consultants and services providers, the course will create an “elite” group of consultants with specific preparation in relation to SME needs in terms of ICT, e-business and certification, able to support SMEs in obtaining the maximum benefit from ICT usage;
- it will contribute to diffusing awareness and specific competencies about certification in SMEs, supporting at the same time the definition of a specific code of conduct for e-business certification;
- the involvement of certification bodies and consulting companies will multiply the effects of the training activity, allowing it to reach a larger number of SMEs in various European countries;
- the undertaking of at least 70 project works will guaranty visibility and an immediate return to the project, that will be used for dissemination and exploitation purposes.

At the time of writing, the DIGI-Q consortium is working on refining and consolidating the structure of the course and promoting it. The first editions of the course will start between September and November 2003 according to countries differences and will end about May-July 2004. Afterwards, in order to ensure the long-term effectiveness of the project, a permanent observatory will be created in each involved country with the task of carrying out training, research and awareness activities in the field of ICT skills in SMEs after the end of DIGI-Q project. To the same end, this observatory will also promote and support the creation of a stable network of persons and organisations with specific competencies on e-business processes qualification and management in SMEs.

4. Conclusions

The DIGI-Q experience confirms the importance of training activities to increase the diffusion of ICT and e-business usage inside SMEs. The presence of proper skills will

indeed enable these enterprises to effectively integrate such technologies in their “normal” activities and to obtain real benefits from their usage.

To obtain the maximum impact, however, these training actions should be addressed not only to SMEs employees, but also to consultants, associations and service providers, i.e. the actors SMEs normally rely on for the introduction of technological and e-business solutions. The involvement of such subjects, together with the undertaking of concrete project work for each trained person, will ensure a real repercussion of the training action on the SMEs context and will allow it to indirectly reach a higher number of SMEs.

Concerning subjects, the users’ requirements analysis highlighted that the real lack is not in purely technical competences: the main problem is often related to the integration between technological and managerial/organisational aspects, which are particularly critical for the success of any e-business project. For this reason, the figure proposed by the DIGI-Q course is not a technician, but an “enabler” capable to interact with all the different figures that participate in an e-business or, generally, in an improvement project inside a company.

Finally, the focus on quality, security, and/or certification allows, on the one hand, to characterise the course, but has also the goal to stress the importance of implementing not “plan” e-business solutions, but “high quality” ones. After the initial moment of euphoria is indeed evident that being on-line or having ICT instruments is not enough, to really benefit from such technologies it is necessary to use and manage them in professional way.

For the same reason, certification issues are gathering growing attention in the European e-commerce context, even if a common standard still does not exist. Nevertheless, various organisations have proposed possible codes of conduct for e-commerce and e-business activities, among which Qweb is one of the most complete [5]. The idea to combine the training course with the refinement of the Qweb methodology has the double goal to provide extra value to the course and, most of all, to obtain a code of conduct really applicable and useful for SMEs requirements, helping them to immediately benefit from certification advantages.

5. References

- [1] Eurostat, Enterprises in Europe: does size matter?. In: Statistics in Focus, Theme 4 – 39/2002.
- [2] e-Business Watch, The European e-Business Report 2002/03, European Commission, March 2003.
- [3] e-Business Watch, The development of e-commerce in the European Union, Special report, European Commission, May 2002.
- [4] Eurostat, E-commerce in Europe. In: Statistics in Focus, Theme 4 – 12/2002, European Community, 2002.
- [5] Nannariello, e-Commerce and Customer Protection – a survey on code of practice and Certification Processes, European Commission Joint Research Centre, project JRC-21, 2001.
- [6] Eurostat, Disparities in access to continuing vocational training in enterprises in Europe. In: Statistics in Focus, Theme 3 – 22/2002, European Community, 2002.

Information Technology Practitioner Skills in Europe: Analysing and Forecasting Demand

Eur Ing Dr. Matthew DIXON
Labour Market Adviser to CEPIS
And SEMTA Visiting Research Fellow, SKOPE, University of Oxford
Email: MatthewD@iisfairfield.demon.co.uk

The current state of the IT Practitioner labour market in Europe is analysed, together with the role and contribution of the Council of European Professional Informatics Societies (CEPIS). The seminal 2002 CEPIS study is reported, together with updates showing the effects on IT Practitioner employment and employment characteristics of the sharp downturn in ICT activity in 2000-2002. The paper concludes with a summary of CEPIS's contribution to policy development at the European level, in relation to labour market definitions and statistics.

1. Introduction

In spite of an extended period of discussion in various bodies about the IT “skills gap” in Europe, there remain many questions about the exact nature of the problem, and how to tackle it, whether from the political or economic perspective. Attempts at policy measures to effectively improve the situation for the benefit of the European economy and employment are still in their early stages in a number of countries. In response to this situation, the EU Commission established an “ICT Skills Monitoring Group” in 2001, and this reported to the October 2002 “e-Skills Summit” in Copenhagen. Since the IT profession has an important contribution to make to effective policy development in IT skills as one of the strong drivers of national competitiveness, CEPIS’s Member Societies agreed through their Council, also in 2001, to commission a serious study drawing on expertise in labour market statistics in this area in the United Kingdom. The report was published in May, 2002, and gained considerable recognition, in particular resulting in CEPIS being invited to play an active role in the new *European e-Skills Forum* that was established by the Copenhagen summit.

2. Usage of Terms

There are many different perspectives on IT (or ICT- or e-) skills, even within one country, and in order to ensure an effective focused debate on the issues between those interested in IT skills in different European Member States a number of key clarifications are required. The CEPIS 2002 study (and subsequent CEPIS work for the *European e-Skills Forum*) has helped significantly in the clarification of concepts and terms. This paper addresses *IT practitioner* skills – in particular the core technical practitioner competencies - rather than *IT user* skills or “*e-business*” skills.

Schematically, the key terms – and components of IT practitioner skills - can be shown as follows:

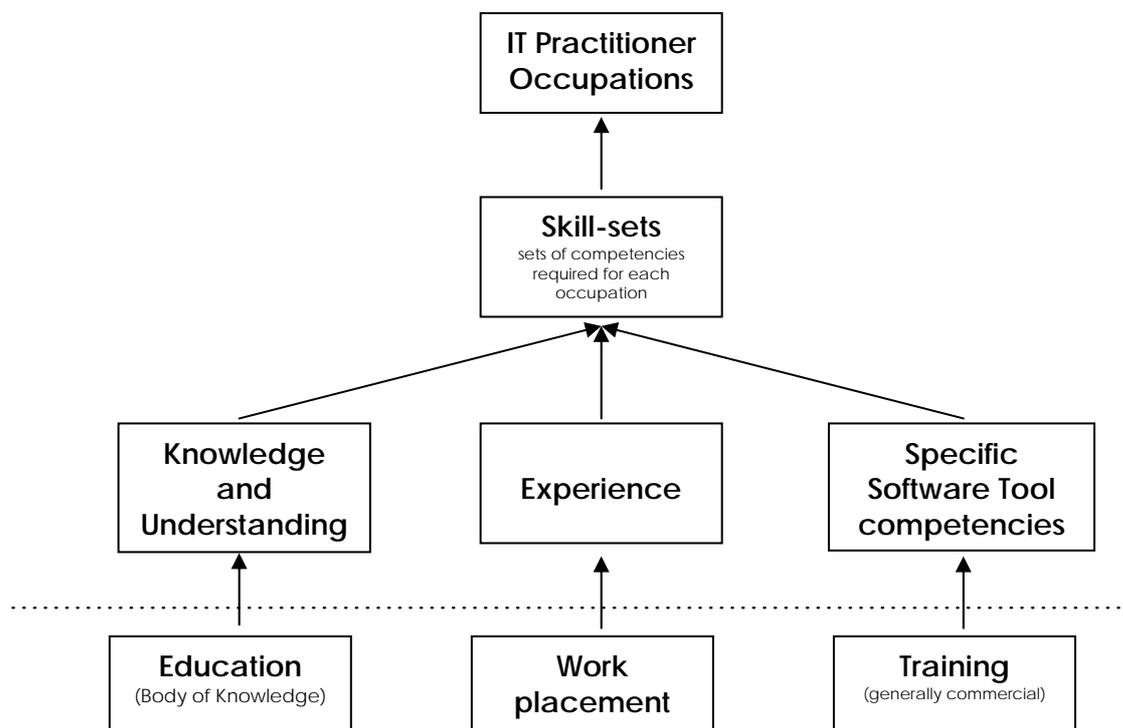


Figure 1: Relationships between Occupations, Skills and components of Skill Development

3. What are IT Practitioners and where do they work?

The key challenge at the core of analysing IT practitioner skills is achieving agreement from those involved in the adoption of a *common occupational (or skills-) framework*, which specifies the different functions (or roles) carried out by IT practitioners, and the different (competence) levels of these roles and functions. There is currently no single agreed framework for IT Practitioner skills at the European level, and it is possible (probable?) that this may never emerge. An idea of what is involved in this aspiration can be gained by examination of the most significant current frameworks:

- the UK’s “Skills Framework for the Information Age” (SFIA) (details at www.sfia.org.uk)
- the German “Arbeitsprozessorientierte Weiterbildung in der IT-Branche” (APO) Profiles (see www.apo-it.de/apo-it/index.php), and
- the only framework of a trans-national character developed thus far: the “*career-space*” framework (details: www.career-space.com./lifestyles/index.htm) of generic job profiles.

It is important to recognize that many of the differences between these frameworks arise from the fact that they were *developed for different purposes*.

Probably the most important principle to be understood when trying to develop a sound view of IT Practitioner skills is to recognize the *fundamental distinction between the sector and occupational employment perspectives*. IT (supplier) companies arise from, and are strongly influenced by, the abilities of “technical people”. But such companies generally also employ people with a range of other skills, in support of

operations of various kinds (e.g. accounts people, admin. people, marketing and sales people, personnel staff, general managers, office cleaners, etc. - see n_3 below). In addition, organizations in most other parts of the economy – e.g. banks, manufacturing companies, local authorities, hospitals (and other health care operations), airlines, retail businesses, government departments, etc. - all make considerable use of Information Technology, and in doing so, generally have “IT departments” that employ teams of IT Practitioners (see n_2 below). In many countries (and indeed for the EU as a whole), the number of IT practitioners employed in these “IT user organizations” is greater than the numbers employed in IT (supplier) companies. Table 1 shows the structure in its simplest form: a 2 x 2 matrix. The numbers of people employed in the 4 categories define the basic “shape” of a country’s IT practitioner workforce.

Table 1: Sector \leftrightarrow Occupation relationship

	IT (Supply) Companies	IT User Organisations
IT Practitioner Occupations	n_1	n_2
Other Occupations	n_3	n_4

Within the European official statistical system, *sectors* are specified with the NACE (*Nomenclature generale des Activites economiques dans la Communauté Europeenne*) classification and *occupations* within the ISCO (International Standard Classification for Occupations) system.

4. The Labour Market in Europe: Findings of an Empirical Study

The report on “Information Technology Practitioner Skills in Europe”, commissioned by CEPIS in 2001, surveyed the current state of these skills within the European Union. Based on Eurostat holdings of Member State *Labour Force Survey* (LFS) data for the internationally-agreed occupational categories of *Computing Professionals* (ISCO 213) and *Computer Associate Professionals* (ISCO 312), it presents an overview of the IT practitioner labour market and summarises in more detail recent trends in employment in four Member States (Germany, Ireland, Sweden, and the United Kingdom). The future development of the size of the IT practitioner workforce was then explored using different plausible employment growth scenarios, with annual increases of 2% to 15%, following an initial downturn.

For the full report, see www.cepis.org/download/cepis_report.pdf.

The study sets the analysis in its Economic and Policy contexts, and then examines the *Computing Professional* workforce in the four countries examined in more detail, in particular in relation to:

- the fraction of female employment;
- the age distribution of IT Practitioners,
- self-employment within the workforce;
- the Supply (IT) Industry share of employment;
- the Computing Professionals’ “Highest Academic Achievement” (measured by the *International Standard Classification of Education* – ISCED); and

- the amount of training recently received.

It also shows the development of these aspects of the workforce for the four countries, enabling key comparisons to be made. In addition, the report shows, for all Member States, the development of the *IT Practitioner share of total national employment*, and how this developed over recent years, and the role of migration. The *findings* for these key variables are shown in graphical form in the Annex. Some of the key messages about the *Computing Professional* (ISCO 213) workforce are as follows:

- *female employment*: as is well known, the fraction of the workforce made up of women is generally comparatively low (with Germany and the UK around 16%), but with modest increases in 2002 for Sweden and Ireland – with 22% and 28% respectively);
- *age distribution*: The IT practitioner workforce is generally thought to be a relatively young one: while it undoubtedly *is* in comparison with Member State overall workforces, numerically the percentage of *Computing Professionals* aged below 35 is a little below 50% in Sweden and Germany and just over half in the UK, while the Irish workforce has had over 70% of its *Computing Professionals* below the age of 35;
- *self-employment*: The fraction of *Computing Professionals* in the four Member States who reported in their national Labour Force Surveys they were self-employed ranges from about 8% to a little over 12%. The percentages for Sweden and the UK are a little higher than those for Germany, and there are clear swings in the percentages between 1999 and 2002 that reflect the movement between employed and self-employed status arising from the major labour market upheavals over this period;
- *Supply (Information Systems) Industry share of employment*: as indicated above, generally there are more *Computing Professionals* working in User Organisations in other sectors than there are in the supply companies (IS Industry). However, the combination of strong growth in business activity and increase in outsourcing has resulted in steady growth in the employment share in the IS supply industry, with the exception of Ireland, where there has been an easing away from the previous dominance of the supply side;
- *“Highest Academic Achievement”*: very broadly, about 2/3 of *Computing Professionals* employed in the four countries have benefited from *Tertiary* education, and around 1/3 have *Upper Secondary* education. The main variations on this have been in Germany (where the fraction with Upper Secondary education increased noticeably in 2001 and 2002), and Ireland, where the split has been above ¾ and below ¼ respectively. The position in Sweden (although affected by coding changes following the revision of ISCED in 1997) is not far from that in Germany; and
- *work-related training recently received*: There are noticeable differences between reported training activity within the *Computing Professional* workforce in the four countries, with Sweden and the U.K. reporting higher levels than Germany, although the percentage of *Computing Professionals* in Sweden who undertook training work-related training in the month before they were surveyed for the national LFS fell markedly after 2000.

The report then elaborates the issues involved in estimating future demand and possible skill shortages, reviews the two main previous EU level studies, and adopts an innovative approach to forecasting employment levels, using four “scenarios” which could prove useful in policy analysis.

5. Estimating Future Demand

The estimating of demand in labour markets is not easy. Estimating *unfulfilled* demand (normally viewed as *skill shortages* and evidenced by recruitment difficulties) is even harder. Many employers have problems recruiting the “right” people, and – particularly at times of strong economic growth – trade bodies in most sectors complain of skill shortages. The approach adopted in the United Kingdom for estimating unfulfilled demand for IT practitioners involves employer surveys of adequate sample size with questions seeking to ascertain the numbers of *hard-to-fill-vacancies* in each of the occupational categories of interest (i.e. within an occupational or skills framework).

Since labour market conditions change over time – sometimes quite significantly over quite short timescales – estimates produced from such surveys often have limited validity after a few quarters. In addition, what policymakers (and indeed employers themselves) would really like to know is likely patterns of *future demand*, as opposed to *current* (effectively *recent*) demand. Forecasting is recognized to be a risky business, and this is no less true in the case of labour markets than of anything else. As elsewhere, forecasting can draw both on an element of extrapolation of recent trends (reflecting the reality that such major economic systems cannot make excessively dramatic “swings”) and a series of (more qualitative) considerations of the impact of a series of underlying “drivers” – factors (or variables) that are likely to influence future levels of demand for labour, given certain assumptions. The scenarios thus produced are generally developed based on the likely impact of sets of *Political, Environmental, Social and Technological* (“PEST”) variables.

In the end, the variables of interest for policy-makers tend to be the estimated numbers of additional (or reduced!) IT practitioners (in the different occupational categories) required over forthcoming months and years. While “proper” (PEST factor-analysed) scenarios are clearly desirable, they will therefore need to produce – as an “output” - the likely development of employment levels in the relevant occupations. However, these can be estimated in broad terms by extrapolation of recent employment levels, giving increases in numbers which can be converted to estimates of new (inflow) levels by the addition of (estimates of) replacement demand (the *attrition* from the workforce arising from retirement or other departure from the workforce). It is this latter approach that has been used in the CEPIS work, since recent trends in employment levels are available from the Labour Force Survey data for the IT occupation categories in each Member State, gathered centrally by the European Statistical Office.

While annual data is available for all Member States, this data is already gathered (and submitted to Eurostat) on a quarterly basis by the majority of Member States and it is intended that there will be quarterly submissions from 2005. As can be seen from the Annex, the CEPIS study laid out four possible employment level growth scenarios for the two ISCO categories (Computing Professionals – ISCO 213 – and Computer Associate Professionals – ISCO 312). Following an initial “trough” - widely expected given the dramatic fall in ICT activity at the change of the Millennium - annual net growth rates of 2%, 5%, 10% and 15% were applied. Given that the employment growth level increase rates of the late 1990s had exceeded 10% for the EU as a whole, these scenarios seemed a broadly plausible set (see Annex).

The latest (2002) Eurostat LFS data emerged shortly before the *e-Challenges* conference, and the actual employment levels for IT Practitioners (Total of ISCO 213 and 312) in 2001 and 2002 are shown in the Annex. While the total employment levels for the Union as a whole have not fallen away anything like as seriously as portrayed by

the “initial trough” postulated (indeed employment of *Computer Associate Professionals increased!*), the differences in the “responses” in the four Member State examined in detail in the Study are significant. These are summarized – for employment in ISCO 213 + ISCO 312 occupations - in Table 2.

	Average annual employment growth over five years (to 2000Q2)	Percentage increase in the latest year for which there is data		% change 2000Q2 – 2001Q2	% change 2001Q2 – 2002Q2
Germany	9.5%	17.8%		11.4%	-4.6%
Ireland	(unavailable)	11.2%		8.5%	13.9%
Sweden	15.6% (over 3 years)	34.7%		9.9%	-2.08%
United Kingdom	12.9%	2.5%		-4.8%	-10.1%
EU as a whole	11.6%	10.5%		9.0%	6.7%

Table 2: Development of IT Practitioner employment from Member State Labour Force Surveys (total employment in ISCO 213 and ISCO 312)

The growing evidence of falls in employment levels across the Union supports the situation reported from employers – namely that the very serious shortages experienced in the late 1990s are no longer evident. Even ignoring the effects of international outsourcing (which appear to be growing in importance), the presence in most Member States of unemployed IT practitioners means that there is no widespread shortage situation.

However, the IT practitioner skills issue in Europe has not disappeared: the focus in this strategically important area needs rather to focus now on specific emerging, leading-edge skills, and the whole question of quality levels on the supply side. Given the evidence of chronic IT practitioner shortages over the whole life of the technology, CEPIS believes that European governments and the Commission should use the opportunity of the easing of shortages to take stock and work on sensible *systemic* measures to improve the relevant supply channels so that the labour market will respond more effectively when the next “upturn” results, once again, in shortage pressures.

6. Conclusions and Recommendations

Overall, CEPIS is ready to further strengthen its contribution to tackling IT practitioner skills problems at the European level, and concludes, in respect of labour market aspects of the issue, the following key points for future policy-making:

- Eurostat Labour Force Survey data provides a reliable baseline for policy-making and commercial planning;
- Comparable time-series data is of considerable value, since it provides real evidence of the broad dynamic characteristic of the labour market;
- Approaches to forecasting must be robust, and while drawing on the experience and expertise of the forecasting research community, need to be restricted to a small number of basic variables on which policy development can be based. Adjusting forecasts in the light of differences between *previous forecasts* using

the same methodology and *what actually took place* adds considerably to the validity - and credibility - of the contribution;

- There would be real value in extending the initial CEPIS Study – in particular to all Member States and where possible, accession countries, as well as to additional data-sets (in particular flows of graduates from Member State Tertiary Education IT courses);
- CEPIS will continue to respond constructively to requests for contributions to the emerging agenda for “e-Skills” at the European level, in particular through the “e-Skills Forum”.

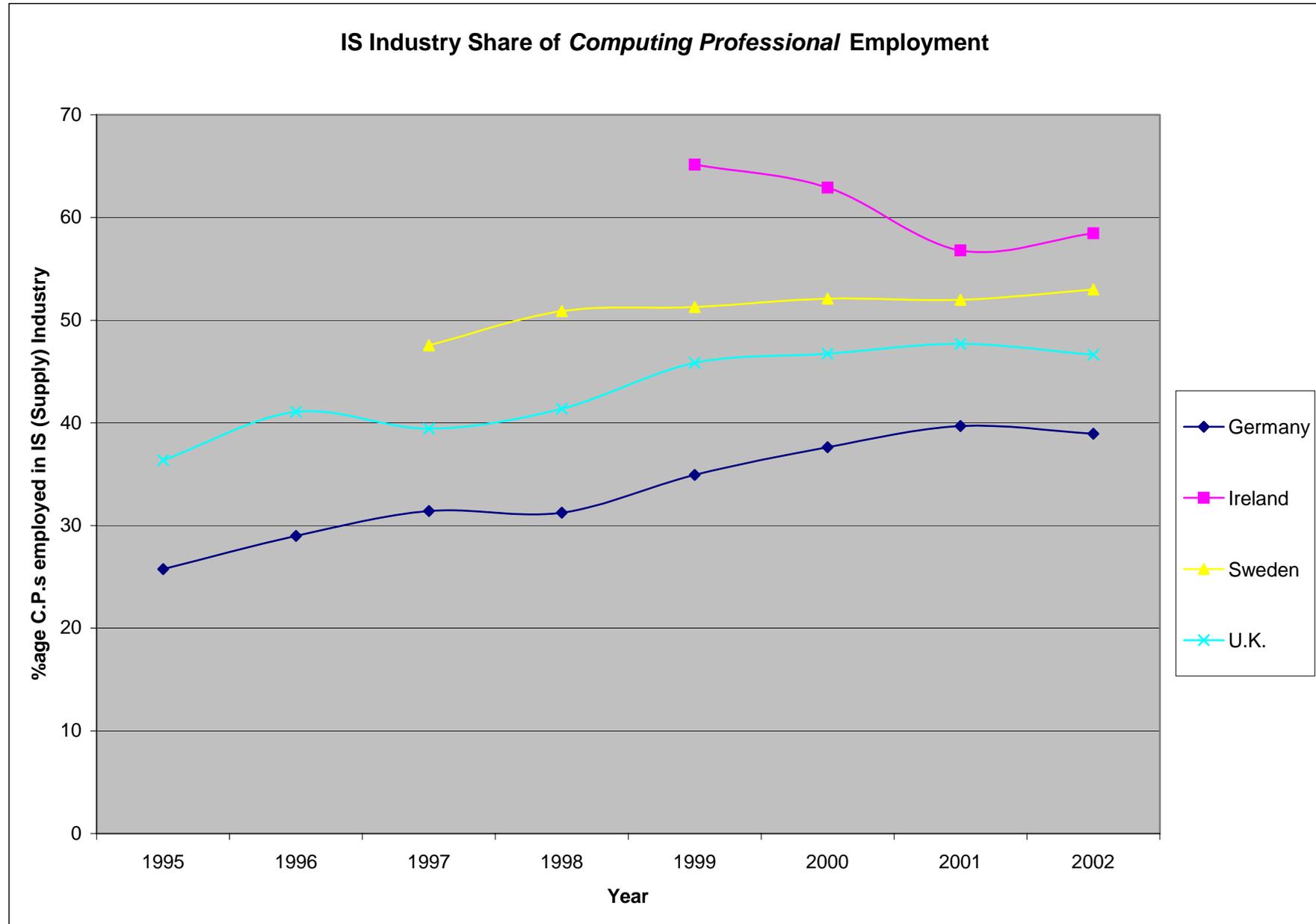
7. Annex

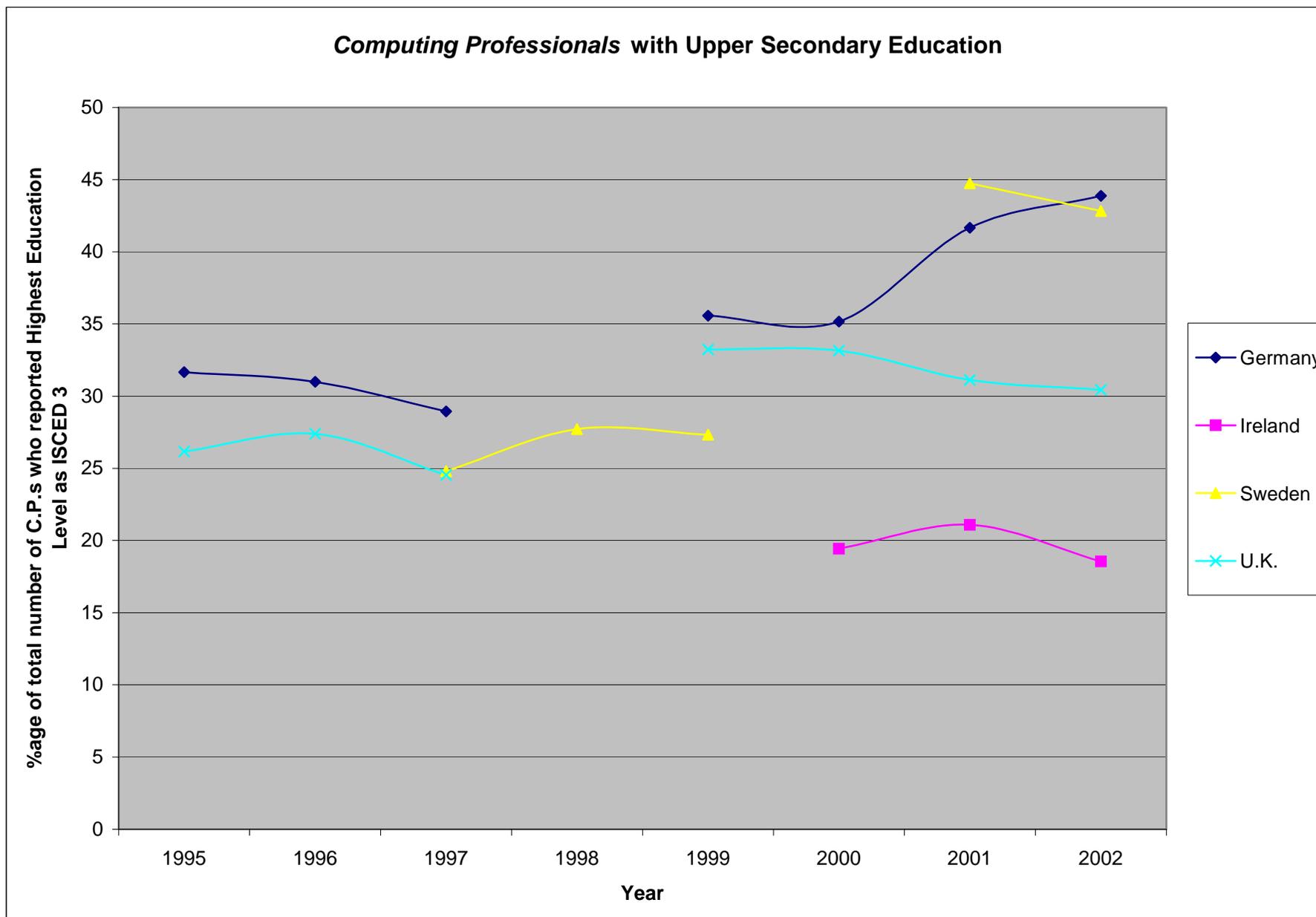
CEPIS Report on IT Practitioner Skills in Europe: the Findings

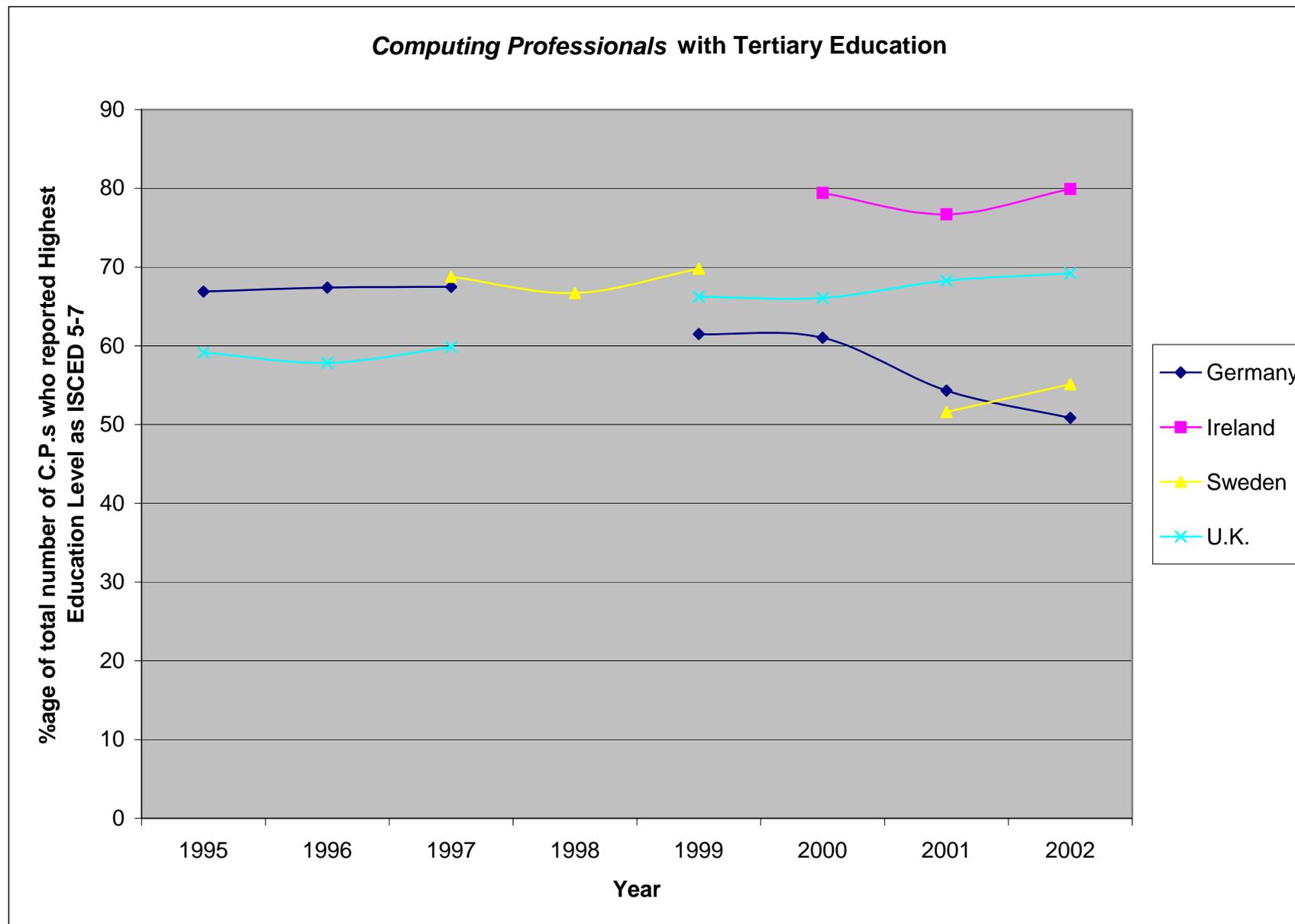


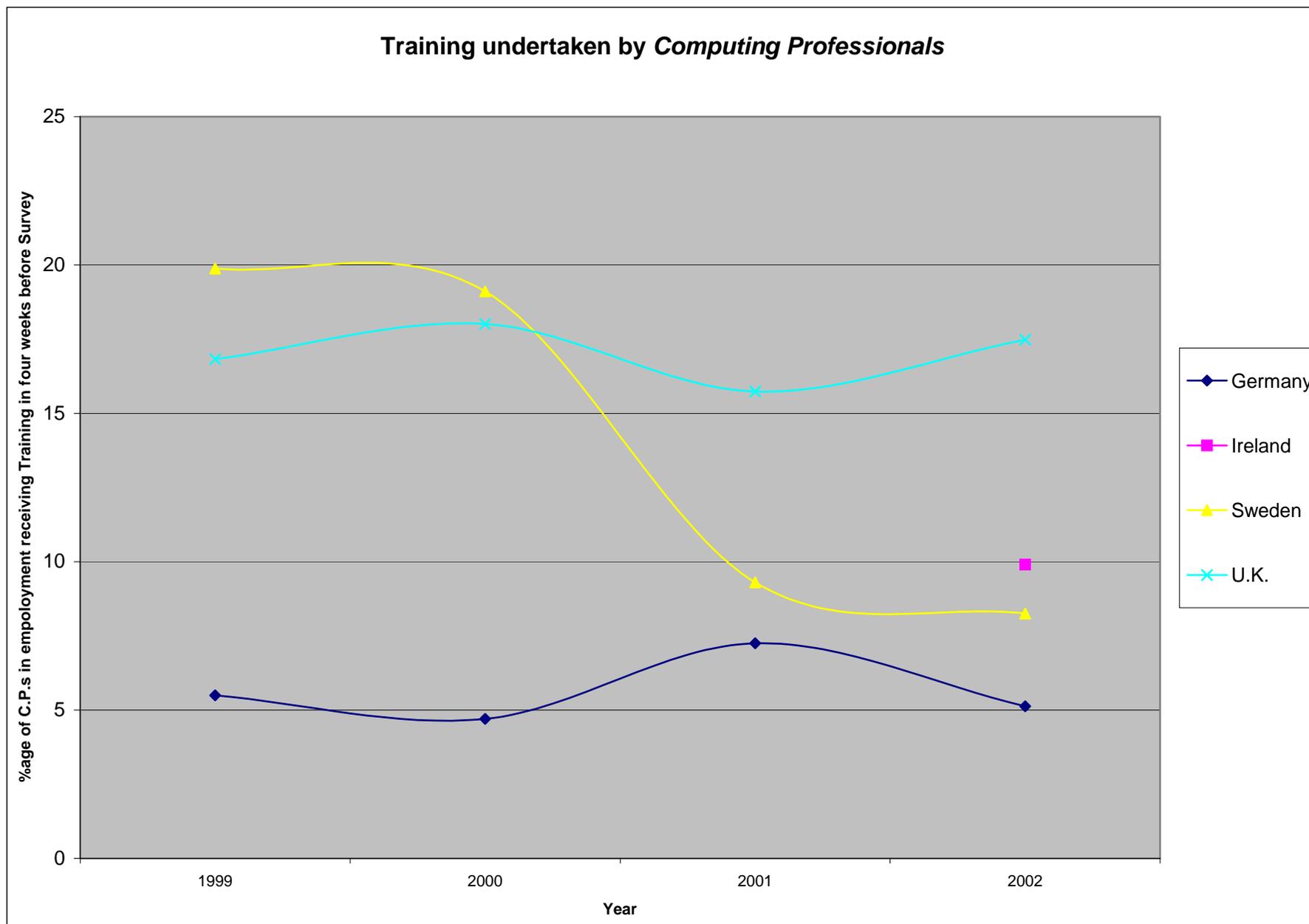








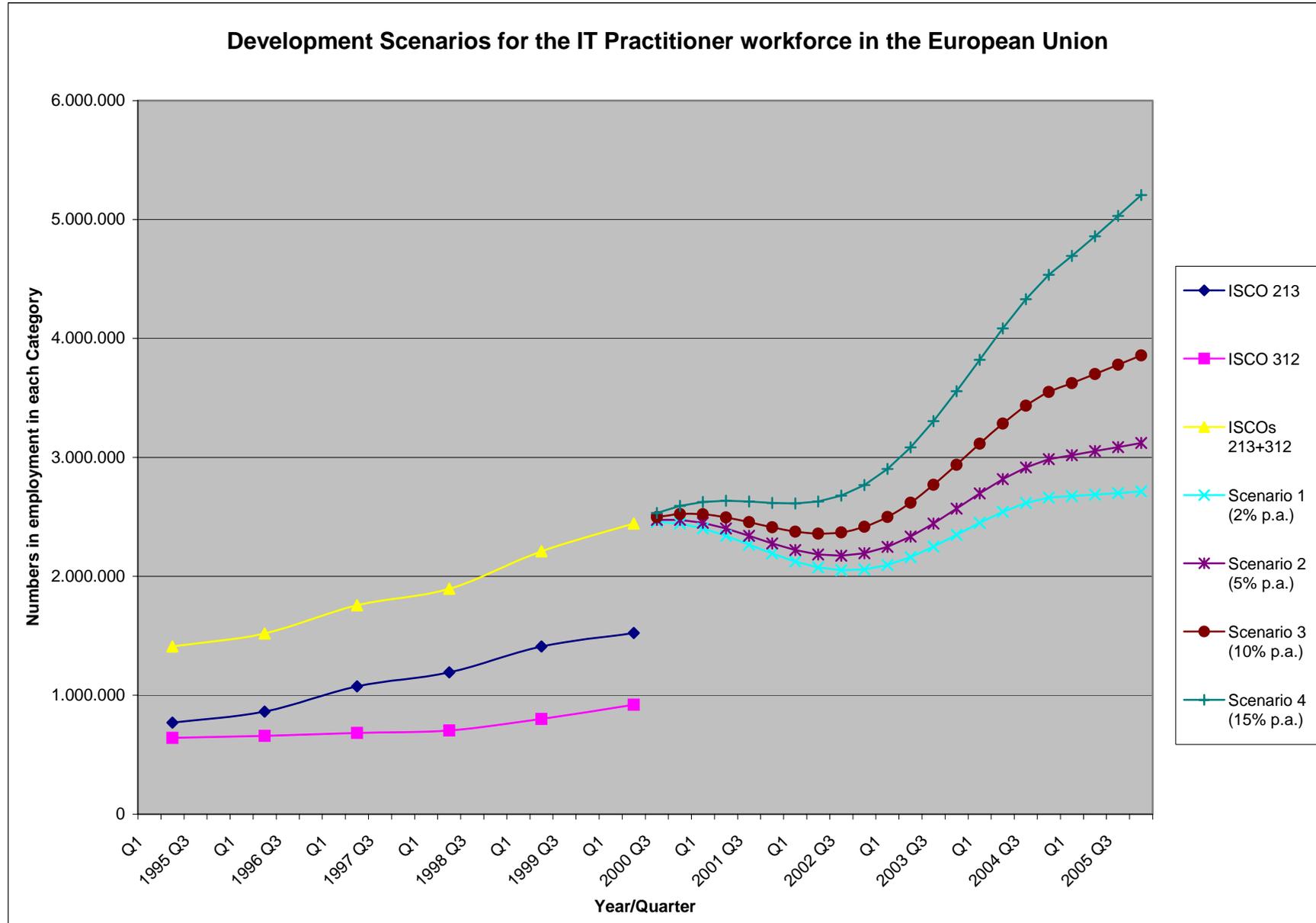




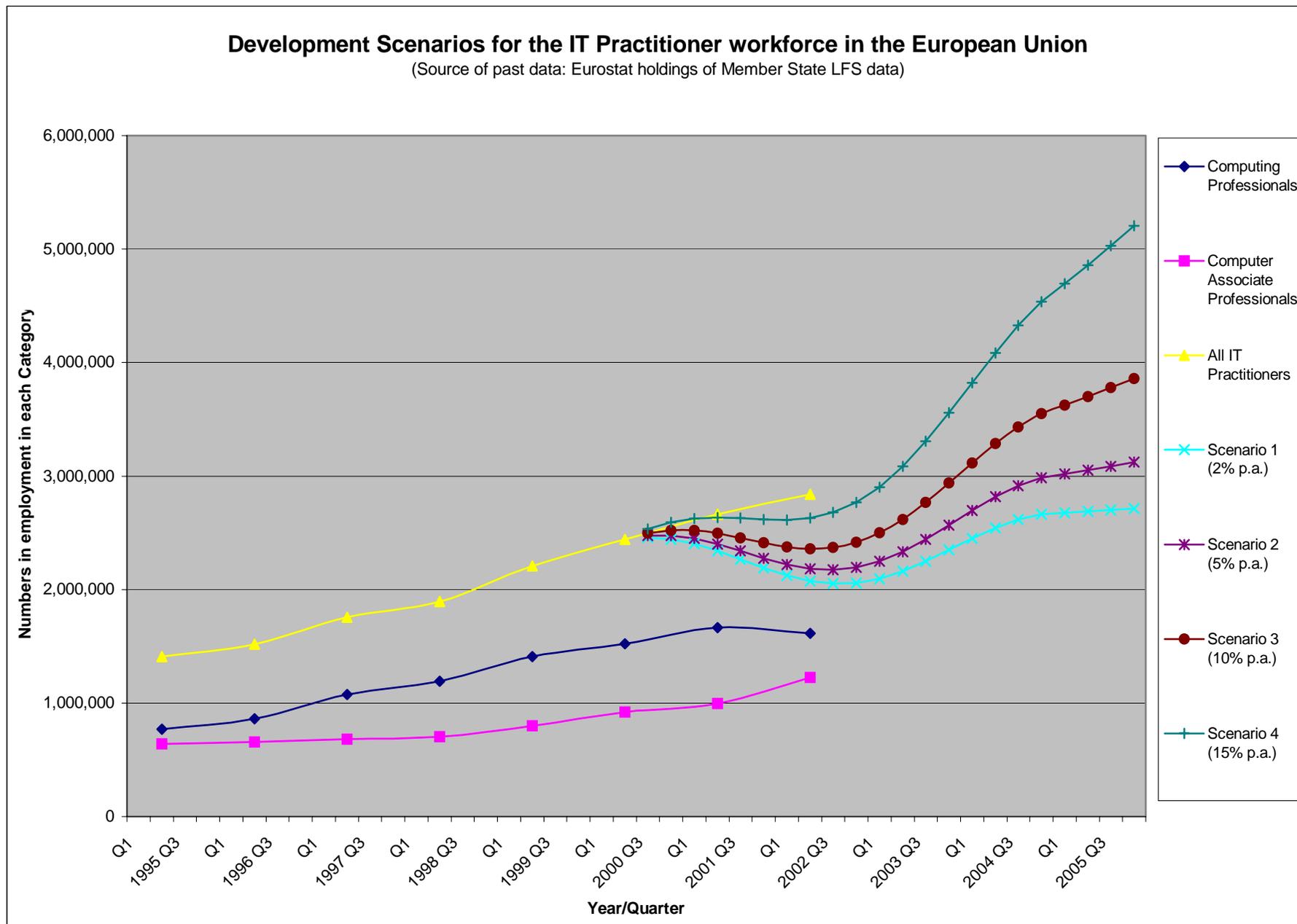
CEPIS Report on IT Practitioner Skills in Europe:

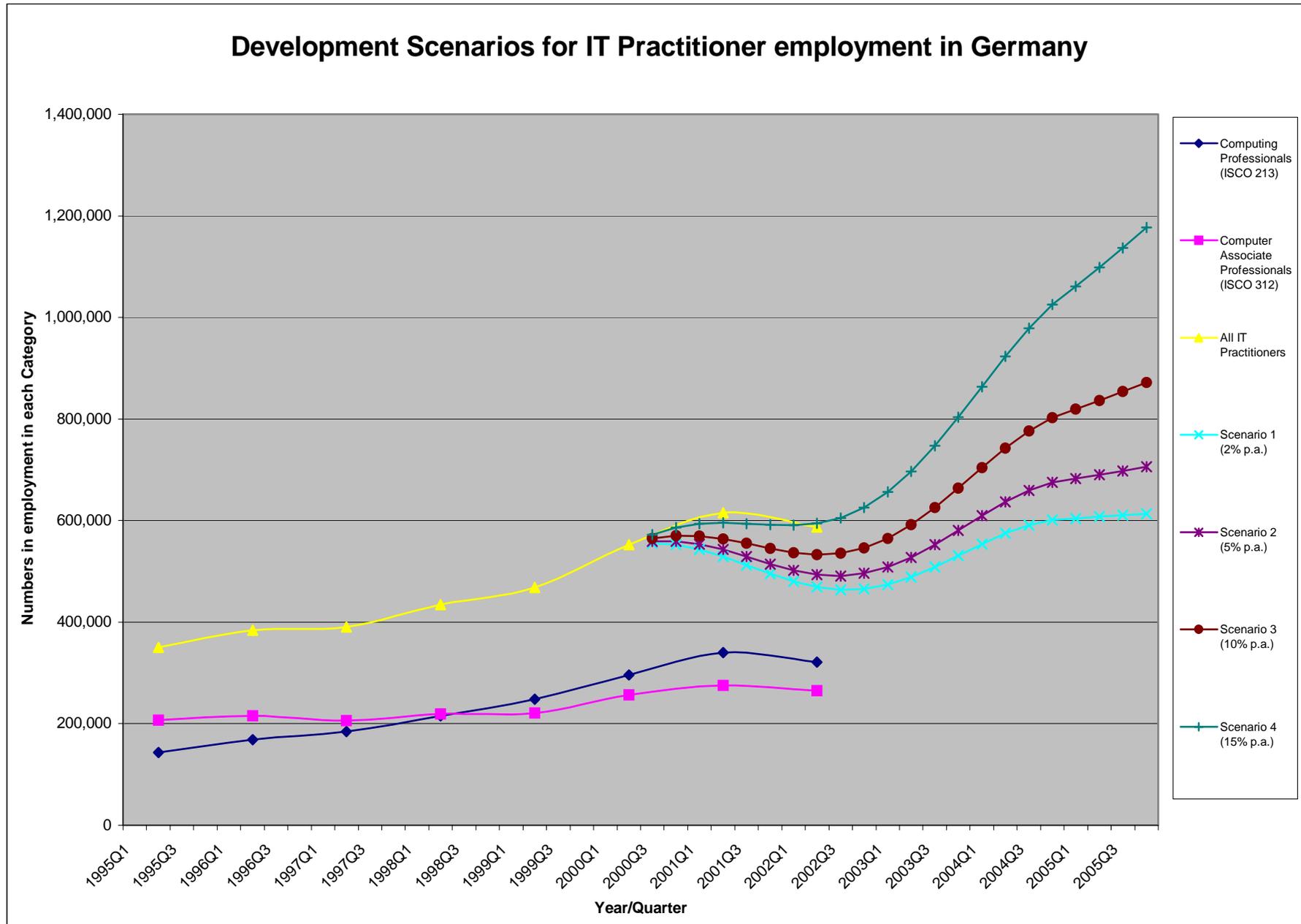
the Future (?)

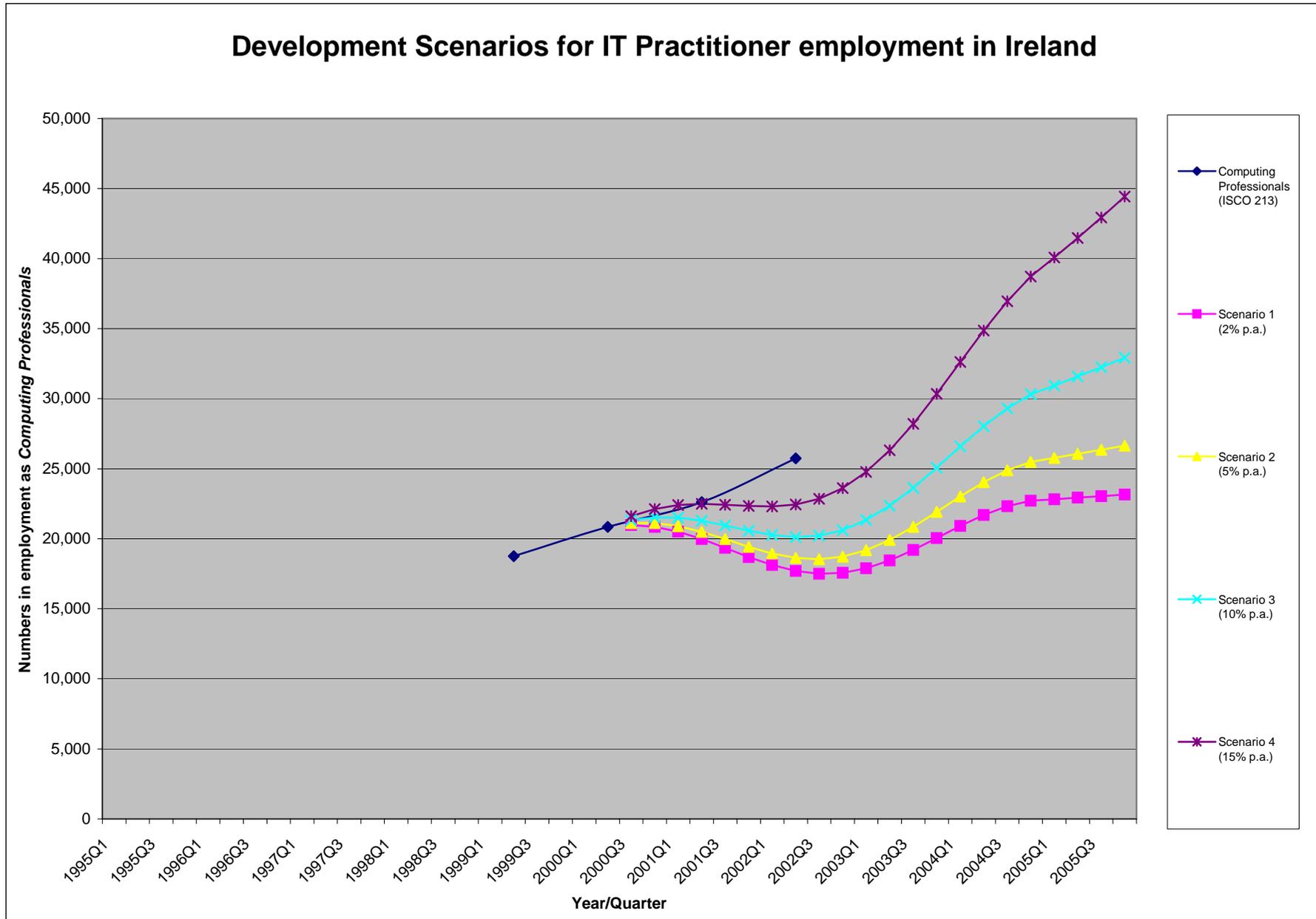
(from 2000)

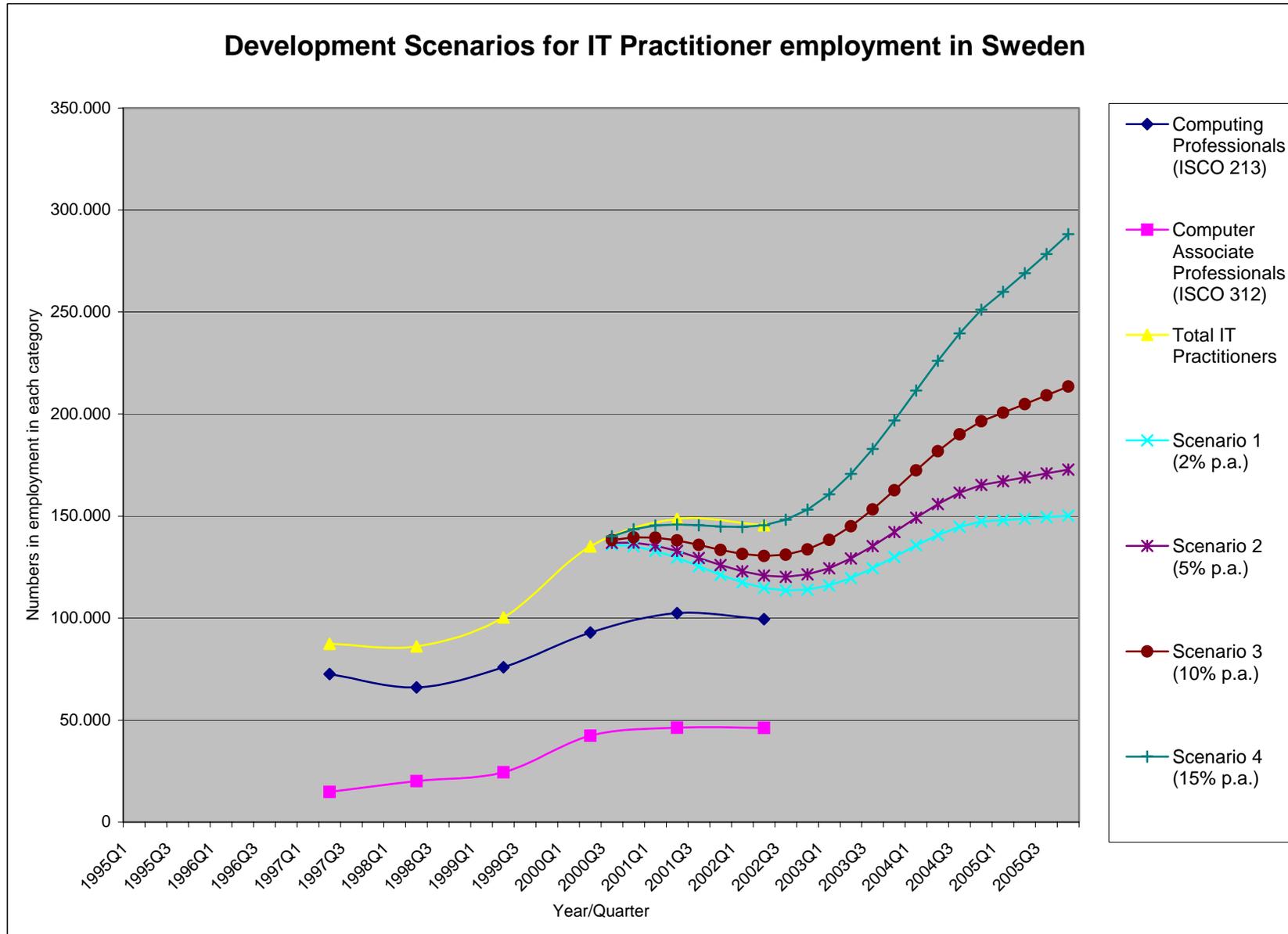


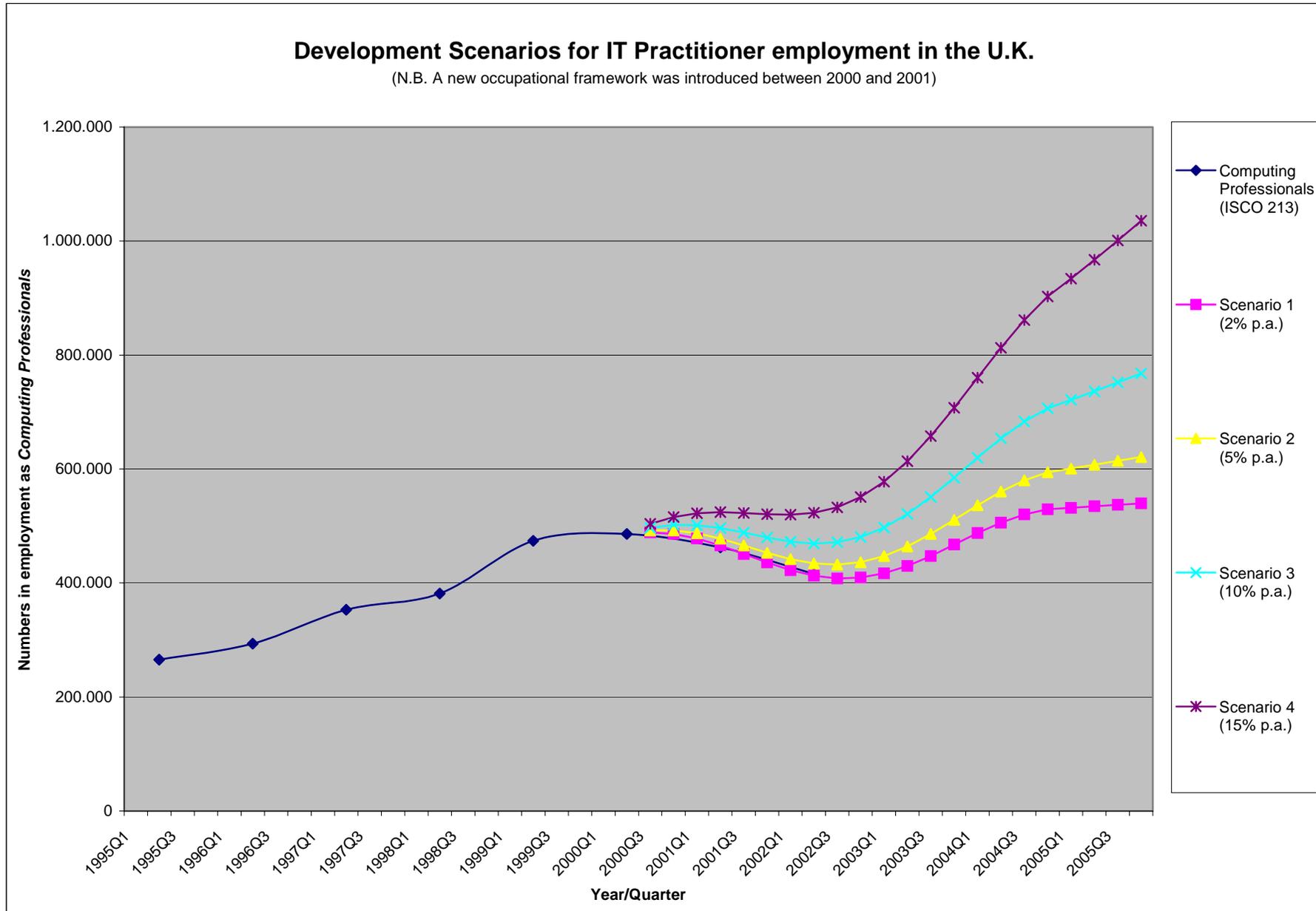
CEPIS Report on IT Practitioner Skills in Europe:
the Future
(as it actually turned out...)











Fostering ICT skills is Crucial to Europe's Development

Based on Trends in Markets and Technology

Henk de VRIES

*Philips Semiconductors, PO box 80021,
5600 JZ Eindhoven, the Netherlands
Tel: +31 40 2722536, Fax: +31 40 2723402,
Email: henk.de.vries@philips.com*

The ICT industry influences the lives of a huge number of people. ICT technology has the potential to enrich lives, develop economies and enable life-long learning – for everyone, anywhere, anytime. ICT can bridge gaps in marginalized groups and open avenues for economic, cultural and personal growth. Poor ICT skills will have an adverse effect on European society and industry. The Career Space consortium, which includes many ICT companies like Nokia, IBM, Philips, Siemens, BT, has expressed its concern about the future availability of skills in Europe. In spite of the current economic downturn these companies are planning their future, and as global companies tend to do, they make use of resources in the best locations and positions available to them. The skills as required in the different regions needs future planning in these companies and in the different educational institutes. This needs a future view from the industry and a platform to communicate this future perspective for Europe and cooperate intensively.

1. Introduction

We have seen that our capital driven economy has vulnerable sides. In recent years we have observed that certain negative forces caused a spiral-down of events-rolling-over (negative) events and many economic graphs/curves went down. Forces like the internet spread information very fast, spirals up or down and stimulate each other in a much faster, and also a more aggressive way. In the up-turn of the late 90's and even in 2000 and 2001 the industry faced a huge skills shortage.

With the support of the European Commission, a consortium of nine major ICT companies, (BT, Cisco Systems, IBM Europe, Intel, Microsoft Europe, Nokia, Philips Semiconductors, Siemens AG, Thales), and EICTA, the European Information, Communications and Consumer Electronics Industry Technology Association, has been exploring new ways of addressing this skills shortage. A project was set up, coordinated by International Co-operation Europe Ltd., to put in place a clear framework for students, education institutions and governments that describes the roles, skills and competencies required by the ICT industry in Europe.

2. The Project and its phases

The first step was to develop generic skills profiles relevant to key jobs in ICT and to create a dedicated website (www.career-space.com) and use other communication tools to make this information widely available. The generic skills profiles presented on this website cover the main job areas for which the ICT industry is experiencing skills shortages. These core profiles describe the jobs, setting out the vision, role and lifestyle associated with them. The specific technology areas and tasks associated with each job are also outlined, as well as the level of behavioural and technical skills required to carry out the profiled jobs.

The second step was to work with over twenty universities and educational institutions across Europe to develop new ICT curriculum guidelines. These guidelines, which can be seen on the Career Space website, are intended to assist the design of courses to match the skills profiles and needs of Europe's ICT industry and eEurope.

In recent years we have seen this skills shortage decrease and the industry faces also a change in the needs for such skills. The main reason was the negative economic spiral in Europe with a main "drive-down" from the UMTS auctions: Years ago many governments arranged auctions for the UMTS frequencies/facilities and a lot of the strong communication companies and -institutes were forced to allocate extensive parts of their R & D capital in this "challenge". The overall effect we face today is a reduction in R & D for the company's own goals. More reasons can be given and the whole world economy, as mainly driven by the USA, influenced the European economic downturn as well. Looking at the European ICT economy we should seriously consider a much broader perspective than the traditional IT areas where computers are used in companies for administrative purposes or other application oriented fields and act as servers in communication networks.

Today we see people move around with many micro controllers/-processors around them, in all kinds of devices like watches, phones, cars, displays, equipment and even cloths.

A lot of ICT functions are part of our normal life and for some parts we are not even aware that a whole chain of services or content-streaming is managed and arranged around us. We move gradually to ubiquitous computing and later-on to a sort of "ambient intelligence" around us.

3. Analysis, reference scenarios

Fig 1. describes technology waves which have impact on the skills needed to exploit these technologies for new business opportunities.

The series of waves show that over the past decades we enjoyed the curves of electro-mechanics, as preceded by the mechanics curve from centuries ago. This electro mechanics curve has e.g. moved up when light bulbs-technology was used to develop radio-tubes, Once these tubes were commodity they we easily and widespread used in radio's and other electronics equipment. This electronics (devices) wave was stimulated even more once the transistor was invented just before 1950. When these transistors (arrays/configurations) became real programmable micro controllers/-processors it was specifically their programming causing a new wave. Bear in mind that so far mainly the successful companies were on the uprising slope of the curves and also the European electronics (incl. mobile-) industries gained much benefits from all these developments and parts of the curves. The personal computer and specifically the microprocessor

driven devices got a lot of attention due to its programming paradigm as marketed so well by Microsoft. Therefore much more economic force developed in parallel for all kinds of devices: TV sets, Cell-phones, audio sets. Also other equipment became loaded with programmable functions. Keep in mind that the SW-wave as indicated here generated also commodity software products.

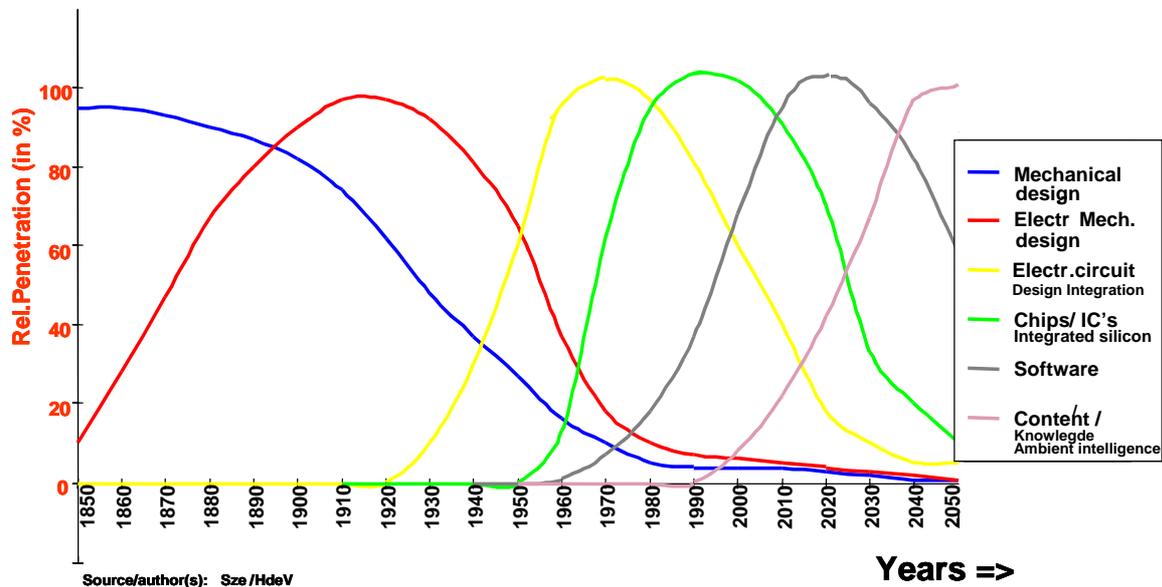


Fig. 1.

This enforced the rule that the (common) availability of such products generate a new wave. The internet and new forms of content transports could be developed due to the easier availability of software in the form of (internet) tools and modules. The next waves as we see develop in their early stage will use the internet, its content and also the previous waves to generate the so-called ubiquitous computing or "ambient intelligence". In the future people will hardly notice the intelligent services and devices around them. Comfort will raise and e.g. health inspections done much easier and, if required, continuously. Also the use of computers, like PC's, PDA's, will not need as much training and special courses as we "suffer" today. User-interface systems will start using the increasing amounts of processor capabilities to become truly user-friendly. Not only many tens-of-thousands SW engineers have a job in the development of applications for the enterprise environment with e.g. financial systems for banking & insurance but also many tens-of thousands work in the SW development for devices services and streaming of content. Some link closely to electronics while others integrate even more disciplines like mechanics and optics. It is specifically this integration of technologies that we see as a strong skill-set for Europe.

Not only in historic perspective but also for its future. Examples are the New Digital TV systems, Set-top devices, DVD and all of them converging to new functionalities. All need a flow of content and this requires standards and well balanced system architectures in the whole delivery chain. Parts of this work might be transferred or will be transferred to Asian countries but specifically the integration of the indicated disciplines and the alignment with services and contents is of utmost importance for e-Europe. e.g. electronics companies have to cooperate with TV-stations to arrange the content flow and this will not occur unless transfer standards are in place. Also new business interests influence the technologies, standards and functions used in the delivery chains.

4. Will growth return ?

YES ! Bear in mind that the previously indicated technology waves are not overlapping in a smooth way. Some technology ‘‘hick-ups’’ (like e.g. the networks auctions and delay of communications technologies) caused slower growths. This has to be taken in account when we plan our future. Also keep in mind that more technologies have their waves (e.g. chemical, biotechnology, energy, etc.).

To show that even with the current downturn we have to anticipate new growth: as an example the general growth curve of the Semiconductors industry. (being one of the most influential high-tech industries today). Fig. 2 shows that so far it had an average growth of + 15 to +17% and is now slowing down to about 10 - 12 %. This curve had years of high growth as well as deep steps-down and is now facing its deepest downturn ever. Due to market estimates predicting a new chips hungry period we will see a recovery within a few years. This will show that the new generations of chips need even more software than ever. Curves like ‘‘Moore’s law’’ show an increase in performance of this technology with a factor 2 in every 18 months and software has a much higher factor in this area. Will this be the same software as we developed in the last decade ? Certainly not. Demand for more robust software in the professional and business area is increasing and in the consumer electronics industry these requirements will also need different tools, methods, SW-technologies and so the skills. For example: we step also in new security paradigms for e.g. business transactions via the WEB and the demand for virus free, secure delivery of services and content.

Long term growth

- Long-term CAGR over four decades at 16.4%
- Growth has not been constant
- Growth has been stimulated by new applications with higher silicon content
- CAGR is likely to decline to 8 – 11.5%

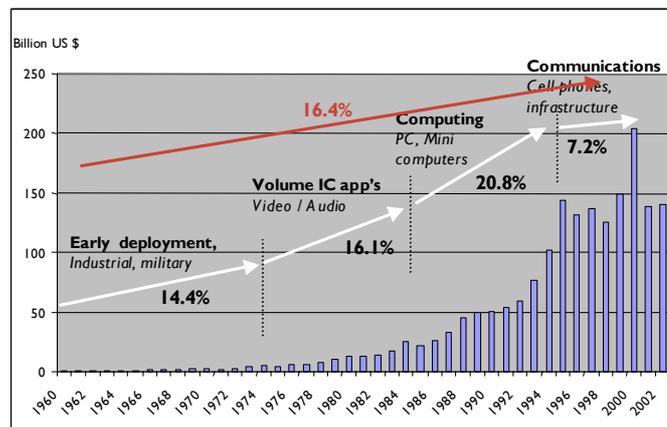


Fig. 2.

5. Which skills are needed to anticipate this future ?

The demand for skills in Europe will change with the trends in the markets and the related technologies used. In spite of the good attempts of Career Space to standardise many ICT job-profiles we have to anticipate new changes.

This is a challenge for all forces in the European ICT arena: The Universities, other training & education institutes, the industrial parties, the SME’s, the governments on

European level and also in countries and regions. To give another example of the changes see fig. 3. for the so-called "infotainment" chain.

Vision

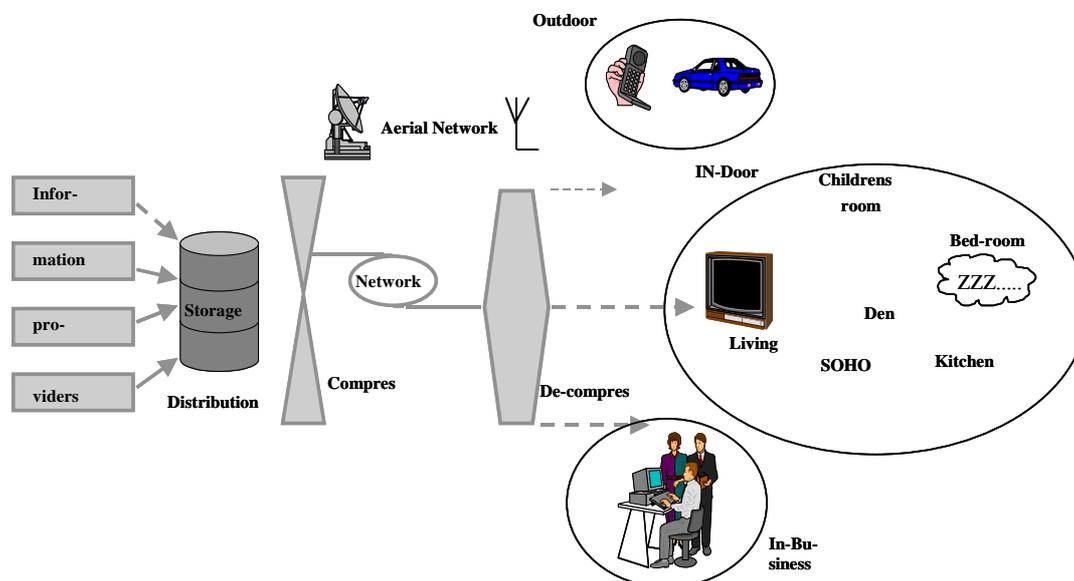


Fig. 3.

The left part represents the content generation, creation, design. Here we need new skills for new creative content but with interaction, with the end-user, in mind. ICT knowledge will be needed there. The storage, coding, and e.g. rights-management part is the next part of the chain and also here a new set of skills is needed. Even in the communication part of the chain the need for new skills is high as new technologies will be combined with new opportunities for content delivery. The waves curves have already indicated that the end-user will use the delivered content with all kinds of new, increasingly converging, devices. The development of these devices requires e.g. skills for high-level architecture design and system integration with knowledge of all technologies in the chain.

The supply and demand of new content and services will increase over the next decades and this is quite an area of opportunity for Europe. This industry needs a lot of new skills combining creative as well as and technical and commercial skills.

6. Results required and actions needed

1. The industry should increase its effort to deliver better trends analysis in their markets, the needed technologies as well as skills required. It needs an effective "platform" to communicate these trends and the derived conclusions and actions.
2. It needs a much better communication (e.g. a special platform) to discuss the consequences of the trends for the curricula of the universities and higher-level BSc types of schools. It needs a solid partnership for this translation of trends towards training programs and curricula. The creativity and professional intelligence of the parties need to be mobilised with a different, more advanced, dimension as we see today.

3. The continuous development and adjustment of job-profiles is needed to show new entrants the way they can develop a career and plan their education program.
4. Promotion: The ICT industry has obviously some communication- and, above all, image- problems. The whole European ICT should take these challenges and find new ways to show the opportunities in this industrial area to people entering their educational phases.
5. The ICT industry in Europe, universities and governments need to co-operate in a more positive way. It is urgent that they be more open and flexible towards each other and share common goals. Also be creative in the stimulation of new enterprises, help start-up to become successful.

7. Conclusions, Recommendations

The location of R & D facilities in Europe will depend on the availability of skills, working capital and facilities. Still the competition between parts of our world and countries play a role and industrial companies have to act according to these economic forces in order to survive. Governments can influence the competitive forces and need to take their responsibilities as well by being anticipative and communicate with the industry in its most broad sense.

The Career Space consortium is well aware of the future needs and ways to develop this future. It needs however a strong co-operation between governments, educational institutes (universities etc.) and industry in its broadest sense.

8. References

For more information about CAREER-SPACE visit: <http://www.career-space.com>

European ICT skills and training needs on sub-degree and vocational levels

Burkart SELLIN

*Cedefop, Europe 123, GR-57500 Thessaloniki
Principal Administrator and Project Manager
Email: bs@cedefop.eu.int*

This paper is stressing the need to further develop provision for ICT training on non-university and vocational level in Europe, makes proposals on which skill profiles to concentrate at and underlines the need to further work in view of proposing coherent frameworks for ICT qualifications and skills. The activity is closely linked to EU's priorities set for the deadline 2010 both in terms of economic and social policies, employment and education/training policies. ICT skill and training development has to be integrated into these overarching scenarios and strategies.

1. Introduction

The providers of Vocational Educational Training (VET) in all Member States and Forthcoming Member States need to be further advised concerning the prospective quantitative and qualitative skill requirements of the industry (both the ICT-industries and user industries) on European and International level:

- in view of their curriculum development and for setting clear and sustainable training standards and objectives;
- in view of the establishment of a transparent structure of qualifications levels frameworks, especially in this dynamic sector but also in main user industries;
- and last but not least in view of a more general certification, assessment and accreditation method recognisable if possible also for the whole sector or (user-) industry as well as on a trans-national, European and/or International level.

The European ICT industry and stakeholders work towards a certain and flexible systematisation of standards of skills in order to allow for a more sustainable training policy both inside and outside companies, public and private. Cedefop and the European Commission want to promote such a development and the study referred to below is supporting this.

This contribution is based on former and current work of the Commission and Cedefop undertaken in partnership since 2002, and is related to current activities which can be consulted at the Virtual Communities set up by Cedefop since the beginning of 2003¹².

2. A clear focus for the next phase of work of Career Space, CEN/ISSS and Cedefop's activity

The next phase of work within the Careers Space consortium in co-operation with key players from the industry (employers' and employees' representatives) training providers and from non-governmental European associations will in close connection with Cedefop, CEPIS and CEN/ISSS concentrate on

- outstanding profiles and levels of skills and competencies not covered so far concentrating notably on sub-degree and vocational level skills (basic and applied skills) as well as
- profiles in relation to an application of ICT skills and e-Business skills in certain user industries (automotive, banking and financial services, graphic and media).

The recent development has shown a certain merger between skill and training profiles for Information Technologies on the one hand and Communication Technologies on the other. Former and more traditional electricity and electronic skill profiles were changing orientation and became separate or part of ICT profiles.

Once the debate on profiles is concluded will be studied later in more depth i. training solutions and curricula for the respective profiles with a special focus on SME's and the user industries applications and finally ii. mechanisms and arrangements for certification, assessment and accreditation at all these levels, which include both Initial VET (IVET) and Continuing VET (CVET), formal training and non-formal job experience incl. self-organised learning and an as wide recognition as possible in occupational and geographical mobility terms.

Time has come for a more coherent systematisation and training provision of skills and competences in line with demand of both industry and individual learners

The ICT labour market for non-university skilled and highly skilled staff was initially characterized by a dominance of non-formal training on-the-job on the basis of some and (from the specific occupational area) different kind of former training for instance on skilled workers' or technician level. The respective employees' training was mainly based on skilled workers or technician training in fields of the following occupational areas: engineering, electricity/electronics, printing and machine-tool operations, publishing and banking etc. It thus exists a huge part of employees (males and females) which were and are not systematically trained for these new jobs in neither the area of ICT nor e-Business. However, they performed and do perform well and access relevant skills in the area and in new fields often not covered by any formal (public or private) education/training provision. A huge amount of commercial, private and public CVET-

¹² See more especially the work in the respective technical working group set up by the Commission in 2002 on Credit transfer and the respective Cedefop virtual communities:
<http://cedefop.communityzero.com> on esF and CEN-ICT

provision is actually developing, which do, however, lack in coherence and transparency and often also in sustainable quality. In some Member States the situation already changed. In many others and more especially in the forthcoming Member States the provision is still lagging behind, both in quantitative and in qualitative terms. University level training being rather well developed everywhere, the non-university and vocational level training is only in a few countries sufficient in Europe.

The time has come to establish a certain systematisation and to enable a certain degree of professionalisation of these profiles, based on a coherent approach to respective qualifications and skills as well as on high quality training provision (initial and continuing). At present, many of these qualifications and skills are company or industry-specific and cannot easily be transferred to other fields and areas. Often non-formal competences and skills predominate, which were never properly assessed and validated. It is thus difficult for the respective holders of qualifications to use these for both occupational and geographical mobility and for enabling access to higher levels of education and training or to professional level skills. Companies and staff managers have difficulties to validate the respective skills and qualifications presented and to develop a proper staff policy based on coherent careers and transparent criteria. The transferability of skills is limited because of a lack in coherence of provision, validation and accreditation of these competences on the one hand, but also because of a certain „Wildwuchs“¹³ of job profiles and applications which developed rather ad hoc and very company-specific without much effort to systematisation.

3. Overarching objectives and features of the linked Cedefop activity

The work wants to contribute

- to the outcomes of deliberations of the eSkills Forum set up by to the Commission in spring 2003 which primarily is studying the development of supply and demand in ICT skills and respective scenarios for actions and measures in the forthcoming years;
- to the next years 2nd eSkills International Conference or Summit to be organised by the Commission in partnership with Cedefop;
- to help the Member States to establish sustainable skill standards and structures including training provisions in this field also on lower levels of educational attainment (ISCED levels 3 and 4);
- to ensure high quality and attractiveness within the ICT- and/or within selected user industries for both companies and participants of such public or private training provision, irrespective of the location, origin and individual characteristics,
- to the collection of good practice training solutions focussing at needs of SME's, disadvantaged regions and target groups.

Overarching features of such a strategy are to make training provisions available for access of all kind of target groups, companies and regions independent of their economic, sectorial, personal, social, gender or geographical background; which thus do from the outset include so-called disadvantaged groups, e.g. foreign workers, ethnic minorities and disabled people, young and older people; people with higher or lower

¹³ 'wild' growth of jobs and profiles, occupations and tasks or activities

formal education and people within employment or unemployed people. The industry in close co-operation with providers at all these levels and especially at local or regional levels is increasingly engaging itself in public-private partnerships within these communities in order to contribute to the up-grading of skills and competencies in the light of the new challenges linked inter alia to the demographic development prevailing in Europe.

The increasing impact of ICT products (and their increasing use) on the economic, social and cultural environment is underlining the urgent necessity to do the utmost to improving and widening the training of ICT practitioners at all levels of skill and to develop their competencies: not only the technical ones but also the soft skills, communication and language skills or personal skills.

The further development of Lifelong Learning (LLL) provision and the validation and accreditation of prior non-formal and informal learning should also be taken into account (see the Commission Action Plan on LLL and the recent framework for actions on competences and qualifications linked with LLL by the UNICE and ETUC as well as the Commission's skills and mobility action plan from late 2002).

The recognised needs to increase competitiveness (especially from SME's in remote regions) and to contribute to the creation of new employment should be anticipated by a comprehensive strategy to up-grading of skills with the assistance of the ICT-industry and main user-industries. Their advise and co-operation to this overall goal, which is repeatedly mentioned by policy makers at all levels and by European level social partners, should be taken into account by the practitioners committed in this work (see the statements made during the June 2001 social partner's conference on ICT skills shortages organised by ETNO and UNI-Europa-Telecom in Brussels). To combat social exclusion and the so-called digital divide is an important issue for Education and Training as well as Employment policies especially in the ICT area. The goals set for Europe 2010 in Lisbon and Barcelona and confirmed by a comprehensive set of education and training objectives and targets confirmed by resolutions approved under the Danish presidency in late 2002 can only be reached if more and more convincing efforts are being undertaken by the industry, by public authorities and policy makers at all levels of intervention.

4. Towards transparent skill and competence profiles and qualification level frameworks at non-university and vocational level for the ICT-industry

Recent studies of Cedefop on „European structures of training levels“¹⁴ and the proposal of the Commission for a directive on recognition of qualifications as well as the Commission action plan to promote mobility and skills, which was accepted by the Barcelona Council Meeting at the beginning of March all do underline the necessity to work towards a transparent structure of qualifications in Europe.¹⁵ Four levels are being distinguished in the forthcoming directive, which was retained as a reference framework and as a means to look more closely at the ICT-sector's situation in each country and to

¹⁴ based on a review of approaches in five Member states: Germany, France, The Netherlands, Spain and the UK

¹⁵ A new activity of the OECD is also looking at this issue of national qualification systems and levels linked to LLL development at the wider International level in which Cedefop is involved

verify whether similar levels could be accepted as a meta-structure for clustering (and classifying) skills and competencies at the respective levels based on outcomes and kinds of certification. A specific expertise on behalf of Cedefop addressed this issue and its findings are being presented below. These are very important indeed and may be used as further guidelines and orientation for the supply and delivery of ICT-and e-Business skills in Europe notably on sub-degree levels.

A major study undertaken by the University of Flensburg (Germany) in co-operation with a number of other researchers in several European countries on behalf of Cedefop in 2002 and in early 2003 is delivering some important quantitative and qualitative elements linked to current and future provision of skills and training and made proposals for further analysis and future policies.¹⁶ The following parts of this contribution are based on these findings and working hypotheses.¹⁷

The concrete relation concerning degree level skills and training and sub-degree level of training depends on the respective country's approach to IVET and CVET as well as to staff recruitment and career policies of the ICT sector and neighbouring branches e.g. metal, electricity, banking and financing. For example the relation between the ICT employment at degree and sub-degree levels in Germany is 50% to 50%, in the Netherlands 60% to 40% and in Portugal 70% to 30%. The figure below indicates the relative allocation of the ICT employment and demand at degree and sub-degree levels for Europe.

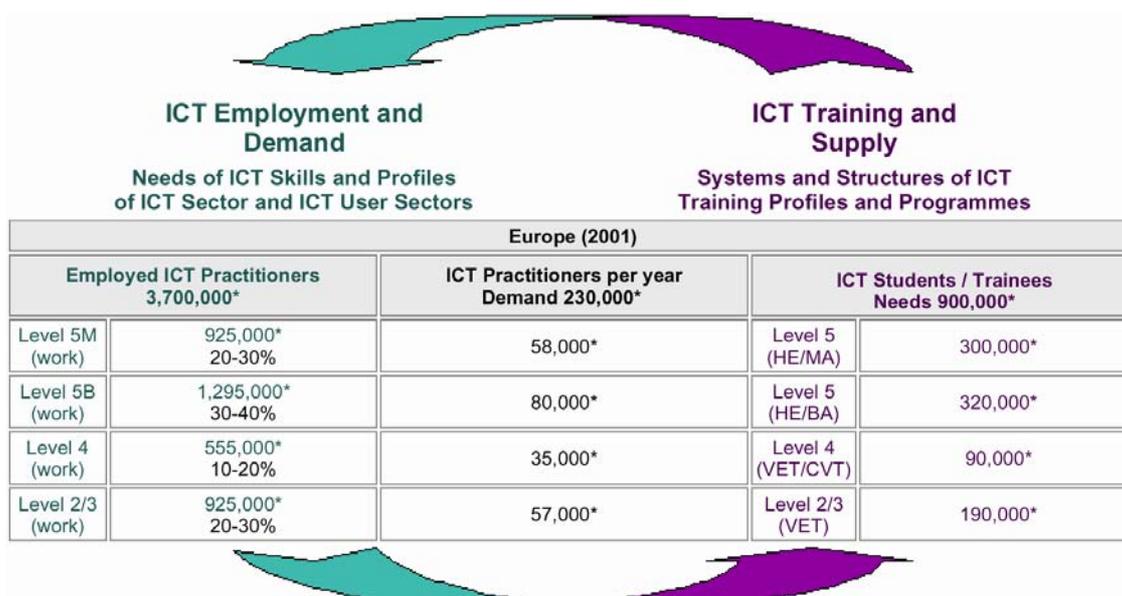


Fig. 1: ICT skills employment and demand at different levels and in relation to the ICT Students / Trainees needed in Europe (cf. CEPIS 2002; *biat 2001; EUQuaSIT 2002)¹⁸

However, we do not really know how many ICT students and trainees we have in total or at each level today in Europe and therefore realistic numbers of the supply of ICT practitioners are not available. The figure shows according to the presumed demand per year only the estimated number of students and trainees needed at each qualification level. For instance and with consideration of an average duration of ICT programmes

¹⁶ Cedefop (forthcoming): "ICT skills and training, non-university and vocational level", authors: W.A. Petersen, W.A. and Carsten Wehmeyer, Biat University of Flensburg

¹⁷ These findings have not been verified in detail by Cedefop or the European Commission and any policy proposals are being forwarded by the author/presenter in his own and personal capacity

¹⁸ Level 5: professional (Higher) ; Level 4: applied or associate professional (Intermediate); Level 2/3: skilled (Basic)

and trainings and also a drop out rate there is a total estimated need of 900,000 ICT students and trainees in Europe. As regards these needs and as we know for most European countries, app. five years ago the numbers of supplied skilled ICT practitioners was much too low. We do also know that due to the increased demand of ICT practitioners in recent years the numbers of ICT students and trainees has substantially increased in the most European countries and seen the recent slow-down of the industry tended to bypass the demand over-estimated by the time.

Current company surveys, however, indicate that the situation of the ICT labour market in Europe is actually not too bad and the supply of ICT practitioners is estimated by the companies as being "fair".

Conclusion:

Despite the slow-down in economic growth of the sector and the current employment situation results of company surveys in Europe do indicate that:

- **the demand of ICT practitioners is in quantitative terms being met by the supply,**
- **the number of ICT students and trainees is possibly sufficient in order to improve the balance on the ICT labour market and**
- **certain gaps in the supply of ICT practitioners are still recognisable notably at degree level 5 and at sub-degree level 4.**

5. ICT work and skill needs at different sub-degree levels and a structure proposed for "Generic ICT skills profiles" on sub-degree and vocational level

More qualitative results of the industry's needs of ICT skills and practitioners in Europe are based on investigations and analyses in form of case studies in the ICT- and in certain user industries, e.g. in small, medium-sized and large enterprises (SMLE's). The results show on the one hand that the broad ICT business area in Europe and therefore the ICT work and skills differ in structures and contents depending on the specific sub-sector and the core and main ICT business of a company. On the other hand the findings of the case studies allow step to abstract all ICT business processes and to draw up a list of relevant ICT business and technology (sub-)areas, e.g. Information Systems Applications and Services (IT); Communications Systems, Applications and Services (CT); Internet and Intranet Systems and Applications; Networks Systems and Solutions; Multimedia Systems and Applications etc. (see the list below).

In a second step and especially linked to workflow structures of the ICT Work Processes and related work organisation show similarities which allow to aggregate and conclude the different structures of ICT Work to one structure of six generic ICT work areas. These six ICT work areas represent the different contents and structures of ICT Work for SMLEs in ICT and ICT user sectors in a generic form. The contents and structure of these six ICT work areas depend on each real ICT business process and do allow to show in detail a cross link to one of the different business and technology areas respectively.

The results of the authors ICT work analysis thus indicate that in each ICT work area there are ICT practitioners at all level involved and in each ICT work area for instance

in the work area "ICT Systems and Application Development" therefore do exist needs of ICT skills at both degree (L5) and sub-degree levels (L4, L2/3). For the ICT skill needs in general the case studies indicate that the ICT industry's qualitative work requirements and quantitative skill needs are currently covered by different ICT job profiles depending on the company and on different European ICT training profiles.

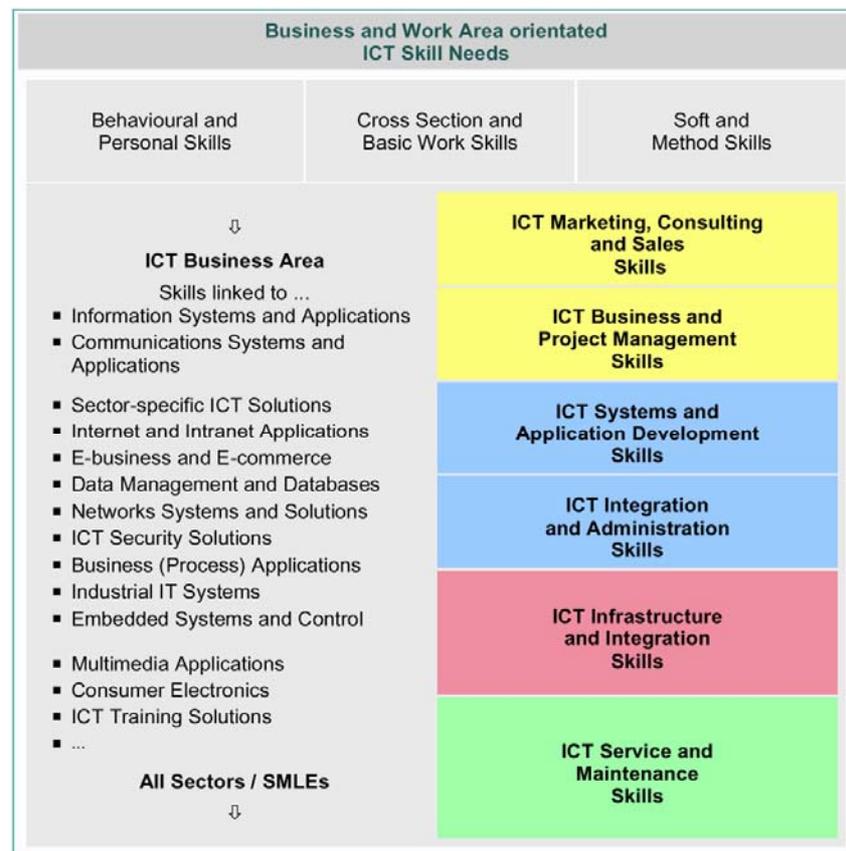


Fig.2: Structure of generic ICT business and work area orientated ICT skill needs

The case studies allow to link to each ICT work a summarised structure of typical fields of activity and to each field a more specific business and technical job roles covering a certain number of generic ICT skill profiles which are the broad empirical fundament for a framework of ICT skills and training. According to the brief the investigations concentrated especially on the fields of activity at ICT sub-degree and vocational levels.

In this assignment the results show in each ICT work area the structures and contents of ICT skill needs at sub-degree levels. In combining these results with results obtained by company surveys in view of the current ICT skills and training profiles based on the European questioning the industry's ICT skill needs they can be aggregated and linked to a structure of 14 "Generic ICT skills profiles" at two or three sub-degree levels¹⁹:

¹⁹ The so-called level one based on a simple insertion and short work experience was regarded by the authors as not relevant to the ICT sector

Level 2/3 (L2/3) ²⁰	Level 4 (L4)
- ICT Business Assistant or Technician	- ICT Commerce Specialist
- Informatics Assistant or Technician	- ICT Business Specialist
- ICT Systems Assistant or Technician	- Informatics Specialist
- ICT Service Assistant or Technician	- ICT Administration Specialist
	- ICT Systems Specialist
	- ICT Service Specialist

Fig. 3: Structure of "Generic ICT skills profiles" at sub-degree levels

Each of these generic ICT skills profiles represents in detail the skill needs at the specific sub-degree level and according to the ICT work areas and specific tasks. The skills profile "Informatics Technician" (L3) is shown in its structure in the picture below. Primary part is the work area orientated "skills kernel" associated with the "Fields of Activity" and "generic ICT Work Tasks" and the various business and technology areas in which the work tasks concretely take place. Furthermore, a set of complementary basic skills like the behavioural and personal skills is also needed, depending on the concrete work tasks and the skill level. Eventually in the ICT business area all work areas are related to each other and ICT practitioners need some fundamental skills of the entire ICT business area. Therefore an ICT skills profile covers also cross work area ICT skills expressed by the other three groups of generic ICT work areas. Detailed examples of the generic work area orientated ICT skills profile are described in the report for all work areas at sub-degree levels.

The division between sub-degree levels could thus be limited to two levels (3 and 4), e.g.

- basic and/or specialist skilled workers or technicians and
- applied or associate professionals.

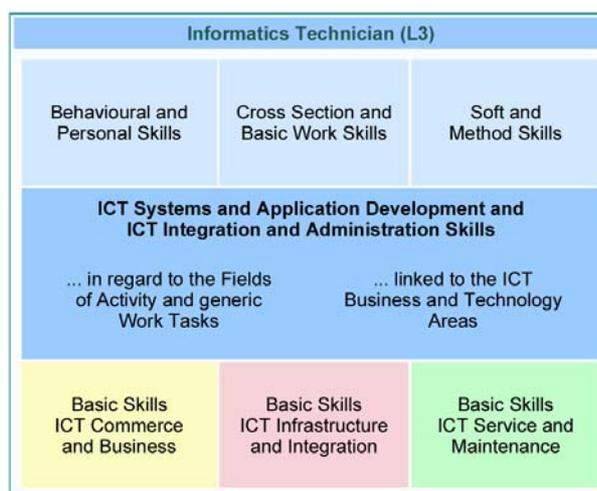


Fig. 4: Generic ICT skills profile "Informatics Assistant/Technician" at sub-degree level 2/3

²⁰ If in the respective country or segment of the industry a division is being made between technicians (Level 3) and Assistants (level 2) these could be subdivided respectively. In this case we would have 14 generic profiles; if levels 2 and 3 are not separate we would only have 10 profiles. It seems the trend is going into the direction of merging assistant and technician levels at least in the ICT industry and on the job. The training levels may be different at entry at least, after certain while these frontiers are blurring.

These skill profiles and the above presented analysis are currently being discussed and will be further developed by both the European Commission's eSkills Forum and the CEN/ISSS ICT workshop sponsored by Cedefop and CEPIS in close linkage to the Career Space Consortium current and further work on ICT generic skill profiles.

6. Generic ICT training profiles are being proposed by German experts as a fundament for a European wide framework at sub-degree and vocational levels

Such a connection of skill and training profiles or curriculum is related to the European ICT Industries' (Career Space's) Generic skills profiles²¹ and is enabled, because the work and training levels are based on a comparable level structure. Like the skills profiles the number and structure of these new fourteen European "Generic ICT training profiles" are designed in reference to the structure of the skill needs and contents of the ICT work areas and not primarily linked to a specific sector, technology or business area. That means the profile numbers at each sub-degree level and the content and competence delimitations of each ICT training profile is oriented

- to one or two work areas and a sample of typical work tasks and job roles;
- to the concrete business and technology areas while respecting their company specific and company cultural (internal) diversity.

ICT Business Area	ICT Work Area	VET recommendation: Generic Work Area orientated ICT Training Profiles				
		L2	L3	L4	L5B	L5M
ICT Business Area Information and Communications Technology (ICT) All Sectors / SMLEs	ICT Marketing, Consulting and Sales (A)			ICT Commerce Specialist		
	ICT Business and Project Management (B)	ICT Business Assistant	ICT Business Technician	ICT Business Specialist	e.g. ICT Marketing Management (CS*)	
	ICT Systems and Application Development (C)			Informatics Specialist		
	ICT Integration and Administration (D)	Informatics Assistant	Informatics Technician	ICT Administration Specialist	e.g. Software Architecture and Design (CS*)	
	ICT Infrastructure and Integration (E)	ICT Systems Assistant	ICT Systems Technician	ICT Systems Specialist	e.g. Communications Network Design (CS*)	
	ICT Service and Maintenance (F)	ICT Service Assistant	ICT Service Technician	ICT Service Specialist	e.g. Technical Support (CS*)	
ICT Business Area	ICT Work Area	VET recommendation: Generic Work Area orientated ICT Training Profiles				
		L2	L3	L4	L5B	L5M

Fig. 5: Structure of the fourteen "Generic ICT training profiles" at sub-degree and vocational levels (* taking into account the 18 Career Space Generic ICT skills profiles currently being updated and completed by CEN/ISSS Brussels)

²¹ See www.career-space.com, profiles from 2001 available in five languages also as brochures, published by Cedefop in 2001 and 2002

7. Main questions in view of a discussion

1. Is this framework a thorough basis for further work in relation to European and wider International level analysis of skills and related training solutions?
2. The clustering of skills is it adequate and the level of detail is this sufficient ?
3. Do exist in other countries or world regions other or parallel developments on which to draw lessons for issues linked to (international) standardisation and/or classification of ICT skills and training?

8. Invitation to actively participating

All workshop participants are invited to consult the homepages indicated and notably the respective Virtual Communities set up by Cedefop: These are open fora and no closed shop! Please login and let us know your own experience, participate in exchanges of knowledge and know-how in order to improve Europe's and wider International approaches to questions linked to IT Skills and Training issues.

9. For further search:

<http://cedefop.communityzero.com>

www.cedefop.eu.int

www.trainingvillage.gr

www.career-space.com

www.e-skills-summit.org

www.euquasit.net

www.biat.uni-flensburg.de/ict

EPICS - market validation for pan-European Certification of Informatics Professionals

Stig ARFF¹, Peter WEISS²

¹DND Den Norske Dataforening, PO BOX 8874, 00280520, YOUNGSTORGET, NORWAY

Tel: +47 9180 3932, Fax: +47 22 86 7601, Email: arff@online.no

²AIFB Institute of Applied Informatics and Formal Description Methods,

University of Karlsruhe, Englerstrasse 11, D-76128 Karlsruhe, Germany

Tel: +49 721 608 4556, Fax: +49 721 608-6582, Email: weiss@aifb.uni-karlsruhe.de

EPICS sets out to address the current and anticipated skills gaps in Europe. Recent surveys, which take into account the current economic downturn, estimate the shortage to be linked to more than 500,000 jobs. EPICS will provide a range of services to assist in raising the skill level of existing IT professionals and to also provide an attractive means of entry into IT profession. It will do this by providing a set of services including information about courses, diagnostic testing of current abilities, certification of skill levels attained and access to educational material about state of the art technological developments.

1. Introduction

EPICS is developed to create a trans-European certification standard for informatics professionals with an associated services network. EPICS will lead to the provision of education and training utilizing web based delivery. EPICS services are particularly suited to the needs of practitioners and also for people working in distance learning schemes, e.g. through their employer. EPICS syllabi have been validated by acknowledged training providers and higher-level colleges. A central part of the services is automated testing of the skills and knowledge acquired. EPICS will set up a quality assurance scheme to ensure that the certification process is valid and consistent throughout Europe. Through the CEPIS member societies EPICS will have easy access to the national markets, i.e. to learning providers and students. The physical content of the services will be delivered through local learning providers and test centres and will be supported by the local informatics societies. The services will, in general, be in English or the local language. The project will set up an accreditation scheme within which local service suppliers can be accredited to participate in the EPICS network.

2. The EPICS project

EPICS has been conceived and developed by CEPIS [1] (the Council of European Professional Informatics Societies). It is an initiative which naturally builds on the success of the ECDL [2] project.

The European Commission is supporting the commercialisation of EPICS [3], through the eTEN programme. The market validation part of the project was launched in October 2002 and will be completed end of this year. The project will likely apply for funding from eTEN for the market deployment, scheduled to begin full scale beginning of 2004. The countries involved in the market validation project are Germany, Greece, Ireland, Italy, United Kingdom, and Norway, each represented as a project partner by their member societies. FZI (Research Centre for Information Technologies) in Germany is the project secretariat and co-ordinating body.

3. Motivation

The motivation for EPICS is the so-called ICT skills gap [6], underlined by the following statements:

- The skills gap has cost US\$106 billion in lost gross domestic product [in the EU] since 1998 and will continue to do so in the absence of skills. (ILO, December 2000).
- Failure to tackle the growing IT skills bottleneck could derail the European Union's declared goal of turning Europe into a world class competitive, dynamic and inclusive knowledge economy (EU minister meeting, Sweden, February 2001).

The skills bottleneck may be broken down into to parts, a *skills gap* and *skills shortage*:

- **Skill shortages** are defined as being where an employer is unable to recruit new suitably skilled people to fill a business need
- **Skills gaps** refer to skills which existing employees do not possess and which consequently can hamper business productivity and growth

Recent studies [4] have estimated that the recent economic downturn has led to a 50% reduction of the total skills gap. It is believed that this reduction is mainly a reduced *skills shortage*, whereas the *skills gap* is largely unaffected. Thus the need for EPICS is still there and will in fact increase as the macroeconomic conditions become more favourable. Therefore vocational qualification is seen as a crucial investment for public and governmental bodies across Europe.

4. Reference scenarios

To illustrate the need for a scheme such as EPICS, we present 3 scenarios which illustrate how certification within EPICS' three knowledge areas ("Plan", "Build" and "Operate" - presented later in this paper) can contribute to developing skills needs in the marketplace:

- Scenario 1: An experienced computer programmer who has the ambition to develop his career in the informatics arena. Currently it is very difficult for such a person to progress gradually up the ladder to full professional qualification in the IT area. The introduction of EPICS will offer a seamless roadmap, which can be followed leading to whatever level of professional competence is desired and will provide a bridge to entrance into full professional education.
- Scenario 2: A practitioner having worked in another specialised area needs to understand and manage IT projects in his/her company or institute. This person can pursue the appropriate stream of EPICS and will thus acquire the knowledge and skill necessary to perform required tasks and to carry out the IT work effectively in his/her business. The certification within the EPICS framework presents an important prerequisite to take over such job responsibility.
- Scenario 3: A self-educated IT practitioner having worked successfully in areas where a degree would have been expected. This situation arises very largely from the fact that the demand for IT labour in industry has outpaced the delivery possibilities of the public education. Such a person will get the opportunity to receive a recognised degree as IT professional and improve the prospects for employment.

5. Industrial relevance

The industrial relevance of EPICS is related to both the supply-side and demand-side for EPICS certification:

The user industry is experiencing that those current job roles for informatics professionals are not formally addressed to sufficient degree in the established educational systems. For example, network administrators are increasingly being educated by IT vendors such as Cisco or Novell. These professionals receive a vendor-specific certification, but this is most often not recognised or given credit in the "official" educational system. In addition, the ICT skills requirements are constantly changing, and there is a need for a scheme which is sufficiently dynamic to address the technology's pace of change. EPICS will offer the user-industry a proven norm when evaluating existing employees and recruiting new employees within ICT.

Learning providers have in initial surveys, done by the EPICS project, expressed the need to close a "certification gap", i.e. the need for a recognised intermediate level for informatics professionals (often called the "practitioner" level, since it addresses real-life industrial needs). EPICS will offer the learning providers an accepted scheme within which to offer this education, increasing the quality and

market value of their products. An important success factor in EPICS is that the scheme is also accepted by the higher educational institutions, where EPICS certification is given credit, e.g. through the ECTS [5].

The major IT-industry players are offering practical courses within their product portfolio. EPICS will seek to integrate these offerings within the elective level, so called because candidates may choose to combine vendor- and non-vendor specific learning schemes. This should serve as a vehicle and incentive for IT-industry to seek adaptation of learning schemes to user-industry needs. Thus, for example, courses in database management could be done in collaboration with user industry, to address real life cases.

6. Objectives

EPICS will stimulate the commercial deployment of multilingual, interactive and multimedia educational and training tools and services across the EU through the provision of a de-facto standard accepted by the market place. The main objectives may be summarized as follows:

- To define an industry-driven vocational structure and standard for the IT profession
- To establish a sustainable European services network for IT competence development
- To contribute to closing minimum 10% of the European skills gap (120,000 EPICS graduates minimum by 2006)
- To offer a vehicle for Life-Long Learning and competency enhancement for the IT profession

7. IT Practitioner skills

The structure of ICT skills needs has changed during the last decade as ICT standards have emerged (both formal and de-facto standards), and there has been an ever-increasing maturity and consolidation in the IT-market. This applies not only to technology, but also to how the technology is deployed and maintained. Thus a new set of skills have emerged, “practitioner skills”, which address the usage of these standards in business environments. As mentioned previously, today there is a gap in the educational market where these informatics skills are not consistently addressed. The educational supply and maintenance is no longer a simple “linear” one, i.e. with a straightforward career path from IT specialisation within education, an IT degree and a career as an IT professional.

8. Need for European-wide standardized qualifications

One of the significant strengths of EPICS is the pan-European aspect of the certification. It provides EPICS candidates with a standardized qualification scheme and job flexibility throughout Europe. The table below describes some of the commercially defined certification standards in the marketplace.

Certification Scheme	Description	Comments
Vendor Certification Schemes; Microsoft, Cisco, Novell etc.	These schemes are very popular and provide skills and knowledge about specific vendor products	Very narrow focus, which is entirely dependent on the products of the particular vendor.
Career-Space	This is an excellent project which involves a solid industry consortium and other public/private partners. The project is supported by the EC and receives EU funding. CEPIS is a full member.	This has the main focus on the needs of the ICT industry itself and is also primarily concerned with developing qualifications at the University Level.
UK certifications such as NCC, City and Guilds and Cambridge Certifications	These schemes are widely used in the UK and throughout the English speaking parts of the World.	The schemes are not generally available in languages other than English and in some cases have not been kept as up to date as the market requires.
US Certifications such as A+	The A+ certification is available in US, UK, Ireland and South Africa	The certification sets out to provide a global standard. It is however mainly focused on hardware and does not provide a broad view of the ICT syllabus.

Table 1 Certification Overview and Comments

The table above illustrates that most IT-certifications are vendor-specific. This may cause problems in the flexibility and adaptation of these certifications, e.g. when an employee changes place of work where another technology is deployed. EPICS offers an integrated approach, where the breadth and usability of skills is attained, while at the same time allowing for vendor-specific (technology-specific) competence.

9. ICT vocational structure

EPICS addresses the need for ICT practitioner skills in the public and private sector. EPICS must therefore begin with describing what these needs are. This is done in the form of a vocational structure, which is a taxonomy of concrete ICT-related positions and what the competency requirements to these positions typically are. The vocational structure must link the individual positions to concrete requirements regarding knowledge areas in the core level, and within the elective levels, as described below. This will often be in the form of a curriculum, describing how modules may be combined to fulfil defined vocational requirements. For example, a network administrator position will require a number of modules within the “Use” knowledge area.

10. Results

10.1 Certification framework

The EPICS skills framework (see figure 1) consists of three knowledge areas: “Plan”, “Build” and “Operate”.

The “Plan” knowledge area. This knowledge area addresses the analysis of ICT needs and planning the usage of ICT. The knowledge area is closely linked to business processes and defining ICT needs in terms of business strategies. Traditional business elements such as return on investment, risk and financing are important elements of the knowledge area.

The “Build” knowledge area. This knowledge area encompasses the specification, development and acquisition of ICT. The crux of the knowledge area is traditional technical aspects of systems development, implementation, integration and the ICT life cycle in general.

The “Operate” knowledge area. The “Operate” knowledge area addresses instalment, supervision and maintenance of ICT. Typical domains are network management, upgrading, support functions etc.

There are two knowledge levels: 1) the core level and 2) the elective level:

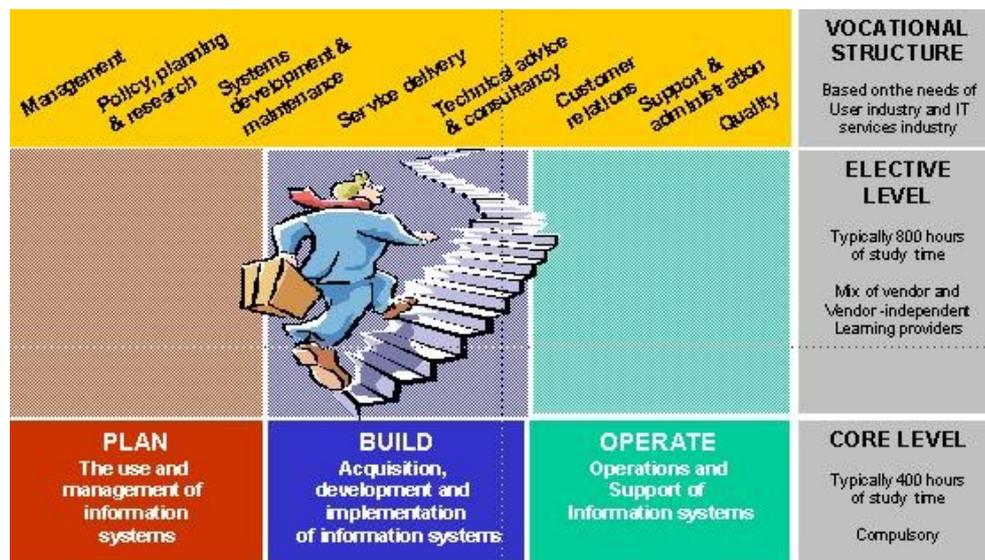


Figure 1 The EPICS Framework

1) The core level defines the minimum ICT knowledge core that is presumed necessary in order to be an ICT-practitioner. It is not sufficient to practice an IT-vocation but serves as a basis for all types of ICT-related work. The core level is compulsory and must be completed before moving to the next level. It encompasses 400 study hours, i.e. total hours spent including face-to-face tuition, self-study etc. Candidates are awarded a core level certificate upon successful completion of the level. They may take the tests even without taking courses before. The three knowledge areas are given approximately equal weight at the core level.

2) At the elective level students may choose a combination of modules corresponding to different knowledge areas. The combinations may consist of both vendor and vendor-independent modules (courses). The total number of study hours for the elective level is 800 hours. The combination of elective courses will correspond to recommended curricula, leading to defined ICT vocational categories, e.g. network administrator or project manager. EPICS is currently developing syllabi for market-leading ICT vocations using existing schemes as a baseline.

10.2 Product constituents

The overall EPICS product consists of three overall constituents:

1. **Framework.** The framework encompasses the content side of EPICS, consisting of a syllabus, a certification scheme and a vocational roadmap (e.g. career paths through the syllabus in order to become a data administrator).
2. **Competency services.** The main service is an automated testing service, aimed both at the end user and the learning providers. Additional services include educational and vocational guidance, learning tools and a collaborate network of several thousand learning providers. Services will be implemented utilising web based delivery.
3. **Distribution & delivery mechanism.** EPICS will need a physical distribution mechanism in order to offer learning provision (e.g. courses at tertiary level schools) and certification. The distributors will co-operate and collaborate in a web-based partner network, which forms the backbone of quality assurance and continuous product development. This mechanism is not operable but will be searched, tested and established during the market validation phase.

10.3 Technology

The core technical implementation of EPICS is based on commercially and proven available testing and learning management systems (LMS). The main technical components of this core service are:

- 1) A Question and Test Base (QTB) which contains the relevant questions and tests to ensure that the candidate has achieved the required knowledge or skill level to pass the test. The QTB is a core asset in EPICS.
- 2) A Test Engine to ensure that the tests can be carried out in a transparent manner without any individual or cultural bias. The testing process used is planned to be automated using software which is currently available in the marketplace.
- 3) An administrative system for entry and maintenance of information related to learning providers, candidates, test results etc.

An automated test system for most of the EPICS testing needs is deemed critical in order to achieve efficiency and the necessary economy of scale.

11. Business Benefits

In a nutshell, EPICS offers a unique and open set of services and a portal to a community of users which alleviates re-education and competence enhancement for the ICT profession. The business benefits are related to the increased performance of ICT professionals (practitioners), and ultimately to the return on ICT-investments in industry and society.

In addition, EPICS will lead to more efficient education, where EPICS candidates are offered a sustainable scheme to keep their skills updated, “as needed”. For the employer this means shorter lead times for increased productivity of their employees. Learning providers will be more closely aligned with industry needs, and increase the market value of their offerings.

Finally, EPICS will create a more efficient ICT professionals market in Europe, where an accepted competency norm allows for greater flexibility between different skills-sets and geographical markets.

12. Conclusions and recommendations

We have presented a scheme for developing and introducing a pan-European standard for the certification of informatics professionals at the practitioner (intermediate) level. The standard is implemented with an associated services network encompassing the IT-industry, learning providers and user industry.

We believe a scheme such as EPICS is necessary in order to meet the current and future skills needs in the industry and public sector, thus influencing the overall competitiveness and productivity of our economies positively.

The future efforts of EPICS will be dedicated to rolling out the services through the market access given by the CEPIS member societies, and to develop the job roles with associated syllabi and curricula at the elective level.

Throughout the EPICS endeavour, the project will seek to utilize and incorporate job-role and certification schemes that have been developed in the public domain, both nationally and at the European level.

13. References

- [1] For more information on CEPIS visit: <http://www.cepis.org>
- [2] For more information on ECDL visit: <http://www.ecdl.com>
- [3] For more information on EPICS visit: <http://www.cepis-epics.org>.
- [4] Studies by IDC and ITAA
- [5] European Credit Transfer System
- [6] European Information Technology Observatory (EITO) 2002 report

DynamITe

Dynamic ICT-training of SMEs

Finn KRISTENSEN

Inter-service ApS, Hillerupvej 39, 6760 Ribe, Denmark
Tel: +45 75 42 42 84, Fax: +75 42 28 95, Email: finn@interservice.dk

More needs to be done to help traditional SMEs make the transition and “go digital”. At the moment SMEs are confronted with significant barriers that prevent them from completely and efficiently using the existing e-technologies in their businesses. Even though many SMEs now do have a basic web presence the greater part find the opportunities difficult to grasp – therefore the main problem is that the majority are still reluctant to use the Internet as a business tool. To improve this we should focus on the skills of employees in SMEs. In general and at the local level, there is a clear need for methods which will break down such barriers. Eliminating the digital divide will clearly promote the competitiveness of SMEs. This paper provides the argument that the main reason is employees lack of crucial IT qualifications needed to capitalise on the new technologies. Do technology providers, project consultants and business schools fully understand the way SMEs think and work? - And furthermore are the methods they use the most suitable? This paper stresses the necessity to give advice that is specially targeted at the individual SMEs actual needs. In that sense strengthening the qualifications of the employees in SMEs through individual training in securing a successful implementation of e-technologies is crucial. The methodology has been tested in four Danish regional based projects dealing with training and implementation of ICT-skills in more than 200 Danish SMEs.

1. Introduction

Reducing the digital divide will both influence the future of SMEs as well as strengthen the overall competitiveness of the European economy. This task is also crucial in fulfilling the aims set up in Lisbon in 2000 – to become the most competitive and sustainable economy in the world by 2010.

The EU Commission has launched several initiatives such as eEurope2005, GoDigital and lots of other regional and national programmes and projects to support SMEs, institutions, organisations etc. to integrate new technologies and e-business solutions. Furthermore, several conferences and seminars such as the eBusiness eWork Conference in Prague October 2002 highlighted that the penetration of digital technologies among SMEs is far too low. Several projects have developed different approaches to solve SME problems. For instance, Flexwork (IST-200-26367) and Proteleuses (IST-1999-20852) have focused on issues related to flexible working as well as providing resources to business advisors to support SMEs in implementing such practices. DynamITe will present a different approach by focusing on the individual employees in a specific geographical area and across sectors in promoting the use of ICT in SMEs business processes.

DynamITe is a project under the European Social Fund financed by the regional funds in the county of South Jutland, Denmark. The framework of DynamITe differentiates from the above-mentioned projects in the sense that the regional dimension is an essential component in the DynamITe project. Furthermore, the focus of DynamITe is more on strengthening the competences inside the company instead of focusing on providing external experts with SME related resources. It will supply SMEs with the knowledge and skills that they need on a continuous basis and help them overcome main obstacles when they engage in e-business. DynamITe has the potential to become a European approach for ICT training of SMEs and therefore effectively deployed in other countries. The solution recommended in the DynamITe project is based on the supposition that SMEs need to be motivated to start the digital process and integrate it in their business process. The motivation factor is a key word in the process outlined in the project and is entirely related to the employees. Therefore the result fully depends on the employees and especially their familiarity with ICT technologies. The intention of the DynamITe project is therefore to promote the familiarity and the motivation of the employees. This paper will describe the approach leveraged in DynamITe in which ICT training and development of local/regional networks are the main parts.

2. Target group

DymaITe is carried out in three counties in Denmark and the project addresses all SMEs in these specific areas. DynamITe has determined that many SME employees independent of sector are facing the same ICT problems. Typical basic problems are outlined below. More than 50% of all employees have basic problems e.g.:

- Storing files in a structured manner on their computers
- Understanding file formats e.g., .gif, .jpg, .txt, .doc
- Understanding size of data: 350 kb pictures to be put on the website
- Poor handling of digital pictures to be published on the website
- No plan and structure for updating their website

These problems can be solved rather easily without spending too much time (often a few hours). The problems may seem low tech, but it is essential that these basic problems be solved, because most e-technologies are based on these basic skills. If these basic problems are overlooked in e-business projects, they will be doomed from day one. DynamITe does not believe in a sector specific focus, but offers training activities that go across sectors to provide all employees with basic ICT skills. This approach further strengthens the establishment of regional based network where employees from different sectors have the possibility of exchanging experiences concerning ICT. Participants meet employees from other sectors and with a diverse educational background, which seems to promote new kinds of networks different from the traditional sector-based ones. The aim of DynamITe is to develop a universal approach in terms of thematic based subjects. The project approaches employees with very low IT skills and therefore an important part of DynamITe is courses, seminars and workshops covering basic IT areas such as MS Office 2000 (Word, Exel, Access and PowerPoint), e-business, web design and promotion, management etc. The educational parts are based on a number of inter-related themes: Information Strategy, Multimedia, and Teambuilding Project management, the creation of network etc. One of the fundamental ideas behind the project is that both managers and staff members participate on equal terms.

3. Objectives

The objectives for the DynamITe project are:

- To develop new methods of dynamic ICT-training and through this implement
- e-technologies in SMEs to strengthen their competitiveness
- Enable SMEs to exploit and make better use of the Internet as an extra asset in their daily work
- To bring SMEs in contact with international projects and networks.

4. Today's situation

The idea of DynamITe arose as a result of the conditions established in earlier projects. We summarise below the present situation and associated issues that DynamITe is focusing on overcoming with its training approach:

- Most SMEs have a PC with Internet access that is mostly used for e-mail
- Many have a website, but very few exploit the possibilities of this
- Most SMEs find it difficult to understand the meaning and relevance of e-terms
- There is a considerable awareness of the potential of the Internet
- SMEs are forced to look for a rapid return on investment in money or manpower – short term investments instead of long term investments
- All SMEs have different technology needs and different levels of knowledge
- Most SMEs are members of several local and regional networks – many of these have greater potential
- Once convinced, they are willing and able to adopt to e-commerce rapidly
- ICT implementation skills learned from participating in courses are often poor. The reason is that the courses are not individually targeted with regard to specific needs.

5. The nature of SMEs

The contexts, which surround SMEs, diverge from the one that surrounds larger enterprises. This means that SMEs are characterised by their own way of thinking. It is of crucial importance, that SMEs can foresee the results and consequences of specific investments and in that sense it has to be measurable within a short time span. Their way of doing business is characterised by a step-by-step approach by which it is possible to see the results of the activities and investments. With regard to implementing e-business it will often take place from day to day. Otherwise, you will enter the critical phase (see model 2) if the training is planned to be strategic and takes place over a longer period. It is fundamental that the training courses meet SMEs at their level, which requires an understanding of their way of learning. Therefore the courses need to be undertaken at an operational level and within a short time period.

5.1 The DynamITe approach with the nature of SMEs in mind

Instead of the traditional courses offered to SMEs based on specific technologies and software, and the content of the courses at a general level, and focused on

functions in the software, DynamITe focuses on the employee's actual needs. The DynamITe project is based on the following ideas:

- To be specially targeted at the individual SMEs actual needs in terms of the actual level of available technologies and personal skills.
- The content of the course is to be rapidly implemented into the actual business process and the results should be a measurable added value for the enterprise and the employee.
- To be followed up by a hotline.

This brings us to the basic idea of DynamITe, which is to drop the strategy (for a moment) and shift focus directly to the employees. Project results show us that it is very easy to find parts of the business process where the use of ICT can be improved with very few resources. The model below illustrates the idea of DynamITe in comparison with the traditional approach. The red arrow demonstrates the general approach focusing on the manager, and the development of strategies and plans. On the other hand the green arrow illustrates the approach of DynamITe concentrating on the employee with the aim of solving immediate individual problems and thereby improve business processes. The improvement of employee skills will be visible within short time. The overall idea of DynamITe:

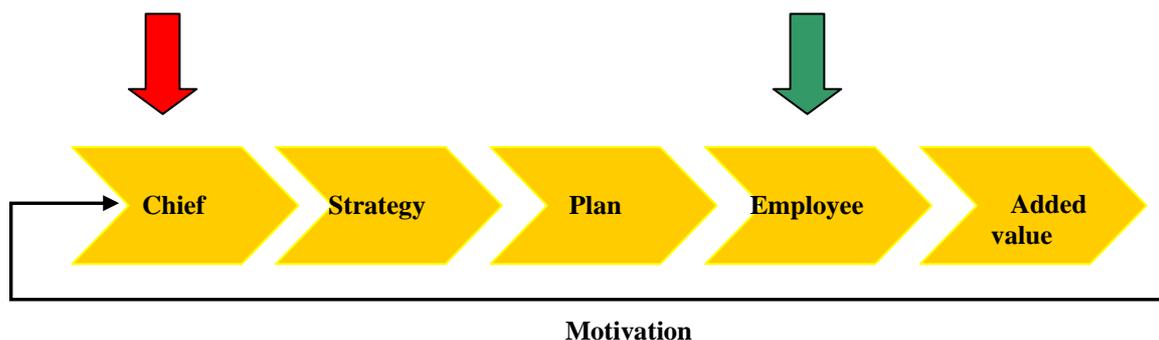


Figure 1: DynamITe model

The model gives a number of advantages:

- Short time span between access to new knowledge and measurable value
- Stimulates the single employee's job quality in relation to ICT
- Motivates the management to look for further knowledge
- Immediate implementation and capitalization of spent resources

6. Technology requirements for undertaking a project such as DynamITe

Generally, a project like DynamITe only requires a PC with Internet access, which should be available to most SMEs. The project requests no further investment in terms of hardware or software. Advanced programs can be used at the course facilities in a number of workshops. The daily use on their own PCs is based on open source software and freeware.

The project has a common web hosting facility, which can be used, but most SMEs already had their own domain name, or invested in one at own expense..

During the project a service provider delivers web shops to be implemented in an existing website.

7. Project process

7.1 Recruitment for the DynamITe project

DynamITe recruitment was launched in cooperation with local and regional players, and was based on the experience, that all materials should focus on the potential value, which could be add to each participant.

The recruitment went very well and more than 200 Danish SMEs are taking part, which shows the very strong need and demand for training in ICT based on SMEs own business processes A SMEs' normal reaction is understandably: "Why should I buy something I don't understand".As a result of training, SMEs become aware of the potential of ICT.

7.2 Motivation

Individual's motivation for learning ICT-skills is often rather complex. The training stimulates employees to promote their ICT skills further as they realise that their daily work gets easier and faster with their increased level of ICT knowledge.

7.3 Timeline for training issues

Based on the experience of DyamITe the following table outlines the logic timeline of the initial approach:

Steps	Elements
1. Initial Training (3 - 5 weeks)	Filling out the missing parts of basic IT-training
	Digital Photo - size and formats.
	Design and colours - how can your website design match your target group
	Text - tell what your costumer wants to know and expect to find on our website
	Navigation on the website
2. Release of website	
3. Post website release	Plans for update
	Training in updating using appropriate tools e.g. MS FrontPage and FTP (if relevant)
	Implementation of other marketing activities
	Optimising for search engines
4. E-business (if relevant)	Implement e-catalogue in website
	Start with few products and scale
	Integration with ERP or offline catalogue via Excel

Table 1: Logical initial approach

8. Results

The results of the DynamITe project clearly demonstrate that it is possible for SMEs to GoDigital, using the right approach. At the same time the results show that the traditional models offered by business schools are not always appropriate to SMEs. New methods of work will enable SMEs to actively use IT in the further development of their company. With the DynamITe approach the value is visible in a few hours time. The employee experiences improved job quality and the manager is satisfied because his competitiveness is improved, but most of all the manager is motivated to spend more time acquiring relevant ICT skills. Other visible benefits from the DynamITe project are:

- The change of ICT from being a problem to becoming a valuable tool.
- Increased motivation and job quality for the single employee. ICT can be fun to use with stunning visible results after a few hours of training.
- Creates the basis for easy and successful implementation of e-business tools
- Creates the foundation for a strategic approach to ICT by SMEs.
- The DynamITe model stimulates local network, with a clear focus on measurable benefits and added value.

The school system is similar in many countries, and so is the low numbers of SMEs using ICT. Therefore it is clear that while national projects are successful, the issues related to ICT-Skills for SMEs is something that needs to be addressed at European level. Some of the more surprising results identified by DynamITe are outlined below:

9. From operational training to strategies

With the DynamITe model it is possible to recruit and deal with the initial training. After this, the SMEs have to move towards more strategic objectives. If the added value is not clearly visible it becomes much more difficult to continue the process.

The objectives may be seen to be less critical path and the development comes to a stand still, which makes it very difficult to start again. With the basic knowledge most SMEs are very willing to look at ICT in a more strategic way, but the transition from operational training with very visible and measurable results into dealing with strategic issues is rather fragile.

The barriers experienced between initial training and strategic goals are illustrated in the figure below:

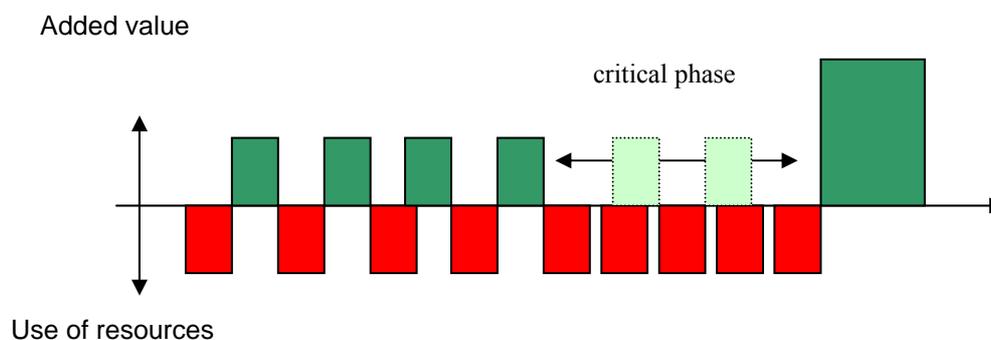


Figure 2: Barriers

As long as the recourses spent (time or/and money) are paid back with measurable added value within hours or days, the process will continue and the SME is motivated to spend more time to get additional added value. Experience shows that as long as the process is “value driven” the process is almost self sustainable.

As soon as the SME has to spend more time to reach a higher goal on a long time basis (week/months) the process come into the critical phase.

In this phase further external support is needed and the project coordinator and others players in the environment surrounding the SME must coordinate their efforts and present “value” (illustrated in the diagram by the light green boxes). This can consist of Best Practice, inspiration meetings or it can simply be a close contact between the SME and the project coordinator.

10. Conclusion

Based on the results of DynamITe and the fact that we are ourselves an SME, which has been involved in several IST-proposals and participated in the eBusiness eWork-conferences in Madrid, Venice and Prague, our conclusions are as follow:

- A strategic approach to SME simply does not work on a large scale, but there is an unlimited demand for operational support directly to the employee
- SMEs do understand and recognise the potential of ICT, and the Internet but many projects, schools and consultants do not understand the nature of SMEs, and they speak a language, which is not understandable for SMEs.
- Training of SMEs has to be reconsidered and new methods developed. Methods of low-tech basic ICT training have to be implemented into the IST programs.
- Too many projects are trying to solve non-existing theoretical problems, with very little relevance to the business processes in SMEs. The focus is on overcomplicated and advanced technologies, where the real present need is on basic training in low-tech technologies and working methods.
- DynamITe does not operate with the causality that access to Broadband/Internet automatically mean that SMEs will GoDigital.

11. Further work and recommendations

More needs to be done to help traditional SMEs make the transition and “go digital” and at the same time reduce the digital divide and strengthening the European economy. In achieving the aims outlined in the EU Commissions IST work programme and the statement made in Lisbon 2000 we recommend the following:

- The supporting environment of SMEs has to coordinate their efforts on a regional, national and European level, and lessons learnt have to be shared. This could be done in projects dealing with the networked future.
- Within the IST-programme focus on state of the art technologies and long-term strategies seems to have overshadowed the fact that most SMEs today are struggling with very basic problems, which could be solved with very few resources. At the eBusiness eWork Conference in Prague in 2002 we raised this problem at the SME Workshop and feel that SME training needs active support from the EU Commission in order to reach the full and necessary effect from these kind of actions.
- As most IST projects by their nature are strategic projects it will be impossible for the projects to approach SMEs directly. The SME involvement in IST-projects should take place through regional and national projects or networks.

12. References

[1] eBusiness eWork Conference Prague October 2002

Participation in the following sessions:

3H : Workshop on eEurope and SME support in FP 6 – part 1
4H : Workshop on eEurope and SME support in FP 6 – part 2

5C : SME issues – part 1

6C : SME issues – part 2

8H : Barriers and opportunities for SMEs in NAS

9A : Networked organisations – part 1

10A: Networked organisations – part 2

11 : Closing plenary

12 : eBusiness and eWork in Framework Programme Six

[2] References to other European projects concerning SMEs and ICT:

PROVE-SME IST-1999-20276 (FP5, Virtual Enterprise, 2000) (www.democenter.it),

FLEXWORK IST-2000-26367 (www.flexwork.eu.com),

PROTELEUSES IST-1999-20582 (www.cbt.es/proteleuses)

ISBN 3-00-013499-9 © 2004, Council of European Professional Informatics Societies

This book has been produced in association with eChallenges e-2003 (www.echallenges.org) 