

MONITORING E-SKILLS DEMAND AND SUPPLY IN EUROPE



SYNTHESIS REPORT

“THE EVOLUTION OF THE SUPPLY AND DEMAND OF E-SKILLS IN
EUROPE”

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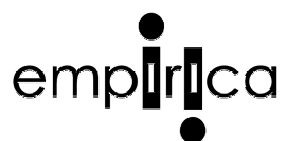
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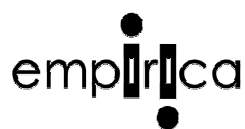


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1 Executive summary

E-skills are a central aspect of European policies to boost competitiveness, productivity and employability of the workforce. Europe needs to ensure that the knowledge, skills, competences and inventiveness - including but not limited to IT practitioners - meet the highest global standards and that they are constantly updated in a process of effective lifelong learning.

This study aims to monitor and understand better the evolution of the supply and demand of e-skills (ICT-related skills) in Europe in order to anticipate change and facilitate dialogue between policy makers at the regional, national and EU level and leading stakeholders to reduce e-skills shortages, gaps and mismatches.

Shortages, gaps and mismatches in the IT labour market may result from a temporal asynchrony (time lag) between supply and demand due to the time usually needed to acquire ICT professional skills. Shortages may be temporary, when the signals from the labour market, i.e. wages and career opportunities transpire only slowly into the educational and professional choices made, - or they may be persistent in nature when these signals permanently fail to reach school leavers to a sufficient degree.

On the demand side, it is arguably reasonable to assume that shortages and mismatches depend on the economic climate both in general as well as in the ICT sector, the stage of the business cycle, as well as the cycle of innovation and adoption (life cycle) of new technologies. Therefore the macroeconomic context and the evolution of the ICT sector are to be taken into account, as well as trends in outsourcing and off-shoring.

When talking about the economy wide supply and demand of ICT practitioner skills it is crucial to distinguish between ICT professionals and the ICT sector.

Since data about the ICT sector is often more easily available, whereas information about ICT professionals is much more difficult to gather, there are often points made about ICT skills when the data refer in fact only to the ICT sector. This is a recurrent flaw often found in the discourse which should be avoided.

Today, more than half of the ICT professionals work outside the ICT industry (understood as including manufacture of ICT products and provision of ICT services) in user industries especially in non-IT services but also in manufacturing and the public sector.

The second distinction to be made is between ICT professional skills and ICT professional occupations. People can work in IT jobs without having a formal degree or diploma in the field. On the other hand, people with IT degrees can work in jobs which are not formally (or statistically) filed under ICT. Figures from Denmark exemplify an amazing discrepancy in this relationship.

Therefore, although the ICT sector can be used as anecdotal evidence and to focus on certain aspects, in terms of data we need to be very strict with definitions when interpreting the statistics issued in various publications. In the current research we refer to ICT professionals according to their occupation only and not according to the enterprise they work for or the formal qualification level they may have acquired.

We use the ISCO based figures which are stemming from the Eurostat Labour Force Surveys system. Still, there are different and changing opinions on which occupations to include. A narrow or core definition of ICT professionals which has been used by the OECD in earlier publications, includes only the two ISCO categories that most certainly have ICT professional skills: ISCO 213 computer professionals and ISCO 312 computer associate professionals. The diversification of occupations requiring ICT specialist skills having taken place during the last years suggests that there might be additional occupational groups with ICT professional skills.

Therefore, we will also introduce a broad definition of ICT professionals, including ISCO groups 213, 312 as well as the groups 313 optical and electronic equipment operators and 1236 computing services managers. Finally, as an even broader definition of ICT workforce, we use a very broad definition including all categories mentioned above plus ISCO 724 Electrical and electronic equipment mechanics and fitters.

Macro-economic context and the crisis

One major factor influencing the development of the demand and supply of IT skills in the coming years will be the effects of the current economic crisis. Therefore we try to learn from previous macroeconomic crises and how they affected the ICT markets.

Hopes for a fast recovery from the current recession are based on the observation that it follows on a longer period of economic growth which suggests that although the current crisis represents a greater systemic shock, the world economy might be more resilient than before.

Others expect a prolonged crisis and claim that at the current point (August 2009) we have only seen the first of at least a double dip of a W-shaped recession because (these arguments being taken from a plethora of other speculations) of the increased fiscal strains leaving little scope to maintain stimulus programs and expected rises in oil, energy and food prices.

How then will the crisis affect ICT employment? At least two trends can be discerned: First, there has been at least since the 1960's a clearly emerging long term trend that is visible beyond all business cycle developments. Much unlike in the majority of other economic sectors, growth rates in ICT hardly turned negative during past recession times.

Therefore, the assumption of a strong long term trend (which one may want to call a Kondratiev wave) representing the structural change of modern economies towards the information sector should be maintained despite the current slump.

On the other hand there are short term economic cycles. In the middle of the 1980s we saw a deceleration which has been interpreted as the "PC shakeout", and the similar 2000/2001 downturn has been termed the "Internet shakeout". Both periods were part of a "natural" long term boom-bust cycle and were necessary to adjust for previous irrational exuberances. The effects of the 2000/2001 downturn were amplified by an overall economic crisis, while those of the mid 1980s paired with more favourable general economic conditions.

Although ICT growth rates have in the past followed general economic trends, especially during recession times, ICT growth rates have until now been performing better than the overall economy in these times. The exception was the 2000/2001 crisis, in which the ICT industry fared worse than the overall economy, arguably because the general economic hardship coincided with the sector specific Internet bust.

The question remains, whether the sector and the demand for IT skilled employment will again fall behind the general economic trend as in 2001, or, as in all previous crises, remain more resilient than the rest of the economy - regardless of the question how severe the crisis is likely to be and for how long it will last.

Today, most analysts agree in that the ICT sector will not suffer as bad as in 2000/2001 when growth rates dropped far under general economic growth. They argue that ICT companies today are far more consolidated than at the time of the Internet start-ups and that also the cash-credit rate is far more favourable today. Both staff and infrastructure are supposed to be on an adequate level thus preventing hidden and inefficient cost structures. Furthermore, business models of the IT services industry have become more mature and are rooted much more deeply in the day-to-day business of the rest of the economy than it was the case in the hype phase of the late 1990's, in which the IT industry was at least partly detached from the developments in the "real" economy.

However, in accordance with an expected slow general upturn due to the extraordinary extent of the global recession, the recovery of the ICT sector from the current recession is expected to be slower and take longer. Being much more deeply integrated into the "old" economy nowadays thus means also that the economic destiny of the ICT sector is more closely related to the general economic cycles.

In any way, the long-term outlook seems not so gloomy. In its most recent assessment, the OECD indicates that although ICT growth slowed down rapidly in 2008, first signs of a potential recovery could already be detected in mid-2009.

Outsourcing and off-shoring

A general trend in the past years affecting the demand for ICT skills is the practice of outsourcing and off-shoring.

Off-shoring will have a significant impact on the ICT employment since it means that both business processes and the jobs related to these are moved from one country to another. Manufacturing has been off-shored for a longer time already, the main destinations being China and Asia in general, but with Eastern Europe and Mexico catching up in importance. Today those destinations are also the main areas for the off-shoring of ICT manufacturing since they offer lower assembly costs.

Concerning the service sector, off-shoring is a more recent phenomenon. During the last years, India has emerged as the number one location for the off-shoring of ICT or business services, due to its large English-speaking workforce and relatively high level of ICT infrastructure and ICT professionals.

What kind of activities is off-shored? Although it is difficult to measure off-shoring (OECD 2005), a look at trade balance sheets shows that Europe a) imports more ICT goods and exports more ICT services and b) it exports more expensive ICT products and services and imports less expensive goods and services. Related to the workforce thus, European ICT professionals need more ICT service than manufacturing skills. Overall Europe needs highly skilled ICT professionals that can contribute to innovation, research and development, especially in services.

The effect of off-shoring on the labour market in the countries from which off-shoring originates is even more difficult to capture than the extent of off-shoring itself. According to the OECD (2005:10) job losses in the USA due to off-shoring are small in comparison to total annual job turnover. The impact on the employment levels remains unclear especially in the services sector, since at the same time as these relocations have taken place, service sectors have expanded, new services been created and efficiency gains of companies off-shoring services can also contribute to overall growth and further job creation in the originating countries.

The future development of off-shoring activities depends on several factors: the availability of skills in the offshore destination countries, the labour costs there and also more generally on whether or not services are suitable to be provided from a distance. Anecdotal evidence about British companies re-locating their services from India to Great-Britain points to the fact that "service from a distance" will not work out in all cases. Besides this, the country reports that the study produced about India and China - especially on the supply and demand of ICT skills - point out that, both in China and India, a shortage of well educated and highly skilled ICT professionals might arise in the near future, especially because local demand will be competing with offshore demand. In India in addition, wages have increased substantially, thus lowering its appeal for ICT companies looking for destinations with low labour costs. These developments might lead to smaller countries gaining larger shares of the offshore business, especially "nearshoring" locations that can benefit from language skills and/or relative proximity.

Sectoral and geographic patterns

When one looks into the statistics about where in the economy IT workers are occupied, the expansion of ICT across many different industry and service sectors becomes obvious. In 2007 a majority of IT professionals in Europe work in industries other than IT. Less than half (45.5%) of the IT professionals in Europe work in the core IT industry, i.e. NACE Rev.1 groups 72 (Computer Services) and 64 (Post and Telecommunications). That means that the majority of IT professionals, or 54.5%, today are working in IT user industries. The most important employers in the IT user industries are manufacturers of machinery and equipment, business services, distribution (wholesale and retail trade), public administration and the financial sector.

In 2008, the total number of ICT professionals in Europe amounted to roughly 3.95 million according to the core definition, approx. 4.78 million according to the broad definition and around 7.03 million according to the very broad definition.

In the core definition, the four largest countries, Germany, UK, France and Italy account for more than half of Europe's labour force, and the seven largest employer Member States (adding Spain, the Netherlands and Poland) account for around 75%.

The number of ICT professionals in the EU27 member states has been increasing at least since data have been available and regardless of the definition used. The number of ICT professionals according to the core definition has more than doubled since 1995 to reach 4 million in 2008.

Historical development

For those countries where we can trace the longer term development, the workforce has increased between 1998 and 2008 by around 77% for the core category, by around 82% for the broad category and only by around 33% for the very broad category. Hence it becomes apparent that the increase of the ICT workforce is due to the core and broad ICT workforce (ISCO 213,312, 1236 and 313), while the number of workers classified according to ISCO 724 (electronic equipment mechanics and fitters) has actually been declining by about 400.000 from 1998 to 2008. The dynamic developments in the IT labour market therefore should be sought in the core segments.

The increase according to the broad definition follows by and large the development of the core definition, with the exception of the year 2000-2001, suggesting that during these years employment in the ISCO groups 313 and 1236 has increased more rapidly than in the core groups 213 and 312.

The increase is not only visible in absolute number terms, but also the share of ICT professionals in comparison to the overall workforce. For the EU15 on average, the share has risen from 1.2% in 1998 to 1.9% in 2008 using the core definition, and up to around 3.2% for the very broad definition.

However, the dynamics of core ICT professional occupations are not in line with employment in the ICT sector: the share of ICT sector employment as percentage of total employment stagnated from 1995 until 2006 at around 5.5% (in OECD countries). Rises in ICT services sector employment did not outbalance employment losses in the ICT manufacturing employment.

Unemployment among ICT professionals may result from imbalances in demand and supply of ICT professionals, which might be quantitative (not as many ICT professionals needed), or qualitative (the ICT professionals available not having the skills and qualifications required by employers). Very high percentages of unemployed ICT professionals as well as rapidly rising unemployment numbers would point to a mismatch between supply and demand.

Looking at LFS data, the following patterns can be found: at the end of the 1990s, the dot.com frenzy prompted high demand of ICT professionals and consequently unemployment rates were down to only 2-3% of the ICT professional workforce. As a result of the crash in

2001, unemployment numbers surged by more than 250% to attain a total of more than 100.000 and a record percentage of 4.7%. Since then, unemployment rates have levelled off to 3% in 2008.

To sum up, ICT sector employment historically shows a pattern: employment rises until the crash in 2001, bottoms out later in 2003-2004 to rise again at a slower pace afterwards. During the current crisis ICT sector employment can be expected similarly slow to recover, even if the structural causes of the crisis are different from those in 2001.

More generally, it is clear that the labour market reacts more slowly to financial turmoil than the financial markets. While general unemployment has only risen by 2% in the Euro zone from January 2008 until June 2009, worse can still be expected to come. For the ICT sector it seems that employment in ICT manufacturing is experiencing a clear decline, while ICT services employments is less vulnerable and holding up a little better, thus confirming the general impression that in Europe ICT service employment is faring better than ICT manufacturing.

For ICT occupations the unemployment rate rose only very slightly in 2008, but will increase most probably in 2009 in line with the general unemployment. Nevertheless, since the current crisis is not related in particular to the ICT sector it seems reasonable to assume that the unemployment of ICT professionals will most probably not increase above the threshold of around 40-50% of the general unemployment rate.

Supply side views

Computer science graduates constitute the most relevant new labour market supply. The number of computing graduates measured as the total of tertiary graduates has risen constantly since 1998 until its peak in 2005. Since then, the total number has slightly decreased by 6000 to reach a total of around 148.000 computing graduates in 2006.

There are several measurement challenges, however. The absolute numbers of computer science graduates are less useful for comparisons across the EU Member States or over time. Although the Bologna process has contributed to a convergence of higher education in Europe, some substantial differences between the countries still persist, for example concerning the percentage of a particular age group participating in higher education (which does not forbid the comparison but should be taken into account), or the distribution between tertiary (higher) education and advanced secondary, professional ICT education (which has hugely different levels of significance in the various countries), or the likelihood for first degree graduates to acquire a second degree (which statistically entails double counting) and finally the lack of comparability of the skills levels of the first national degrees.

Further to this, other supply sources should not be forgotten. Students who drop out of tertiary education computing courses prior to receiving a diploma or other degree often have acquired sufficient ICT skills to work as ICT professionals and do so. However, on a European scale, no statistical data is available for this group.

The uptake of computing courses is influenced by the expected job satisfaction and security, likely levels of remuneration and the overall image of the ICT industry. In order to assess the attractiveness of computer courses - and subsequently ICT occupations, it is useful to look not only at absolute, but also at relative values. The decrease in the number of computing students and graduates cannot be attributed to a decline in overall student numbers - rather the percentage of all students in tertiary education enrolled in computing courses has dropped significantly since 2005 as well. The number of graduates has also dropped since 2005. Most likely therefore at least in the next few years the number of computing graduates will stabilise at the best or decline even further, if no action is taken to reverse the trend.

The number of computing students and graduates varies considerably across the different EU27 member states. The absolute numbers of graduates are difficult to compare due to dis-

tortions related to either changes over time caused by for example by a general education expansion (Poland) or changes in courses and diplomas (Germany) or differences across the countries, for example differing proportions of an age group taking part in higher education.

The UK and Spain show a clear drop in the proportion of graduates having taken computing courses since 2003/2004, while other countries, such as Germany, the Netherlands and Poland show an increase in computing graduates at the same time. In Italy, the share of computing graduates remains more or less stable.

Graduates from other fields regularly enter the labour force as ICT professionals, be it from closely-related courses in the field of "science, mathematics or engineering" or "manufacturing and construction" or from other more thematically distant fields, such as in social sciences or the humanities. There is no data available as to the proportion of these other graduates in the ICT workforce, nor is a detailed breakdown by study subjects feasible.

A rough indicator of the importance of non computer-science degree holders for the ICT workforce might be derived from an available statistic for Denmark where these graduates make up 70% of the workforce in ICT occupations. This proportion is confirmed by older data from the USA and the UK: in the USA in 1997 among "core" IT workers, 46% had IT degrees, 14% engineering 26% science and maths and 6% business degrees.

Life-long learning and continued education courses such as the vendor certificate play an important to help to avoid or close a gap or mismatch between demand for and existing supply of ICT professionals. Unfortunately, it is impossible to estimate how many ICT professionals with vendor certificate might be added to those with formal computing

The reasons for this are non availability of such data at the vendors and training course providers in a central source and the problems in reliably counting the number of such certificates achieved by individuals, difficulties counting those who attend the e-skills training courses without aiming at a certification but who in the very end also obtain (some) ICT practitioner skills (although without a certification), and the danger of double counting individuals from these target groups since they - or at least some of them - will already appear in the workforce statistics as ICT practitioners.

An additional source of ICT professionals can come from highly-skilled labour migration. Labour migration is regulated in nearly all countries. Therefore, the number of foreign ICT professionals that might complement the national ICT labour force is first of all limited by migration policies. Secondly however, the number of real and potential migrants is determined by the question if they consider the respective country to be attractive in terms of working and living conditions and if they can communicate in a common language.

A relevant number of in-migrants working as ICT professionals can produce a significant impact on wages, distorting the level they would reach if only national ICT professionals were available (see country report USA). On the other hand, temporary in-migration can help to meet short-lived elevated demand.

Excess demand

We diagnose at least for pre-crisis times a significant unfilled demand for e-skills which manifests in hard-to-fill vacancies on the side of employers, i.e. enterprises and organisations. A significant 18 percent share of the European enterprises employ ICT specialists and among these almost half had acute difficulties in filling these open positions in 2006.

Because they have the highest share of IT specialist employing enterprises, these difficulties obviously affect especially the ICT intensive parts of the economy - large enterprises are more likely to be affected than small enterprises and knowledge intensive services such as computer related activities, banking or telecommunications also express a higher demand than other sectors.

Types of e-Skills in demand

From literature and research it is known that demand for e-Skills is not universal but related to specific bottlenecks. A recent INSEAD (2009) report concludes that Europe's skills issue is not one of quantity, nor of quality, but rather of matching and of fluidity, that is the ability of the skills pool to undergo continuous changes and adapt to new challenges. The fast change in demand for e-Skills makes it difficult to monitor the types of skills that are most in demand. However, the most recent studies dealing with the type of e-skills in demand showed that for 2008 these were e-skills related to "security/firewall/data privacy "as well as "soft" skills (customer service, sales, project management, communication etc), "non-specific server technology" and "general networking and network infrastructure" (CompTIA 2008). System architects and project managers were also in high demand (IDC Insight March 2009).

This report should be understood as a stock-taking enterprise of the eSkills situation today. It represents the groundwork from which the study assesses likely future scenarios. Therefore the present report is to be complemented by a report on forecasting e-Skills supply and demand which will be produced shortly.

2 Definitions and Terms

"ICT practitioner" (synonyms: IT practitioner, IT or ICT professional, IT or ICT worker): people whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems) (cf. "ICT practitioner skills").

"ICT practitioner skills" are defined as the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems. ICT practitioners are people whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems). For their surveys, Eurostat has operationally defined "ICT specialists or IT specialists have the capability to specify, design, develop, install, operate, support, maintain, manage, evaluate and research ICT and ICT systems. ICT is the main job."¹

"ICT user skills" are defined as the capabilities required for the effective application of ICT systems and devices by the individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialised tools supporting business functions within industry. At the general level, they cover "digital literacy". For their enterprise ICT surveys, Eurostat has operationally defined "Capabilities enabling the effective use of common, generic software tools (basic user skills) or advanced, often sector-specific, software tools (advanced user skills). Jobs requiring ICT user skills: ICT is an important tool for the job and is used to produce work output and/or used intensively at work (in day-to-day activities)".²

"e-Business skills" are defined as the capabilities needed to exploit opportunities provided by ICT, notably the internet, to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organisational processes; and/or to establish new businesses.

"e-Skills deficiencies" (according to the European e-Skills Forum of the European Commission):

e-skills "Shortage": an insufficient number of skilled people in the labour market or in an occupational segment;

e-skills "Gap": a competence shortfall between the current and needed competence levels of individual staff within organisations;

e-skills "Mismatch": a mismatch between the competence of the trainee or graduating student/learner and the expected competence needs of the employers. Mismatch is assumed to arise from course/curricula misalignment.

Shortages, gaps and mismatches are not always reasonably to be distinguished from a macro perspective, however.

"GDP": Gross Domestic Product

"HRST": Human Resources in Science & Technology

"HRSTE": Human Resources in Science & Technology in terms of Qualification

"HRSTO": Resources in Science & Technology in terms of Occupation

"ICT": Information and Communication Technology

¹ Eurostat model for a Community Survey on ICT Usage and e-Commerce in Enterprises 2007 (Model Questionnaire Version 3)

² *ibid.*

3 Introduction

Broad agreement exists that e-skills are central aspects of any policy to ensure that Europe boosts the productivity and the employability of its workforce and responds successfully to global competitive challenges. Europe needs to ensure that the knowledge, skills, competences and inventiveness of the European workforce - including but not limited to its IT practitioners - meet the highest global standards and that they are constantly updated in a process of effective lifelong learning. CEPIS (2007:2) even holds that unless the supply of ICT professionals meets future demands "Europe's states will lag behind the world technologically and therefore slip economically".

It is within this line of reasoning that the present study on "Monitoring e-Skills Demand and Supply in Europe" has been commissioned by the European Commission, Directorate General for the Enterprise and Industry. The main expectation for this new study is to monitor and understand better the evolution of the supply and demand of e-skills (ICT-related skills) in Europe in order to anticipate change and facilitate dialogue between policy makers at the regional, national and EU level and leading stakeholders to reduce e-skills shortages, gaps and mismatches.

Shortages, Gaps and Mismatches (see chapter 2) result partly from the temporal asynchrony (time lag) between supply and demand due to the time needed to acquire ICT professional skills.

On the supply side, the uptake of computing courses (secondary, tertiary or training/certification courses) is influenced by the perceived job satisfaction and security, likely levels of remuneration and the overall image of the ICT industry (CEPIS 2007: 2). Since these reflections are usually based on the current state of affairs while the students will enter the workforce only some time - typically 1-4 years - later, hog cycle effects might occur. CEPIS (2007:2) points to that fact that extreme swings in interest that leave the skills market short of qualified people are most likely to happen when the market recovers from a recession and needs a specialised workforce most urgently. This part of the supply side will be dealt with in more detail in chapter 6.2.1.

Concerning the demand side, the OECD (Information Technology Outlook 2004: 233-234) esteems that shortages and mismatches "are likely to depend on the general economic climate, that of the ICT sector, and the stage of the business cycle, as well as the cycle of innovation and adoption of new technologies" The chapter 5 will therefore refer to the macroeconomic context and the historical evolution of the ICT sector as a background for the description of the ICT workforce itself. A section on outsourcing and off shoring trends will complete the picture.

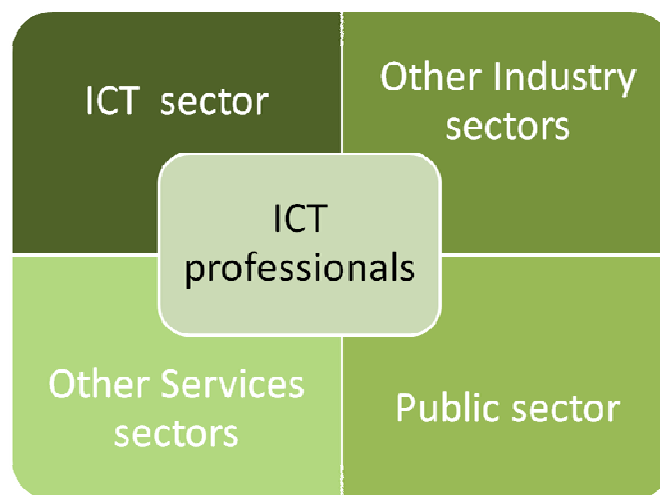
Although we deal mainly with the situation in EU27 member states, additional insight has been gained concerning the demand and supply of ICT professionals in other industrialised countries (USA, Japan) and India and China as two of the large, emerging countries. This report is the first deliverable of the e-Skills Monitor and presents the current situation of ICT professional employment. It will be followed by a second report developing scenarios and forecasts for future demand and supply of ICT professionals in Europe.

4 IT professionals and the IT sector

When talking about ICT practitioner skills, several important aspects have to be taken into account:

1. First of all, it is crucial to distinguish between ICT professionals and the ICT sector. This distinction is often neglected, especially since data about the ICT sector is easily available, whereas information about ICT professionals is much more difficult to gather. However, the OECD stressed already in 2002 the fact that: "Industry-based data can provide information on the relative importance of IT-producing sectors in national economies, but are insufficient to capture the true size and nature of the IT workforce (OECD Technology Outlook 2002: 159). The Exhibit 4-1 below shows that on the one hand a large part of ICT professionals work for sectors other than the ICT sector, and on the other hand the ICT sector employs a large number of non-ICT professionals. For this reason it would be misleading to use the ICT industry workforce as an approximation for ICT professionals in general. In addition, employment in the ICT sector on the one hand, and the ICT workforce on the other hand have recently been characterized by divergent development paths (see chapter 6.1.1).

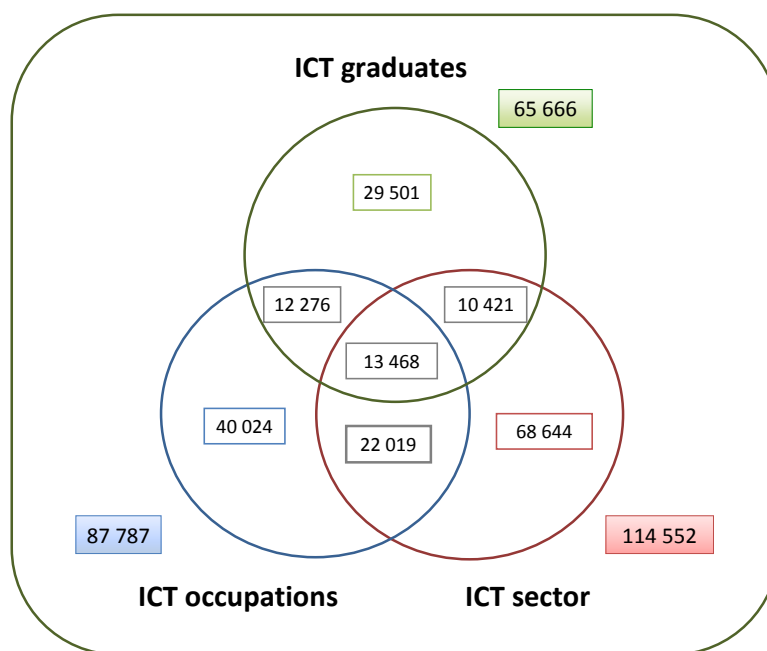
Exhibit 4-1 ICT professionals across the economy



Source: empirica

2. Secondly the distinction between ICT professional skills and ICT professional occupations should be borne in mind. While it can be assumed that arguably all those working in an ICT-related occupation have acquired some degree of ICT professional skills (otherwise they could not do the work required), there are also many people with ICT professional skills that do not work in mainly (and therefore statistically filed as such) ICT related occupations - either only at a given moment of time or permanently. This point is underlined by the overview of the Danish ICT labour market presented below. It shows that in 2002 only around 54% of ICT graduates worked in an ICT-related occupation, while 16% worked in the ICT sector, however in a non ICT occupation and 45% of graduates with ICT skills worked in non-ICT related jobs (or were unemployed).

Exhibit 4-2 The Danish ICT labour market in 2002



Data: Danmarks Statistik(2003) p.2114, own representation

Why is the IT sector still referred to?

Many studies concerned with e-skills and ICT professional employment still refer largely to the ICT sector because first of all it remains the single largest sector employing ICT professionals. Secondly, data about the ICT sector (market volume, value added, or employment) is easily available even on a multinational scale, while information about ICT professionals across the overall economy is much harder to come across.

Different developments

For the current study, the ICT sector developments will also be referred to, however only as one of many factors influencing demand for ICT professionals. In this context it is crucial to keep in mind that the development of employment in the ICT sector does not reflect the ICT professional employment across the larger economy. First of all, ICT Sector employment is "more cyclical than value added and lags the value added recession cycle" (OECD 2009:3). Secondly, during the last years, the employment numbers in the ICT sector have stagnated or decreased, while value added has increased, suggesting that the ICT sector is becoming less labour intensive in the OECD countries. This might relate inter alia to an ever larger part of off-shoring and shifts in the global division of labour (OECD 2008). This development contrasts with the share of ICT specialists as a share of the total labour force has been increasing during the last decade (OECD 2009:3).

Alternative approach

Since virtually no multinational statistics on e-Skills exist, the current study will use data on ICT-related occupations. Although a very rough proxy only, this measure does allow for a certain measure of cross-country comparisons and the aggregation of data on the EU27 Member States. In this case as well, different methodologies used by different actors for estimating the number of ICT professionals result in contradictory data (i.e. for France the number of ICT professionals given for 2004 varies between 400.000 and 680.000). In order to avoid simi-

lar inconsistencies, we will use the ISCO add-up based on the Eurostat Labour Force Surveys since it comes from official sources and uses the soundest methodology.

Still there are different and changing opinions on which ISCO categories to include. A narrow or **core definition** of ICT professionals that has been used by the OECD in earlier publications (i.e. IT outlook 2002), includes only the two ISCO categories that most certainly have ICT professional skills: *ISCO 213 computer professionals and ISCO 312 computer associate professionals*.

The diversification of occupations requiring ICT specialist skills having taken place during the last years suggest that there might be additional occupational groups with ICT professional skills. Therefore, we will also introduce a **broad definition** of ICT professionals, including ISCO groups 213, 312 as well as the groups *313 optical and electronic equipment operators and 1236 computing services managers*.

Since some EU27 member states use an even broader definition for their ICT workforce, we will also present results for a **very broad definition** including all categories mentioned above plus *ISCO 724 Electrical and electronic equipment mechanics and fitters*.

5 e-Skills in Europe since the 1980s

This chapter will look at the main factors that have been influencing the demand side for e-Skills in Europe. The demand for e-Professionals is inscribed in the general, global macroeconomic environment (5.1.1). It is secondly influenced by the developments relating to the ICT industry and services sector (5.1.2) and thirdly by the repartition of the demand for ICT professionals across the economy.

5.1.1 The macroeconomic environment: a tale of expansion and recessions

Fluctuations are a common characteristic of the world's economy. Both times of recession and times of expansion are considered natural results of the economic cycle. However, the periods of slowed economic growth (recessions) have attracted heightened attention because they are characterized by a general decrease in output, income, employment, and trade. These undesired effects signal a major economic crunch that economic and fiscal policies should react to in order to avert a slump into a longer period of depression.

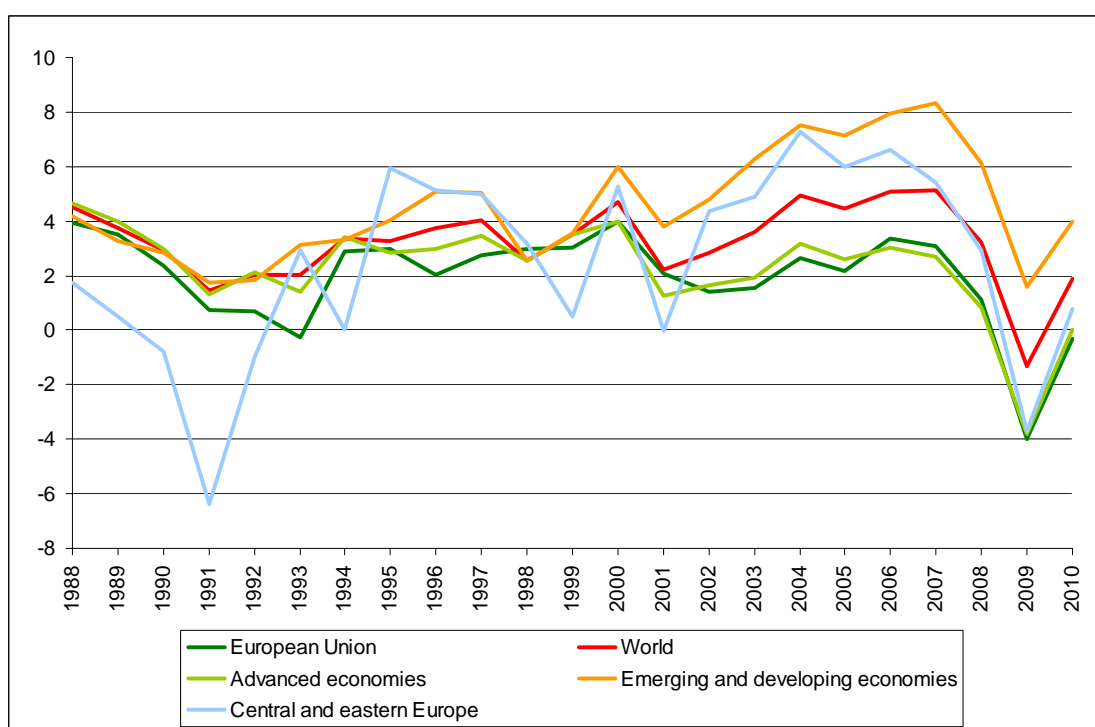
In our case, a look at past times of recession and crisis might help to better understand the situation of the global economy today, in the middle of yet another recession. A short characterization of past economic crises should help us to infer whether the global downturn will have similar or differing impacts on the demand for ICT practitioners in Europe.

A recession is a significant decline in economic activity spread across the economy, lasting more than a few months, and normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales. The most common measurement for a national recession is the one used for example for the OECD area, where a recession is considered to start in the second consecutive quarter of negative growth.

“Global recession” has until recently been defined by the International Monetary Fund (IMF) as a period where the global GDP growth rate falls below 3 or 2.5 percent³. However, according to a recent publication of the IMF (IMF 2009: 11-14), global recessions should be defined using the world real GDP per capita on the basis of PPP weights as key indicator. This would mean that during the past 50 years, four global recessions can be distinguished: 1975, 1982, 1991, and 2009.

Since the overall economy and the ICT sector in particular is changing rapidly, we will consider only the latest developments, starting with the recession in 1991. The Asian Crisis in 1997 and the dot.com bubble crash in 2001 (see Exhibit 5-1 below) do not qualify for a recession - neither on a global, nor on a Euro area scale⁴. However, they will also be shortly addressed since they impacted on the development in the ICT sector.

Exhibit 5-1 GDP annual growth 1988-2010



Source: empirica, based on IMF world economic outlook data base 2009
(<http://www.imf.org/external/pubs/ft/weo/2009/01/weodata/index.aspx>)

1991-1993

The recession during the early 1990s (1990-1993) took its starting point on the “Black Monday” in October 1987 when the Dow Jones collapsed and lost 22% in a single day. Although the US economy was able to recover from the slump, the longer term effects impacted negatively

³ “What’s a Global Recession?”; The wall street Journal, <http://blogs.wsj.com/economics/2009/04/22/whats-a-global-recession/>; „The global slumpometer“; Economist, Nov 6th, 2008.

⁴ For the Euro area a recession is defined by the Center for Economic Policy Research’s Euro Area Business Cycle Dating Committee as a „significant decline in the level of economic activity, spread across the economy of the euro area, usually visible in two or more consecutive quarters of negative growth in GDP, employment and other measures of aggregate economic activity for the euro area as a whole, and reflecting similar development in most countries.“ http://www.cepr.org/press/releases/2009/Dating_Committee_Press_Release31032009.pdf

on the savings market. The gulf war resulted in a peak in oil prices, entailing low consumption levels, high unemployment rates, government budgetary deficits and slowed GDP growth in the USA as well as in related economies. Germany and Japan were drawn into the crisis from 1991 on, when the US economy started to recover at a slow pace.

1997-1998

In the late 1990s the so called "Asian Financial Crisis" started with the financial collapse of the Thai bath caused by the government's decision to float the bath although the country was already overburdened by its foreign debt. Subsequently, the crises spread to most of South-east Asia and Japan, resulting in slumping currencies, devalued stock markets and other asset prices, and a precipitous rise in private debt. The instability of financial markets in Asia made investors apprehensive also of other developing countries that were therefore also drawn into the downturn. The powerful negative shock also sharply reduced the price of oil, causing a financial pinch for oil exporting nations. This reduction in oil revenue in turn contributed to the 1998 Russian financial crisis (Kaufman et al 1999).

2001-2003

The most recent economic crisis resulted from the burst of the so called dot.com bubble, a speculative bubble that caused a spectacular rise in equity value, especially in Internet and ICT-related domains. The novelty of the Internet companies founded at that time, in addition to widely available venture capital and rapidly rising stock prices for these so called "dot.com" companies resulted in a situation where even very risky business concepts were funded. Several events contributed to the deflation of the bubble: first, a massive sell out of high tech stocks in March 2000 triggered a chain effect and resulted in a severe dip of the NASDAQ. March 2000 also saw the announcements of the rather poor results of Internet retailers that did not live up to the expectations raised beforehand. Thirdly, in 2000 many businesses invested heavily in ICT infrastructure and maintenance in order to prepare for the Y2K switchover. This meant that in 2001 new investments in ICT were considered unnecessary by most businesses and consequently sales of ICT equipment plummeted. The attacks of September 11th, 2001 added up to the effects of the stock market crash. They caused the biggest one-week loss of the Dow Jones and undermined consumer confidence (and spending).

The subsequent recession (March - November 2001⁵) was limited in its geographic scope mainly to the United States itself, but had significant negative impacts on the ICT sector and ICT employment in Europe as well. The recovery in the USA was extremely slow with a definite and decisive rebound not earlier than spring 2003.

2008 - ?

The current recession has been sparked by a financial crisis which was caused in part by the bust of a real estate bubble in the United States. Sub-prime loan losses in 2007 exposed other risky loans and over-inflated asset prices. With the losses mounting, a panic developed in inter-bank lending. Turmoil in the banking sector spread to the real economy world wide, lead to a downturn of the housing market and a decline in consumer spending. The situation was made even more difficult by a sharp increase in food and commodity prices. Subsequently, many large and well established investment and commercial banks in the United States and Europe suffered huge losses. Some banks facing bankruptcy could only be rescued by state aids. The NBER declared a recession for the USA since December 2007, the CEPR announced a recession for the Euro Area since January 2008, and the IMF expects a global business cycle trough for 2009 based on current forecasts (IMF 2009:11). This global recession has resulted in a sharp drop in international trade, rising unemployment and slumping commodity prices. How long the crisis will last and what impact it will have on the global economy is still unpre-

⁵ (<http://www.nber.org/cycles/recessions.html>)

dictable. The IMF underlines that "the economic outlook is exceptionally uncertain" (IMF 2008:1).

2008 crisis: similar or different?

Like the current crisis, also the Great Depression of the 1930s and the minor stock-market hiccups of 1987 and 1997 have been caused by boom-bust processes in the financial sector⁶. However, a significant difference is seen in the fact that in 1987 and 1997 the crisis affected spending and investment, rather than consumption. The latest IMF statistics predict a -1.11% decline in per capita consumption for 2009, as compared to a 0.62% consumption growth during the recession of 1991, and a minor decrease of -0.18% during the 1982 recession (IMF 2009:14). The drop in consumer spending results partly from a surge in unemployment, which is expected to increase by 2.5 points in 2009.

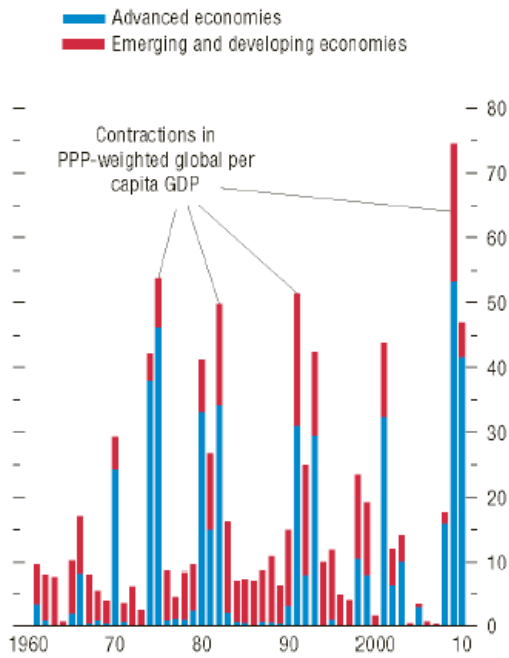
According to the IMF a novel characteristic of the current crisis is the degree of synchronicity of the current recession across countries world-wide (see Exhibit 5-2 below). This means that although growth rates in the emerging and developing countries have exceeded those in the advanced economies for the last years, (see Exhibit 5-3) they cannot fully escape the global recession because of the increased degree of globalisation. Still, the higher growth rates and softer slow-down of the economy in the developing world - as well as their greater part in global GDP (Exhibit 5-3 below) dampen the recession on a global scale.

Hopes for a fast recovery from the current recession are based on the observation that it follows on a longer period of economic growth than for instance the Asian Crisis and the dot.com crash, which suggests that although the current crisis represents a greater systemic shock, the world economy might be more resilient than before (Kelly 2009). Other, more pessimistic analysts predict a recovery that is slow, anaemic and below trend in advanced economies. They even see a growing risk of a double-dip, W-shaped, recession. Roubini (2009) cites two reasons for this risk: first, exit strategy risks related to public debt and secondly, the oil, energy and food prices that rise faster than economic fundamentals warrant.

⁶ Geoff Bertram, senior economics lecturer at Victoria University of Wellington, <http://www.salient.org.nz/features/whos-afraid-of-the-global-recession>

Exhibit 5-2
Number of Countries in Recession 1960-2010

Countries Experiencing Recessions¹
(Purchasing-power-parity (PPP)-weighted percent of countries)



Source: IMF staff estimates.
¹Data for 2009-10 are based on the WEO forecast.

Source: IMF, *World Economic Outlook*, April 2009, p. 14

Exhibit 5-3
Real GDP growth in Emerging and Advanced Economies 1980-2009

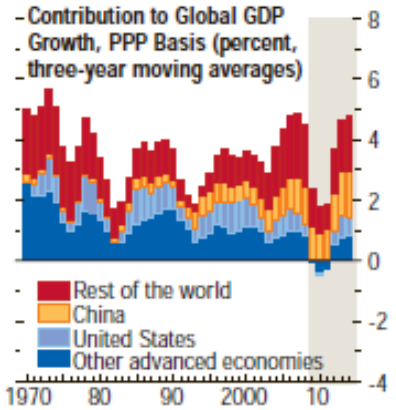
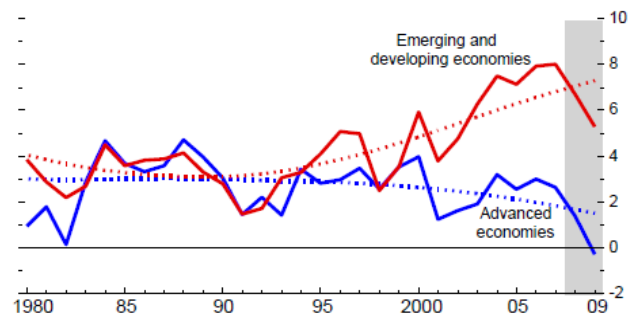


Figure 1. Real GDP Growth and Trend
(Percent change)



Source: IMF (2008) *World Economic Outlook - Update*, November 2008, p. 1.

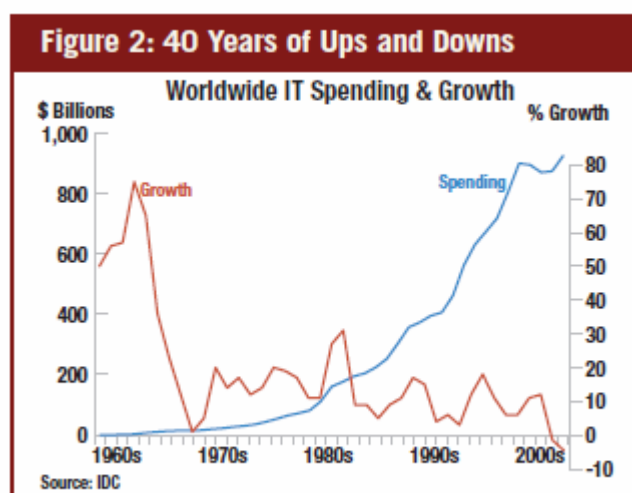
5.1.2 Bubble and Burst: The ICT sector developments

As mentioned before, the ICT sector is only one of the economic sectors employing ICT professionals. However, since it still represents close to 50% of the ICT workforce, a short definition and overview of the sector will be presented here.

The OECD member countries defined the ICT sector in 1998 “as a combination of manufacturing and services industries that capture, transmit and display data and information electronically”. Based on the international standard classification of activities (ISIC) this definition breaks with traditional sector identification in that it includes both services and manufacturing activities, the *main activity* of which is to produce or distribute ICT products⁷.

The following chapter will discuss the impact of recessions and economic crises on the ICT sector and explain the changing role of ICT for the global economy.

Exhibit 5-4 Worldwide It spending and growth since the 1960s



Source: IDC (2004): 40 years of IT. Looking back, Looking ahead.

The ICT industry is a comparably young sector that has shown an unprecedented growth since its beginnings in the 1960s. IT spending has rocketed to attain a level of about one trillion dollar around the year 2000. However, as the growth rates (see above) show, there have been periods of accelerated and periods of dampened economic growth in the ICT sector.

Growth rates in the ICT sector are related to both sector specific business sector and innovation cycle developments and the condition of the overall economy.

Long term trend

However, as the exhibit above clearly shows, there is a clearly emerging long term trend beyond business cycle developments. Much unlike in the majority of other economic sectors, growth rates have never turned negative in past recession at least until the current crisis. Therefore, the assumption of a strong long term trend (which one may want to call a Kondratiev wave) representing the structural change of modern economies towards the information sector should be maintained despite the current slump.

⁷ <http://www.oecd.org/dataoecd/34/33/2771125.pdf>

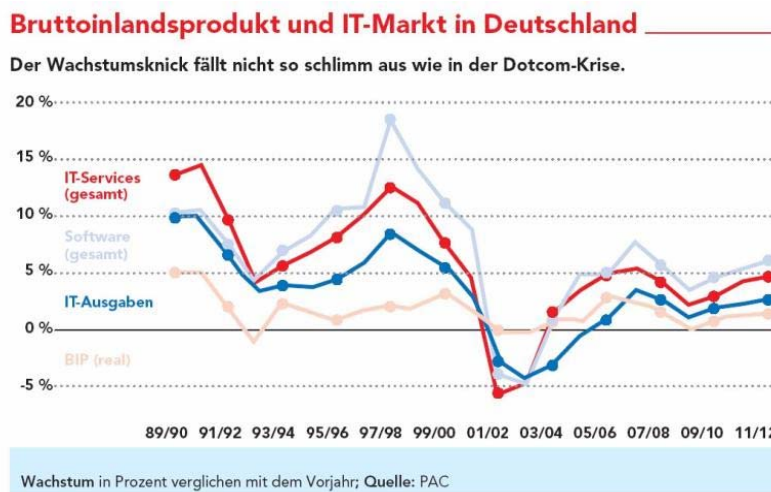
Economic cycles

The deceleration in the middle of the 1980s is interpreted by IDC as a “PC shakeout”, while the 2000/2001 downturn is termed the “Internet shakeout”. Both periods being part of a “natural” long term boom-bust cycle, the effects of the 2000/2001 downturn were amplified by the overall economic crisis as described above, while those of the mid 1980s paired with more favourable general economic conditions.

A different case is the rather short drop in ICT growth rates at the beginning of the 1990s, which is attributed mostly to the general economic recession, with boom-bust processes having no part in it. The current situation resembles the 1990s constellation in that we have a global recession which is however not paralleled by a sector-specific bust.

Using the example of the ICT industry in Germany, the Exhibit 5-5 below shows the relationship between generic economic growth (GDP in light red), and ICT sector growth (Services growth in red, all software in light blue and IT spending in dark blue). It seems that although ICT growth rates do follow general economic trends, especially during recession times, they have until now performed better than the overall economy. During the 2000/2001 crisis, when general economic hardship coincided with the sector specific Internet bust however, the ICT industry fared worse than the overall economy.

Exhibit 5-5 GDP and IT sector growth in Germany



http://www.computerwoche.de/knowledge_center/it_strategie/1883533/index3.html

(Data: Pierre Audoin Consultants)

(Red: IT-services, light blue: software, dark blue: IT spending, light pink: GDP)

How will the current crisis affect the ICT sector?

The sector

Many analysts agree in that the ICT sector will not suffer as bad as in 2000/2001 when growth rates dropped far below the overall economic growth. They argue that ICT companies today are far more consolidated than at the time of the Internet start-ups and that also the cash-credit rate is far more favourable today. Both staff and infrastructure are supposed to be on an adequate level thus preventing hidden and inefficient cost structures. Furthermore, business models of the IT services industry have become more mature and are rooted much more deeply in the day-to-day business of the rest of the economy than it was the case in the hype phase of the late 1990's, in which the IT industry was at least partly detached from the developments in the “real” economy.

The economy

In comparison to recession at the beginning of the 1990s, the recovery of the ICT sector from the current recession is expected to be slower and take longer in accordance with a slow general upturn due to the extraordinary extent of the global recession. Being much more deeply integrated into the "old" economy nowadays thus means also that the economic destiny of the ICT sector is more closely related to the general economic cycles.

The relationship

The recession impacts on the ICT sector in two ways:

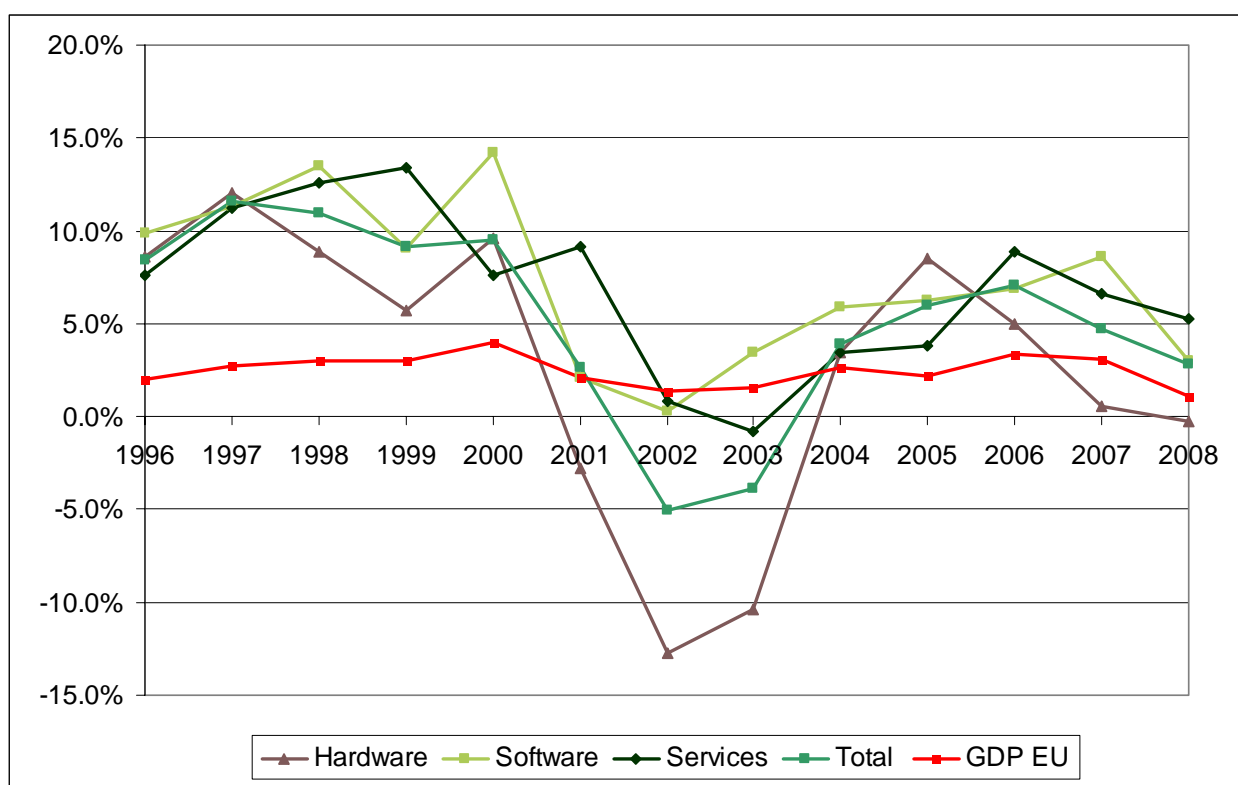
With relation to consumer spending the impact is most likely negative: consumer confidence and consumer spending dropped sharply since 2008, resulting in major downward pressure on ICT goods expenditure (OECD 2009b:6).

The use of ICT for business processes could be influenced in two contradictory ways: First, there are those that argue that ICT spending today, like in 1992/1993, is seen as a strategic tool to enhance efficiency and productivity in order to escape the crisis. In addition, as an integral part of most businesses processes, IT is essential enough not to be one of the first areas for budget cuts. These arguments would suggest a rapid recovery of at least certain parts of the ICT sector, such as business services. Other analysts however evoke fears that businesses will rather react as they did after the dotcom-crisis, seeing ICT equipment and services only as additional costs that have to be cut down. This reasoning would entail the downscaling of businesses' ICT costs. The use of ICT would shift from "change the business" to "run the business"⁸.

In any way, the long-term outlook for the ICT sector seems not so gloomy. In its most recent assessment, the OECD indicates that although ICT growth slowed down rapidly in 2008, first signs of a potential recovery could already be detected in mid-2009 (OECD 2009b:4).

⁸ source: www.computerwoche.de/1883533

Exhibit 5-6 EU27 Historical growth of ICT spending and GDP in the EU27



Sources: IT spending: IDC, GDP: International Monetary Fund, World Economic Outlook Database, 4/2009

5.1.3 Outsourcing and Off-shoring

A common measure for companies to reduce cost is to outsource those activities that can be carried out more efficiently by an external supplier - either due to specialisation or because of economies of scale. Outsourcing becomes particularly attractive in times of crisis when cost-cutting is a priority.

These external suppliers can be located either in the same country - then called domestic outsourcing, or in another country - then called international outsourcing or "offshore outsourcing". For the current study national outsourcing is not of interest, since its impact on the size of the ICT professional workforce is negligible because jobs are transferred only inside a country, with little change in the overall demand⁹.

Off-shoring, however, will have a significant impact on the ICT employment since it means that both business processes and the jobs related to these are moved from one country to another. Off-shoring can take place both as "Offshore outsourcing" or as "international insourcing" or "Internal Off-shoring". Internal Off-shoring is for example when a multinational company shifts tasks from a branch located on one country to another branch located in a different country. Off-shoring enables companies to profit from the specific advantages of a certain location, be it labour costs, the availability of skilled staff or the advantage to be gained though working in different time zones.

⁹ Due to the above mentioned advantages of outsourcing, the overall demand might turn out slightly lower than in an economy without the possibility of outsourcing ICT services. More importantly, it might impact on the working conditions of ICT professionals since external ICT service providers strive to keep their actual workforce as close to actual demand as possible, this might result in an important number of ICT professionals with insecure, temporary work contracts (some evidence for this for the case of France: /www.munci.org, http://recruteurs.apec.fr/resource/mediatec/domain1/media26/14706-bwmey1x5f7f.pdf)

Manufacturing has been off-shored for a longer time already, the main destinations being China and other Asian countries, but with Eastern Europe and Mexico catching up in importance. Today those destinations are also the main areas for the off-shoring of ICT manufacturing since they offer lower assembly costs (see OECD 2008:31-35).

For the service sector, off-shoring is a more recent phenomenon since a certain level of ICT infrastructure is needed as a prerequisite to offer services over a longer distance. This means that virtually all services that are off-shored relate at least indirectly to ICT (ICT-enabled). During the last years, India has emerged as the number one location for the off-shoring of ICT or business services, due to its large English-speaking workforce and relatively high level of ICT infrastructure and ICT professionals.

What kind of activities is off-shored? Although it is difficult to measure off-shoring (OECD 2005), a look at trade balance sheets shows that Europe a) imports more ICT goods and exports more ICT services and b) it exports more expensive ICT products and services and imports less expensive goods and services. Meijers et al (2008:3) deduce from this that Europe is more likely to off-shore mature products and services with lower profit margins while exporting rather innovative and new products and services. When related to the workforce this would mean that European ICT professionals need more ICT service than manufacturing skills. Overall Europe needs highly skilled ICT professionals that can contribute to innovation, research and development.

The main destinations of European ICT off-shoring are difficult to trace. However, an OECD report suggests that a larger part of European off-shoring goes to other European destination, inside or outside the European Union (OECD 2005:22). When asking for the destinations of service off-shoring, the issue of language skills has to be taken into account: this means that for Germany, some eastern European countries might be preferable while France might rather offshore to North Africa or other francophone countries, with the UK again having other preferences (India or Ireland where off-shoring was flourishing in the 1990s).

The effect of off-shoring on the labour market in the countries from which off-shoring originates is even more difficult to capture than the extent of off-shoring itself. The OECD (2005:10) suggests that at least for the USA, job losses due to off-shoring are small in comparison to total annual job turnover. Especially in the services sector, impact on the employment remains unclear since during the same period of time when relocations have taken place, service sectors have expanded, new services have been created and - in theory at least - efficiency gains of companies off-shoring services will also contribute to overall growth and further job creation in the originating countries (OECD 2005:10).

The future development of off-shoring activities depends on several factors: the availability of skills in the offshore destination countries, the labour costs there and also more generally on whether or not services are suitable to be provided from a distance. Anecdotal evidence about British companies re-locating their services from India to Great-Britain points to the fact that "service from a distance" will not work out in all cases. Besides this, the following country reports about the supply and demand of ICT skills point out that both in China and India, a shortage of well educated and highly skilled ICT professionals might arise in the near future, especially since local demand will be competing with offshore demand (McKinsey 2005: 20). In India in addition, wages have increased substantially, thus lowering its appeal for ICT companies looking for destinations with low labour costs. These developments might lead to smaller countries gaining larger shares of the offshore business, especially "nearshoring" locations that can benefit from language skills and/or relative proximity. A recent survey (IDC 2009:1) suggests that at least during the next 12-24 months, off-shoring might experience an stronger upturn than it would have been the case in more favourable economic conditions. If such a strong shift to offshoring really takes place, it is feared that this might then entail a throughout restructuring of the offshore-onshore markets.

India -e-Skills demand and supply match and a shortfall in qualified ICT professionals

Supply

No reliable data on the number of IT professionals exist for India. We therefore need to rely on the statistical data on graduates from Computer Science and related subjects.

The number of graduates in "Computer Science, Electronics, Telecoms" has increased from 126,000 in 2002/03 to 193,000 in 2006/07. Around 57% of these have in 2002/03 as well as in 2006/07 entered the workforce and become IT professionals. The absolute figures are 72,000 in 2002/03 and 109,000 in 2006/07. NASSCOM provides data on the number of graduates from other disciplines who have become IT professionals. This in 2006/07 includes 40,000 non-IT engineers and 30,000 from other disciplines. Adding up these figures we end up with almost 180,000 graduates from universities who have become IT professionals in 2006/07 as opposed to 147,000 in 2002/03.

India seems to have a problem in terms of quality of IT education. Experts predict severe shortage of competent faculty in computer science. The U R Rao Committee (Report on Technical Education 2004) stated that India would over the coming 3-4 years need at least 10,000 and up to 26,000 PhDs in engineering to ensure quality education of engineering and IT students. In 2005-06, which is the last year for which data is available, India produced 1058 doctorates in engineering and technology only. This means that there will be a serious shortfall in qualified education personnel.

According to a McKinsey survey from 2005, only 25% of the Indian engineering graduates come up with the e-skills required to make them employable in multinational companies (McKinsey Global: The Emerging Global Labor Market Part II, 2005, p.14).

Demand

For India, no data is available on the number of ICT professionals. As a very rough indicator of the size of the ICT sector at least, some sector data is available: According to FICCI (Federation of Indian Chambers of Commerce and Industry), the number of employees in the IT Sector in India has increased from 284,000 in 1999/2000 to 2,236,614 in the year 2008/09.

It is not clear whether or not demand and supply of ICT professionals in India meet or not. However, according to a survey conducted by McKinsey, the wages for IT jobs in India have soared from 2000 until 2004, a fact that usually hints at a demand that exceeds supply. In any case according to the above mentioned lack of qualified education personnel, the lack of sufficiently qualified ICT professionals seems to be a threat looming over the otherwise prospering ICT sector in India.

(Rajesh Kumar from AUUM Research and Analytics has contributed to this report as National Correspondent for India)

China – e-Skills supply and demand match and poor education level of ICT professionals

Supply

There is no data or statistical source on the number of IT practitioners available in China. It was decided to take the professional personnel in information transmission, computer services and software from 2003 - 2007 as a proxy indicator. Using this data empirical evidence exists on a strong increase of the number of IT-related jobs and occupations in China from 411,000 in 2003 to 569,000 in 2007.

The supply of ICT practitioners, as measured by the number of engineering graduates and students in higher educational institutions in “Electronics & Information” has increased 10 times over the past 10 years and today is accounting for around 50% of all students in this area as opposed to 25% a decade ago. (1997: 69,840; 2006: 711,412). A similar development occurred with respect to student enrolments in this area with a 9-fold increase over the last decade (1997: 98,157; 2006: 912,063) accounting for 46% of all students in this areas as opposed to 26% a decade ago. (Note: “students in Electronics & Information” can only be seen as a very rough proxy indicator to shed some further light on the supply situation with respect to IT practitioners but should not be mistaken as a hard indicator for this)¹⁰. When taking data from other sources (Note: data is restricted to the Province of Shanxi) it becomes apparent that overall the supply of IT practitioners (here IT practitioners in the narrow sense and not students from the much broader category “electronics & information”) from universities in general has dropped, while the supply from universities with high quality education remains stable. This means that without any drastic policy changes, the supply of ICT practitioners from universities will remain stable or even decrease in the future¹¹.

Currently, IT staff in Chinese enterprises on average has low education levels. In 2005 almost 70% have education levels other than Master, Bachelor or PhD, which means that they most likely hold sub-baccalaureate degrees. Training programs can be seen as a means to improve skills levels. However, Chinese enterprises do not offer sufficient training for IT staff, compared to business staff and managers. The percentage of IT spending allocated for training in 2004 was 5.5%. In the USA companies on average spend about 40% of their IT budgets on personnel (compensation and training). This rather low level of education and lack of e-skills is underlined by a McKinsey study from 2005 (McKinsey Global: The Emerging Global Labor Market Part II, 2005, p.14) where it says that only 10% of Chinese engineering graduates are esteemed employable for multinational companies.

Demand

Chinese enterprises indeed demand IT practitioners. In 2005 between 30% and 46% of Chinese enterprises claim the need for IT professionals of different type.

Lack of IT professionals is widely recognised as a critical problem by Chinese enterprises. According to a survey of 300 CIOs in 2008, 96% of CIOs reported that “lack of IT professionals” is a problem for their companies.

A quantification of demand is not possible since the necessary data for such calculations do not exist.

(Sean Xu from Hong Kong University of Science and Technology has contributed to this report as National Correspondent for China)

¹⁰ In terms of reliability of this data one needs to bear in mind that the aggregate numbers were obtained by adding the numbers of “engineering graduates” as reported by different provinces. These provinces were not required to report these degrees by major and further there was no standard definition of engineering between the provinces.

¹¹ According to Sean Xu from Hong Kong University of Science and Technology, the national correspondent for China for this study, the drop in one province (here Shanxi) is a reasonably good proxy for the whole country.

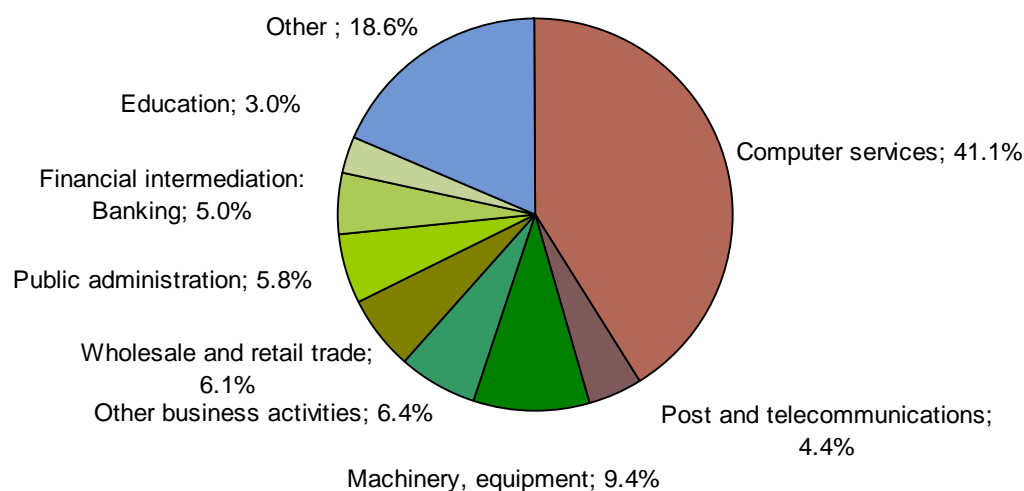
5.1.4 The diffusion of ICT professionals across the economy

The expansion of ICT across many different industry and service sectors went along with the creation of “new” economic activities such as Internet retailing and the integration of ICT into “old” business processes, resulting in a new, digital “Knowledge Economy”. This dispersion of ICT use across all economic sectors is mirrored by the employment of ICT professionals across the economy.

Looking at the computer professionals and computer associate professionals in the EU27 member states in 2007 split by industry, it becomes clear that only around half (45.5%) of the IT professionals in Europe work in the core IT industry, i.e. NACE Rev.1 groups 72 (Computer Services) and 64 (Post and Telecommunications). That means that the majority of IT professionals, or 54.5%, today are working in IT user industries.

Depending on how one aggregates NACE divisions, the most important employers in the IT user industries are manufacturers of machinery and equipment, business services, distribution (wholesale and retail trade), public administration and the financial sector.

Exhibit 5-7 Computer professionals and associate professionals in the EU 27 workforce 2007



Computer professionals and associate professionals in workforce			
NACE	Sector		%
IT-industry			
72	Computer services	1,554,200	41.1%
64	Post and telecommunications	167,600	4.4%
IT user industry			
29-37	Machinery, equipment	354,900	9.4%
74	Other business activities	241,300	6.4%
50-52	Wholesale and retail trade	228,800	6.1%
75	Public administration	220,500	5.8%
65	Financial intermediation: Banking	189,300	5.0%
80	Education	114,500	3.0%
	Other	705,800	18.60%
Total		3,776,900	100%

Source: Eurostat LFS 2007(made available on request by Eurostat)

6 Supply and Demand of ICT professionals in Europe

6.1 Status Quo

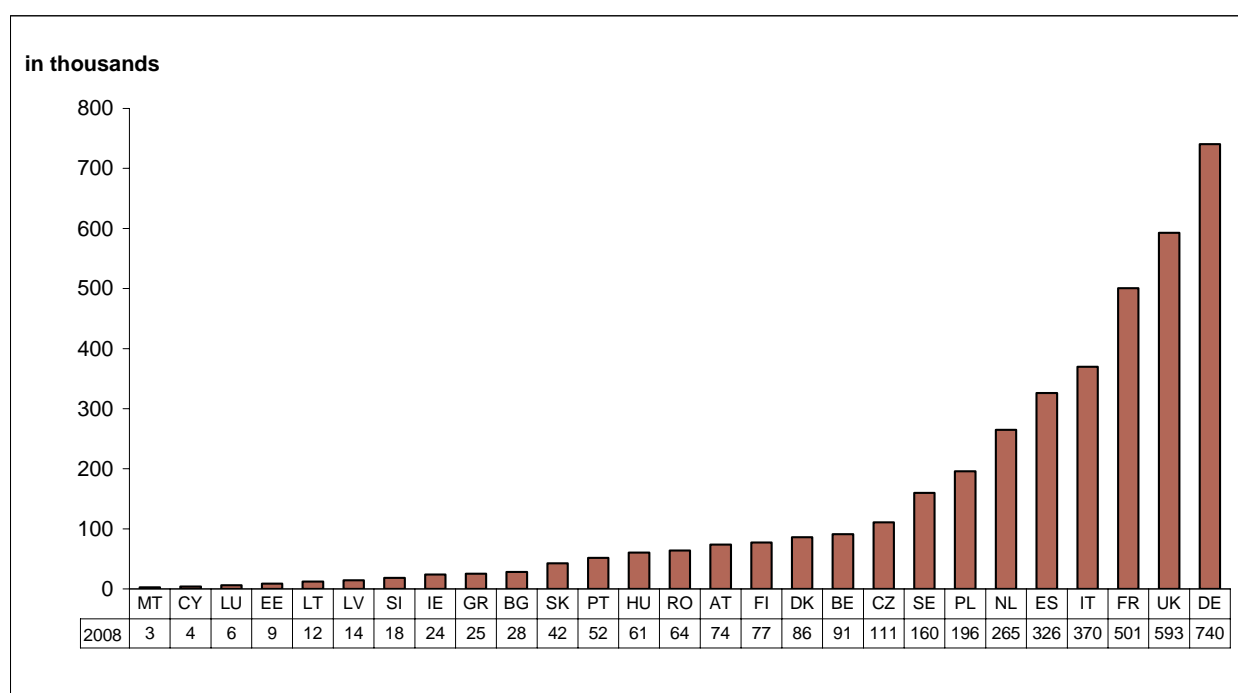
6.1.1 ICT professionals in the workforce

The number of ICT professionals in employment represents the realised demand and indicates therefore the point, where demand and supply meet.

In 2008, the total number of ICT professionals in Europe amounted to roughly 3.95 million according to the core definition, ca. 4.78 million according to the broad definition and around 7.03 million according to the very broad definition.

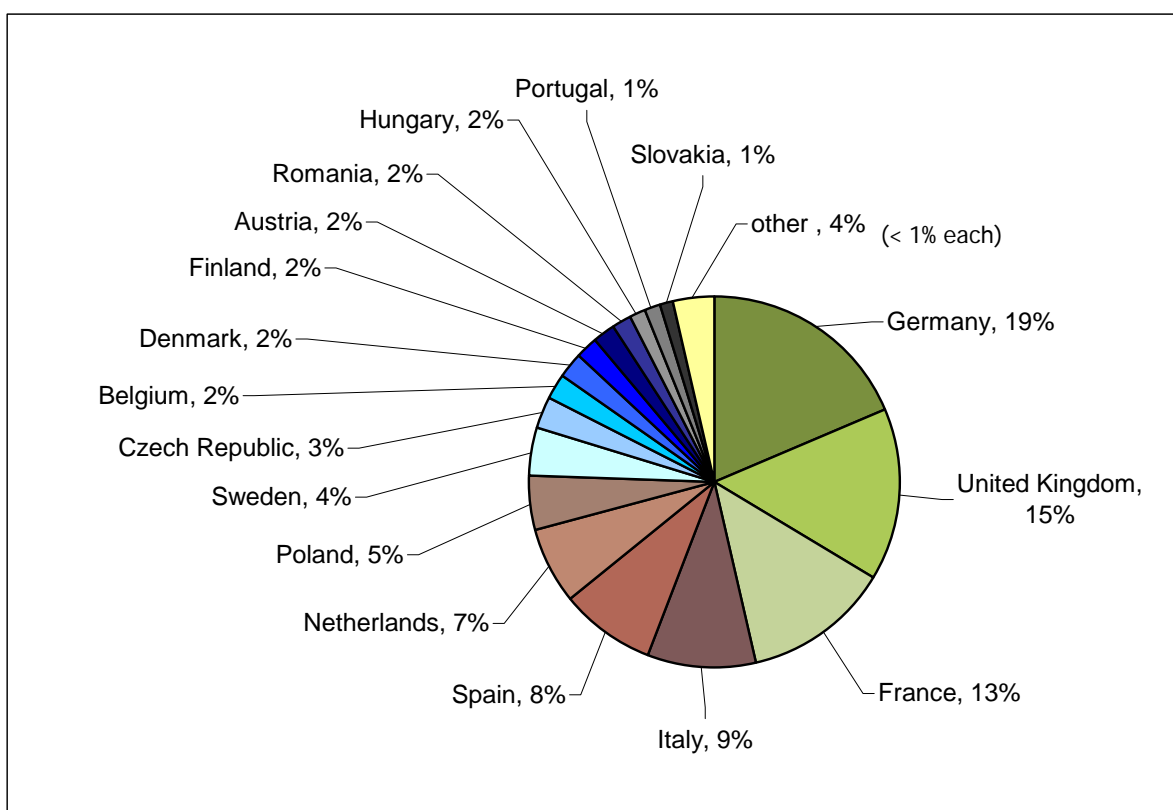
Exhibit 6-1 below displays the repartition of the ICT workforce (ISCO 213,312) across the EU27 Member States. The four largest countries, Germany, UK, France and Italy come up with more than half of Europe's labour force, and the seven largest employer Member States (adding Spain, the Netherlands and Poland) account for around 75%.

Exhibit 6-1 ICT workforce in the EU27 by country



Source: Eurostat labour force survey, data made available upon request

Exhibit 6-2 ICT professionals in EU 27 Member States 2008 (Core) in %



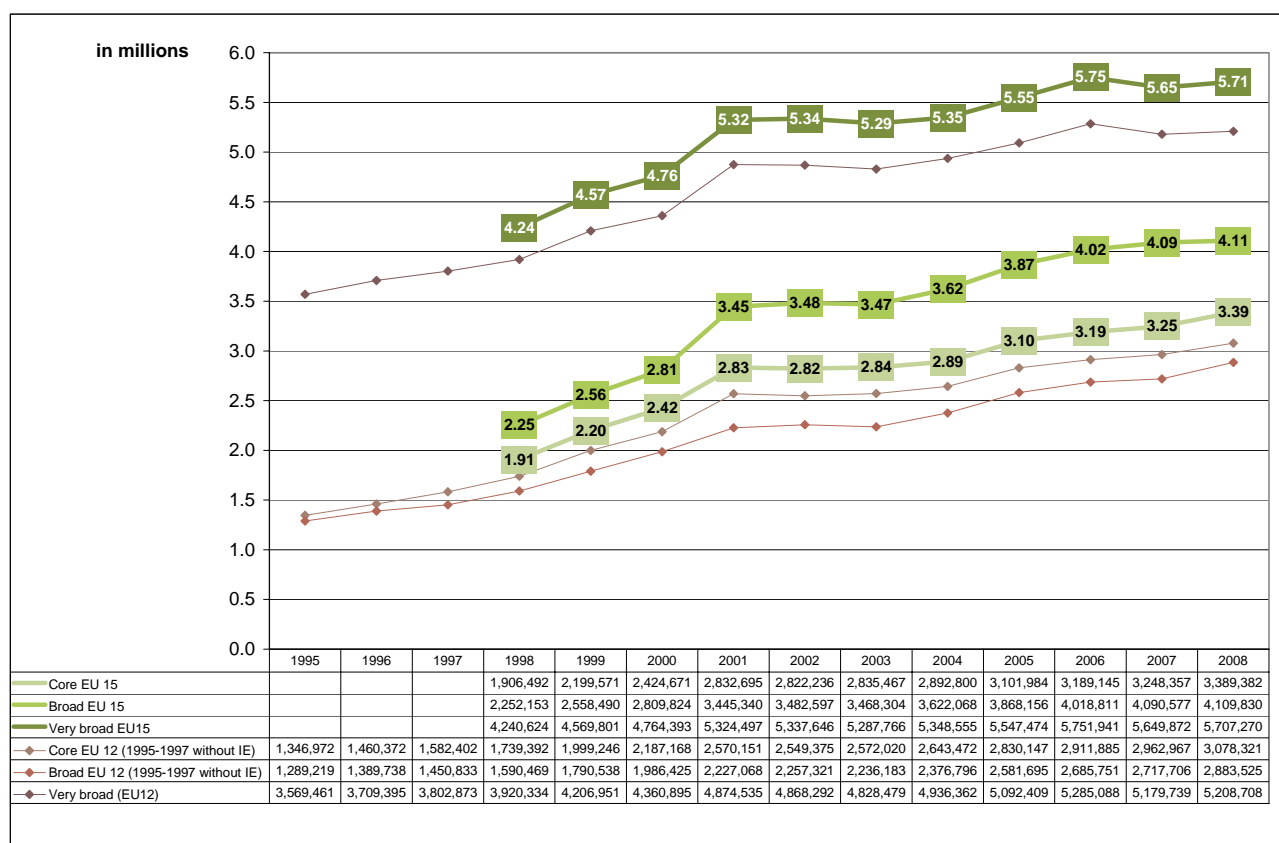
Source: Eurostat Labour Force Survey, data made available upon request, own calculations

The timeline shows a clear trend: since the mid 1990s. The number of ICT professionals in the EU27 member states has been on the rise - regardless of the definition used (see Exhibit 6-3 below). The number of ICT professionals according to the Core definition has more than doubled since 1995 to reach 4 million in 2008. According to the very broad definition, the workforce has also increased to reach 7 million in 2008.

For those countries where we can trace the longer term development (EU12 and EU15) see below), the workforce has increased between 1998 and 2008 by around 77% for the core category, by around 82% for the broad category and only by around 33% for the very broad category (see Exhibit 6-3 below). Hence it becomes apparent that the increase of the ICT workforce is due to the core and broad ICT workforce (ISCO 213,312, 1236 and 313), while the number of workers classified according to ISCO 724 (electronic equipment mechanics and fitters) has actually been declining by about 400.000 from 1998 to 2008. The dynamic developments in the IT labour market therefore should be sought in the core segments.

The increase according to the broad definition follows by and large the development of the core definition, with the exception of the year 2000-2001, suggesting that during these years employment in the ISCO groups 313 and 1236 has increased more rapidly than in the core groups 213 and 312.

Exhibit 6-3 EU12 and EU15 ICT workforce 1995-2008



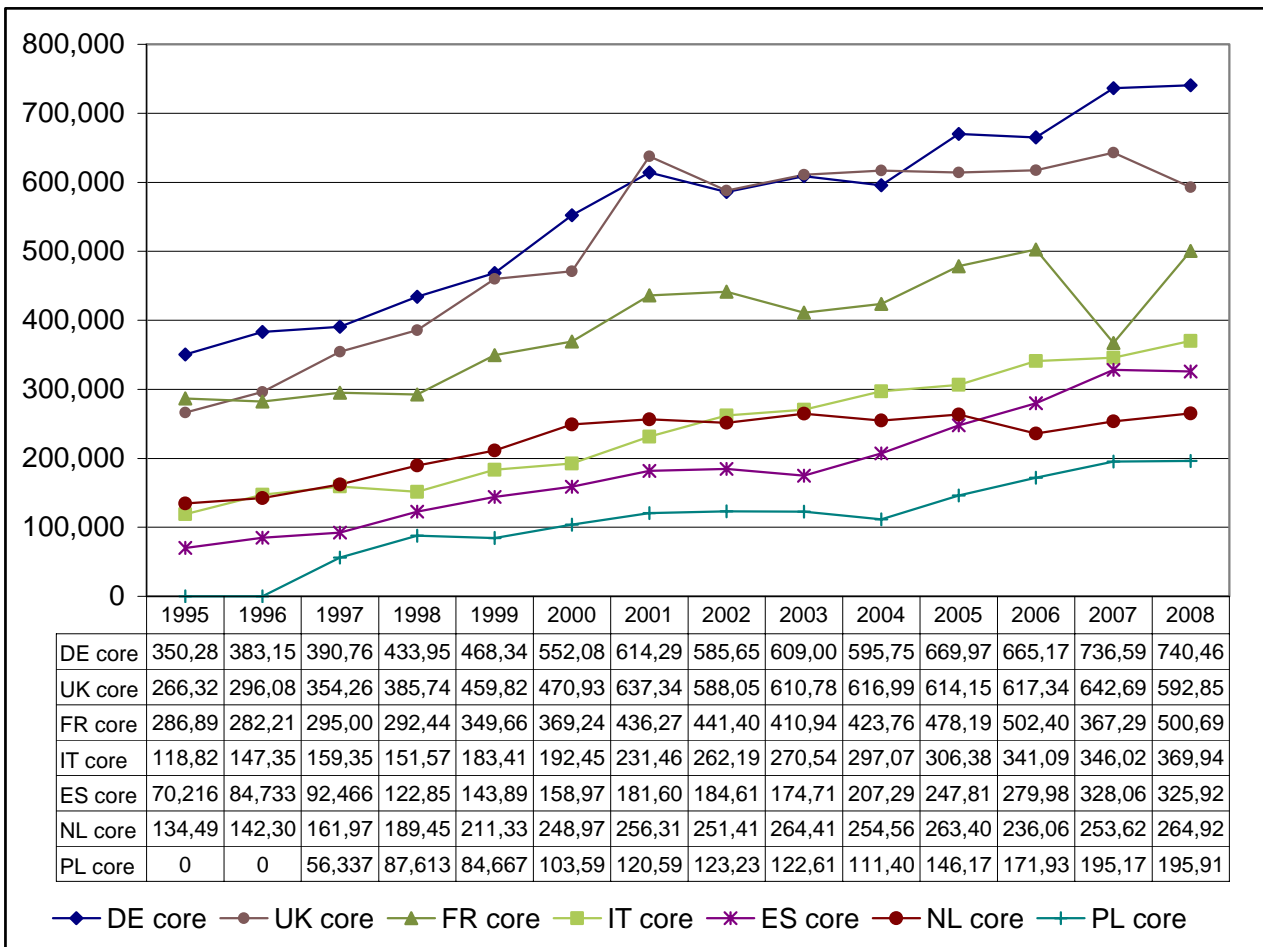
Source: Eurostat LFS, data made available upon request, own calculations

Core= ISCO 213+312, Broad = 213, 312, 313+1236, Very Broad = 213, 312, 313, 1236 + 724

EU 12= BE, DE, DK, ES, FR, EL, IE, IT, LU, NL, PT, UK; EU 15 = EU 12+ AT, SE, FI

Exhibit 6-4 above shows that on a national level, the number of ICT professionals varies in accordance with the characteristics and changes of the national economy. The changes in the national workforces according to the broad and very broad definitions fluctuate accordingly, with very few exceptions (i.e. for the UK 2000/2001, see Annex 9).

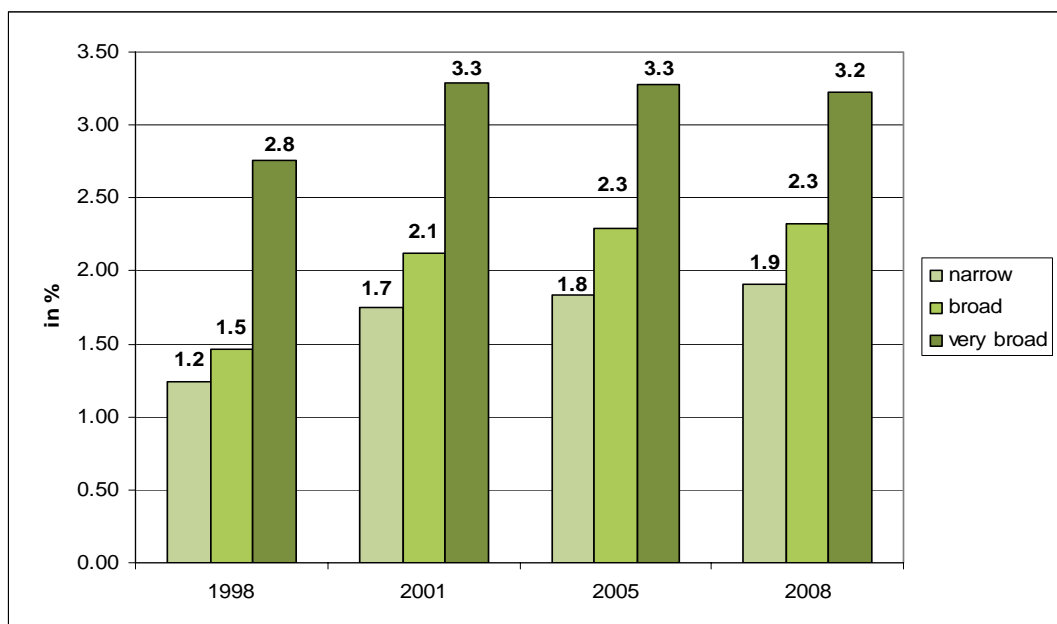
Exhibit 6-4 ICT labour force in the seven largest markets (Core definition)



Source: Eurostat LFS (made available on request by Eurostat)
 (See Annex for Broad and Very Broad definition)

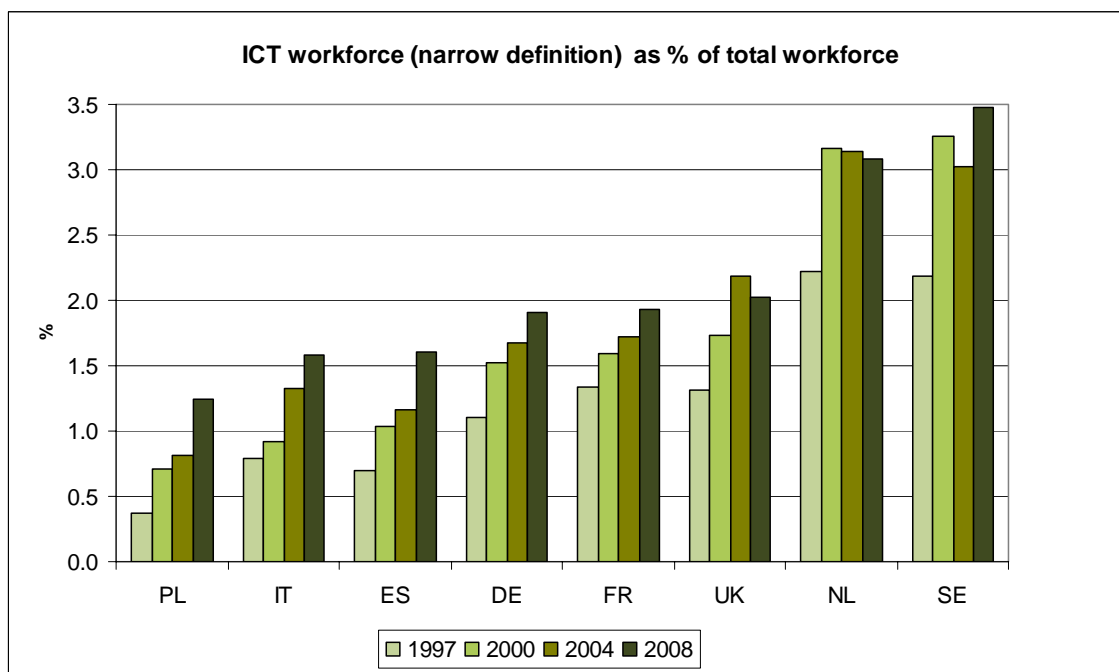
The rise in the number of ICT professionals might either result from an overall increase in workforce number, or point to the growing importance of ICT professional skills for the overall economy. Exhibit 6-5 below shows that in the EU 15 there has actually been an increase in ICT professionals in comparison to the overall employment: Not only has the absolute number increased substantially, but also the share of ICT professionals in comparison to the overall workforce. For the EU15 on average, the share has risen from 1.2% in 1998 to 1.9% in 2008 using the core definition, and up to around 3.2 % for the very broad definition. This is in line with estimates by the OECD that in the OECD countries the ICT specialists represent a significant part of the workforce with around 3-4% of total employment in 2008 (OECD 2009:14). The EU 15 averages for 2008 amounted to 1.9% of the workforce (core definition), 2.3% of the workforce (broad definition) and 3.2% (very broad definition). The Exhibit 6-6 illustrates the expansion of the share of ICT professionals for the seven largest ICT markets plus Sweden as the country featuring the largest share of ICT professionals in the workforce.

Exhibit 6-5 EU 15 ICT workforce as % of total workforce 1998-2008



Data source Eurostat labour force survey, data made available upon request, own calculation

Exhibit 6-6 ICT workforce as % of total workforce for the seven largest markets and Sweden 1997 - 2008



Source: Eurostat Labour force survey, own calculations
(See Annex for Broad and Very Broad definition)

The highly dynamic development of the core ICT professionals contrasts with the employment in the ICT sector: For the OECD countries the share of ICT sector employment as percentage of total business sector employment stagnated from 1995 until 2006 at around 5.5%. Rises in ICT services sector employment did not outbalance employment losses in the ICT manufactur-

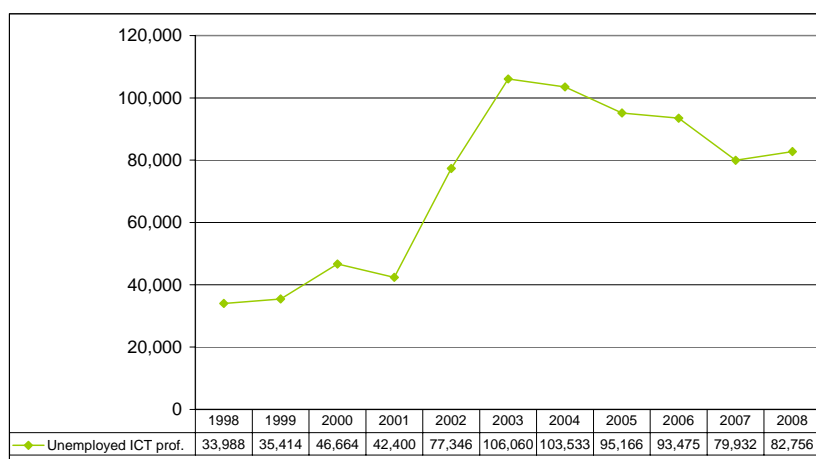
ing employment (OECD 2009:13-14). These numbers underline the argument of chapter 4 to differentiate between employment in ICT occupations and employment in the ICT sector.

6.1.2 Unemployed ICT professionals

Not all persons with ICT professional skills are part of the active workforce. At any time, a certain number of ICT professionals are out of work. There are different reasons for an ICT professional to become unemployed: First of all, the unemployment might be frictional, caused by time gaps between for example graduation and the integration into the workforce, or the time required to find a new employer after being laid off. Frictional unemployment is a naturally occurring phenomenon that cannot be avoided. Since it is a time lag effect, it can be neglected when looking at the demand and supply of ICT professionals. On the other hand, however, unemployment might also result from imbalances in demand and supply of ICT professionals, which might be quantitative (not as many ICT professionals needed), or qualitative (the ICT professionals available not having the skills and qualifications required by employers). It is very difficult to distinguish between the two types of unemployment. However, very high percentages of unemployed and/or rapidly rising unemployment numbers seem to point rather to a quantitative mismatch between supply and demand.

Since national unemployment statistics differ dramatically with regard to the calculation methods, we chose to look at the numbers given by the Eurostat labour force survey instead. We calculated the specific unemployment rate for core ICT professionals in Europe (EU15, data for Fr and NL not available, for SE only since 2003) by dividing the number of unemployed classified according to ISCO categories 213 and 312 by the total workforce in these categories (employed and unemployed). The resulting timeline (see Exhibit 6-7 below) supports the message drawn from the employment data: at the end of the 1990s, the dot.com frenzy prompted high demand of ICT professionals and consequently unemployment rates were down to only 2-3% of the ICT professional workforce. As a result of the crash in 2001, unemployment numbers surged by more than 150% to attain a total of more than 100.000 and a record percentage of 4.7%. Since then unemployment rates have levelled off to a low 3% which corresponded to around 80.000 ICT professionals in 2008 in the EU 15 (without FR and NL).

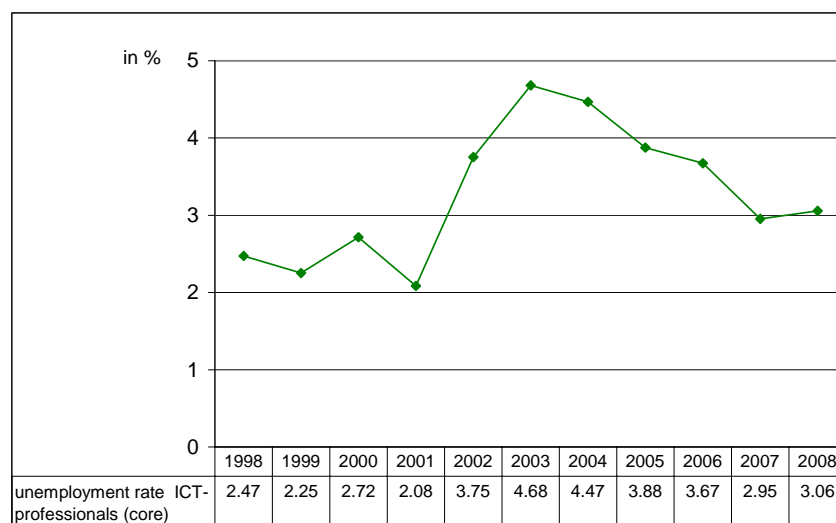
Exhibit 6-7 Unemployed ICT professionals EU15 1998-2008



Source: Eurostat Labour force survey, own calculations

Core = ISCO 213, 312; EU 15 = BE, DE, DK, ES, EL, IE, IT, LU, PT, UK, AT, SE, FI (until 2002 without SE, all years: without NL and FR)

Exhibit 6-8 Unemployment rate ICT professionals (core definition) EU 15 1998-2008

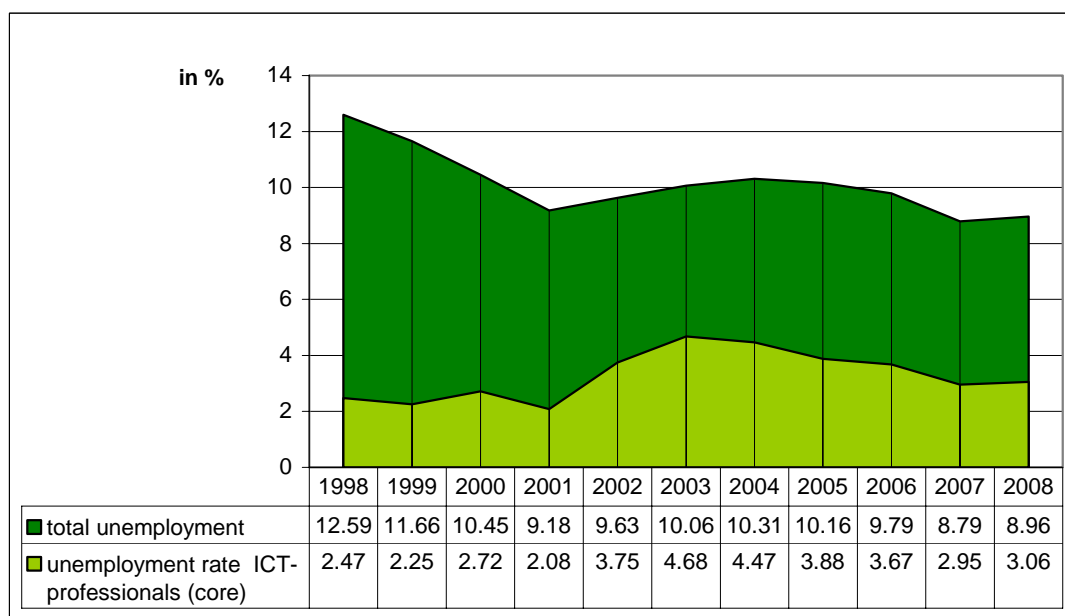


Source: Eurostat Labour force survey, own calculations

Core = ISCO 213, 312; EU 15 = BE, DE, DK, ES, EL, IE, IT, LU, PT, UK, AT, SE, FI (until 2002 without SE, all years: without NL and FR)

However, it is important to note that ICT specific unemployment has stayed way below total unemployment rates at all times (see Exhibit 6-9 below). Only during the sector specific crisis between 2001 and 2003 has the ICT unemployment rate increased faster than the overall rate. Even at its peak however, it stayed below 50% of the total rate. On average, during the last ten years the ICT workforce unemployment rate was around 36% of total unemployment.

Exhibit 6-9 Unemployment rate ICT professionals Core EU15 from 1998 - 2008



Source: Eurostat Labour force survey, data made available on demand, own calculations

Core = ISCO 213, 312; EU 15 = BE, DE, DK, ES, EL, IE, IT, LU, PT, UK, AT, SE, FI (until 2002 without SE, all years: without NL and FR)

6.1.3 ICT employment in times of crisis – past and present

Concerning ICT sector employment, the OECD member states display a pattern similar to the trends described above: employment rises until the crash in 2001, bottoms out much later in 2003-2004 to rise again at a slower pace afterwards. Consequently, the OECD concludes that during the current crisis ICT sector employment might be similarly slow to recover, even if the structural causes of the crisis are different from those in 2001 (OECD 2009a:3). More generally, it is clear that the labour market reacts slower to financial turmoil than the financial markets itself, especially in Europe where the labour market is more regulated than in the USA (Economist, August 6th 2009: "The sun also rises"). This means that, although general unemployment has only risen by 2% in the Euro zone from January 2008 until June 2009, worse might still be to come. For the ICT sector it seems that employment in ICT manufacturing is experiencing a clear decline, while ICT services employments is less vulnerable and holding up a little better (OECD 2009a:4-5), thus confirming the general impression that in Europe ICT service employment is faring better than ICT manufacturing .

For ICT occupations the unemployment rate rose only very slightly in 2008, but will increase most probably in 2009 in line with the general unemployment. Nevertheless, since the current crisis is not related in particular to the ICT sector it seems reasonable to assume that the unemployment of ICT professionals will most probably not increase above the threshold of around 40-50% of the general unemployment rate.

The scope of ICT professional unemployment in the EU27 will depend on

- the situation of the general EU27 economy and the worldwide economy (see chapter 5.1.1),
- the situation of the ICT sector in the EU27 countries (see chapter 5.1.2),
- the use of ICT across the economy: either considered as an additional cost factor or as a means to solve the crisis by increasing productivity and innovation (see chapter 5.1.2 - the relationship) and
- the implementation of governmental economic stimulus packages involving the promotion of the use of ICT across the economy and/or the ICT sector in particular.

In the long term, the OECD supports the idea that the share of ICT professionals in relation to the overall employment might continue to rise, even if in the short-term future the absolute number of ICT professionals might decrease due to the recession (OECD 2009a:14).

6.2 e-Skills Supply

6.2.1 Students and Graduates

Computer science graduates are the first and most relevant "inflow" contributor. This inflow can be measured by looking at the number of new computer science graduates on an annual basis.

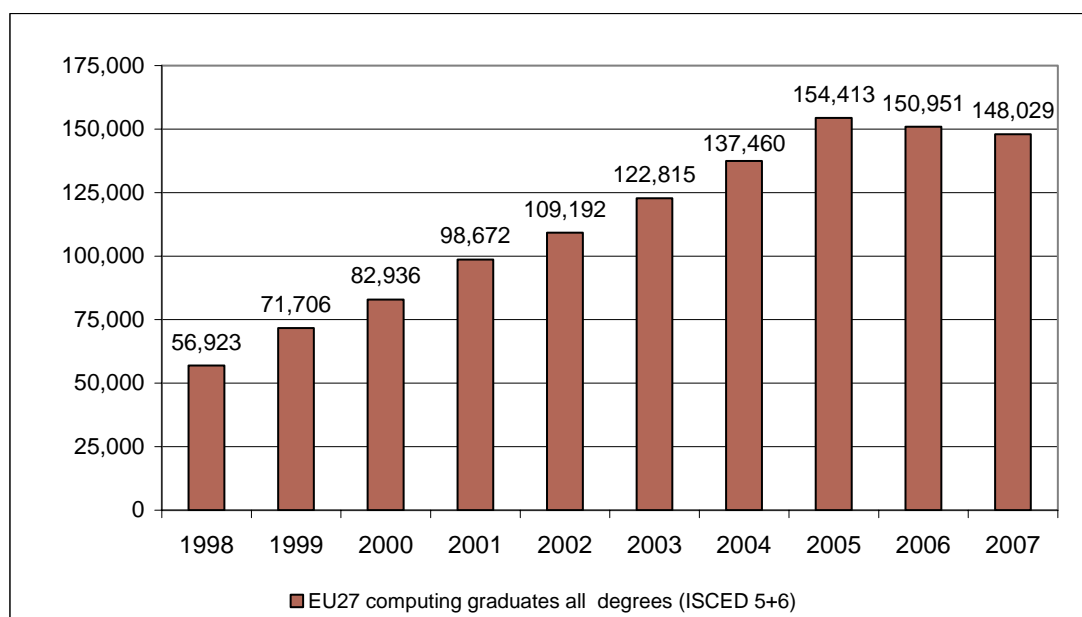
a) How many "new" and additional ICT professionals?

The absolute number of computer science graduates in the EU member states can be used for estimating the output of ICT professionals per year. However, they are less useful for comparisons across the EU Member States or over time. Although the Bologna process has contributed to a convergence of higher education in Europe, some substantial differences between the countries still persist,

- for example concerning the percentage of the particular age group participating in higher education, or
- the distribution between tertiary (higher) education and advanced secondary, professional ICT education.

The number of computing graduates measured as the total of tertiary graduates (first, second and third degree, occupational and academic occupation) has risen constantly since 1998 until its peak in 2005. Since then, the total number has slightly decreased by 6000 to reach a total of around 148.000 computing graduates in 2006 (see Exhibit 6-10 below).

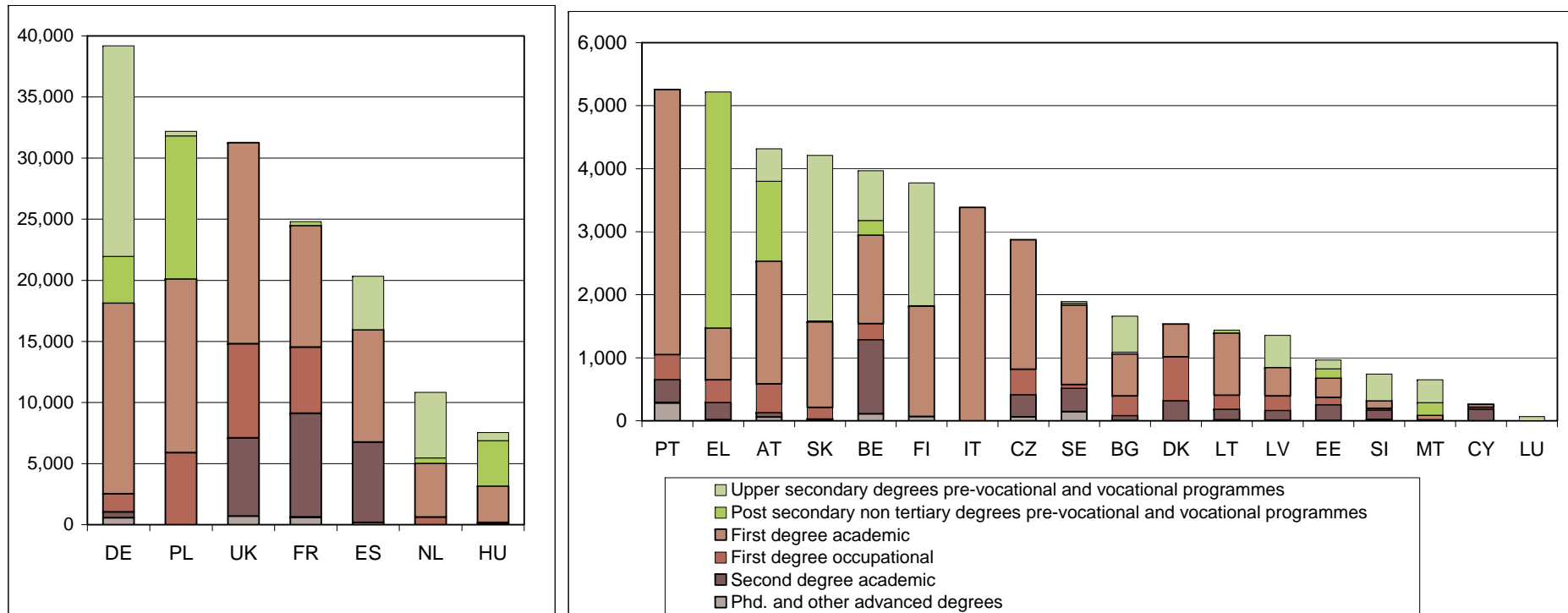
Exhibit 6-10 Total number of computing graduates EU27 1998-2007



Source: Eurostat database (educ_grad5)

There are also computing graduates from non tertiary courses that might enter the workforce as ICT professionals. Depending on the characteristics of the national education these graduates might contribute a significant share to the total degree holders in computing courses. This holds true especially for Germany and Poland, as well as Hungary (see Exhibit 6-11 below).

Exhibit 6-11 Total computing graduates in European countries (ISCED 3-6) in 2007



Source: Eurostat database (own calculation)

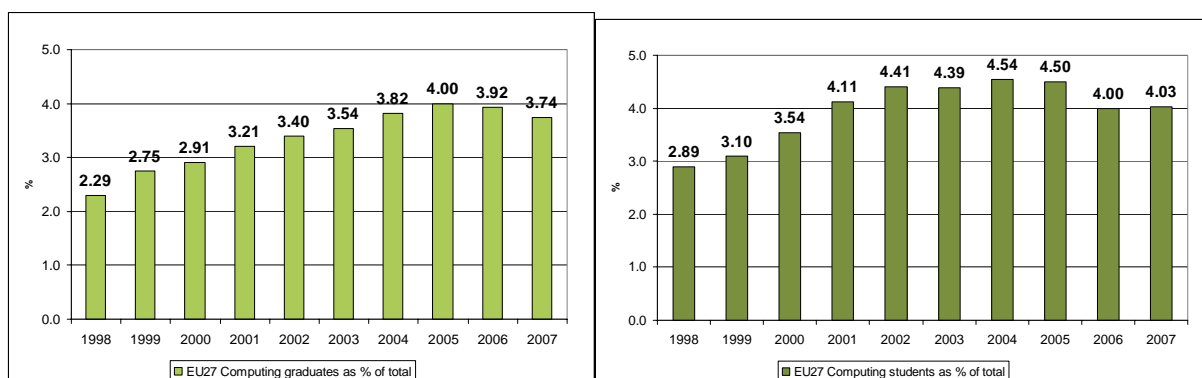
The annual number of computing graduates gives an idea about the pool of ICT skilled persons that might enter the workforce in a particular year to be either added to the existing number of skilled people or to replace workers leaving the workforce for different reasons, e.g. retirement (see chapter 6.2.3).

In some countries, for example in Germany, a high number of students drop out of tertiary education computing courses prior to receiving a diploma. Those drop-out students might also have acquired sufficient ICT skills to work as ICT professionals and should therefore be added to the graduates. However, on a European scale, no statistical data is available for this group.

b) Is interest for ICT professions vanishing?

As stated before, the uptake of computing courses is influenced by the perceived job satisfaction and security, likely levels of remuneration and the overall image of the ICT industry. In order to assess the attractiveness of computer courses - and subsequently ICT occupations, it is useful to look not only at absolute, but also at relative values. For the EU 27 in total, the . below show that the decrease in the number of computing students and graduates cannot be attributed to a decline in overall student numbers since the percentage of all students in tertiary education enrolled in computing courses has dropped significantly since 2005, the number of graduates having decreased gradually as well. Most likely therefore at least in the next few years the number of computing graduates will stabilise at the best or decline even further, if no action is taken to reverse the trend.

Exhibit 6-12 Computing graduates and students as % of total graduates and students



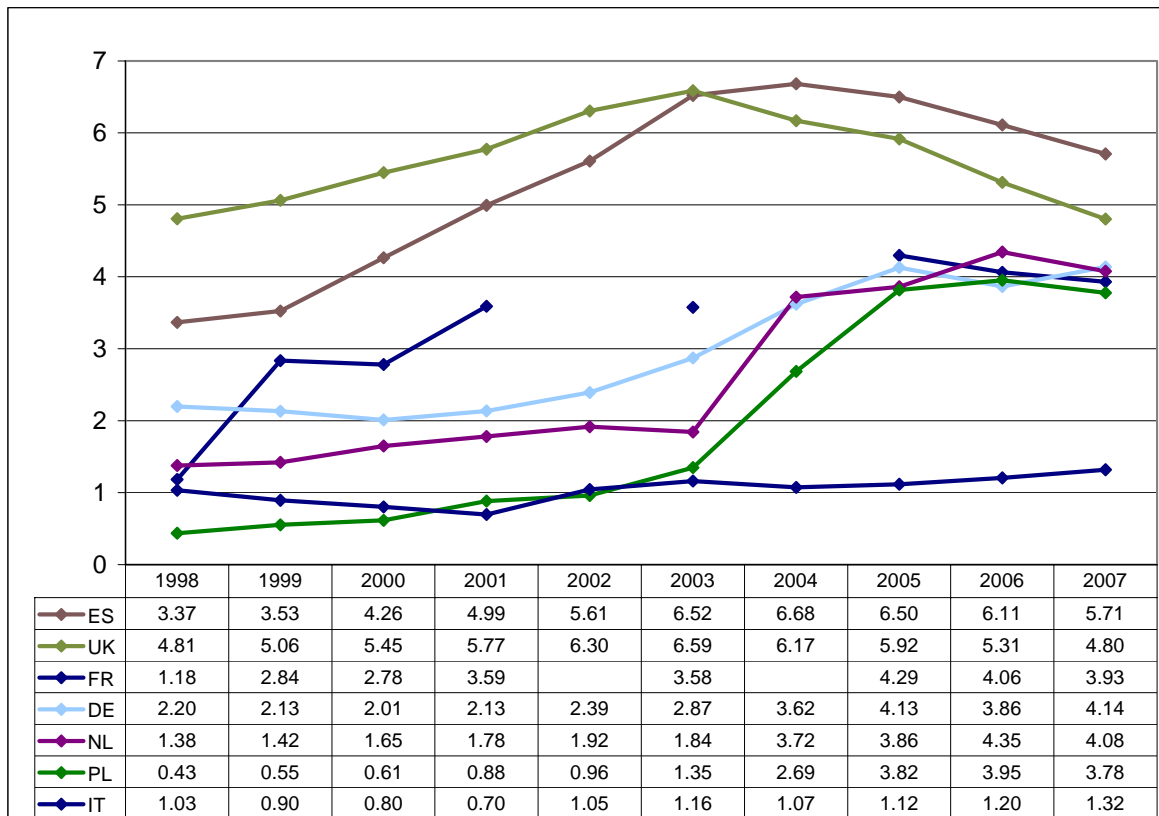
Source: Eurostat database, own calculation

The number of computing students and graduates varies considerably across the different EU27 member states. However, the absolute numbers of graduates are difficult to compare due to distortions related to either changes over time caused by for example by a general education expansion (Poland) or changes in courses and diplomas (Germany) or differences across the countries, for example differing proportions of an age group taking part in higher education.

Looking at the percentage of computing graduates with relation to all graduates helps to avoid these distortions and to gain insight into the particular evolutions on a national scale.

The timeline (Exhibit 6-13 below) indicates that while the UK and Spain show a clear drop in the proportion of graduates having taken computing courses since 2003/2004, other countries, such as Germany, the Netherlands and Poland show an increase in computing graduates at the same time. In the Italy, the share of computing graduates remains more or less stable. It seems that at least across the seven major ICT labour markets, the share of ICT graduates is converging to approach a level of around 4-5% of all graduates (with the notable exception of Italy, where the share of computing graduates remains at a very low 1%).

Exhibit 6-13 Computing graduates as % of all graduates in tertiary education
for selected European countries 1998-2007



Source: Eurostat database, own calculation

6.2.2 Other inflows

Other graduates

Besides computing graduates, there might also graduates from other fields who enter the labour force as ICT professionals. They will most probable have followed closely-related courses, e.g. in the field of “science, mathematics or engineering” or “manufacturing and construction” but might also have acquired other degrees, such as in social sciences or humanities. Unfortunately, on a multinational level, there is no data available as to the proportion of these other graduates in the ICT workforce, nor is a detailed breakdown by study subjects feasible. A rough indicator of the importance of non computer-science degree holders for the ICT workforce might be derived from the labour force statistic for Denmark (Danmarks statistic 2003), where computing degree holders made up only around 30% of the workforce in ICT occupations. This proportion is confirmed by older data from the USA and the UK: in the USA in 1997 among “core” IT workers, 46% had IT degrees, 14% engineering 26% science and maths and 6% business degrees (OECD Information Technology Outlook 2002).

Those in the ICT workforce that have not taken a computing degree, might have acquired their ICT professional skills either informally, through training on the job or private interest or they might have taken IT practitioner training courses, offered for example by different vendors such as Cisco, Microsoft etc.

Life-long learning and continued education courses such as the vendor certificate play an important role to help to avoid or close a gap or mismatch between demand for and existing supply of ICT professionals. Unfortunately, it is impossible to estimate how many ICT professionals with vendor certificate might be added to those with formal computing

The reasons for this are non-availability of such data at the vendors and training course providers in a central source and the problems in reliably counting the number of such certificates achieved by individuals, difficulties counting those who attend the e-skills training courses without aiming at a certification but who in the very end also obtain (some) ICT practitioner skills (although without a certification), and the danger of double counting individuals from these target groups since they - or at least some of them - will already appear in the workforce statistics as ICT practitioners or computing graduates.

Migration

An additional source of ICT professionals can come from highly-skilled labour migration. Labour migration is regulated in nearly all countries. Therefore, the number of foreign ICT professionals that might complement the national ICT labour force is first of all limited by migration policies. Secondly however, the number of real and potential migrants is determined by the question if they consider the respective country to be attractive in terms of working and living conditions and if they can communicate with autochthon workers in a common language. That immigration of highly-skilled migrants is not simply an issue of political will has been shown in Germany at the beginning of the 2000s, when the attempt to attract foreign ICT professionals with a "Green card" programme failed due to the above mentioned barriers in addition to some conceptual flaws (e.g. comparably tough conditions for immigration).

A relevant number of in-migrants working as ICT professionals can produce a significant impact on wages, distorting the level they would reach if only national ICT professionals were available (see country report USA below). On the other hand, temporary in-migration can help to meet abruptly increasing demand for ICT professionals.

In the EU27 Member States, in addition to the regulated in-migration from third-countries, ICT professionals can also come from internal migration between the Member States. The internal migration can help to balance supply and demand of ICT professionals between countries where supply is higher than demand and countries where the contrary is the case (until recently to be seen between Poland and the UK, for example). Thus, the balancing of demand and supply across and between the EU27 could be imagined either as a migration of people and/or a migration of jobs through near-shoring. These options provide for a certain degree of flexibility of the ICT labour markets in the EU27 member states that does not exist to this extent in Non-Member States.

USA

Supply

The number of IT professionals in the USA continues to grow at an annual rate of 3%. In absolute figures there has been an increase from 2,255,410 in 1997 to a first peak of 3,679,870 in 2000 and to 4,027,120 in 2007. Therefore it seems that the supply of IT professionals in the USA is still growing.

The number of graduates in Computer Sciences has increased by 6.9% from 1997 to 2007. However, one has to bear in mind that this growth rate is due to a tremendous growth rate of 59% (!) from 1997 to 1998 and since then steadily decreased to 3.6% in 2004 to become even negative at around -9% in 2007. Over the period of the last four years the average growth rate was negative and amounts to -6.1%. In absolute figures the situation is as follows: from 25,422 Computer Sciences graduates in 1996/97 the figures increased to an all-time peak of 80,540 in 2003/04 to then constantly decrease to 59,997 in 2006/07.

The increase in enrolment to Computer Sciences has been negative in 4 of the last 11 years. Starting with 34,158 enrolments in 1994 the peak was reached with 55,269 in 2002. Since then the enrolment numbers have decreased to 47,653 in 2006. However, and according to the latest Taulbee Survey, for the first time in six years, enrolment in Computer Sciences increased in 2008 and was up 6.2% from 2007.

From these figures one can conclude that while the number of IT professionals in the workforce is increasing, i.e. e-skills supply is growing, the "inflows" to the supply side in terms of graduates from Computer Sciences is in the meantime strongly decreasing and so is the number of enrolments.

The still steady growth of IT professionals supply in the USA is due to the significant contribution temporary foreign workers make to the ICT workforce in the USA and in closing the obvious e-skills supply gap. According to the National Science Foundation (NSF), in 2006, 51% of new H-1B visa recipients were in computer-related occupations. This actually represents an increase from a low 25% in 2002 in the proportion of new H-1B visas going to computer-related occupations. In absolute figures this amounts to a total of 113,593 new H-1B visas, with 57,932 being visas for computer-related occupations. In 2007, the absolute number of approved visas for computer-related occupations amounted to around 135,000 for both initial and continued employment. The department for professional employees stated the opinion that it is mainly the H1-B programme that keeps IT-wages from rising as fast as would be expected in a tight market (DPE 2009:3).

Demand

From the above figures on numbers of IT professionals in the workforce, graduates from and enrolments in Computer Science programmes and the inflows to the supply side originating from foreign workers one can conclude an e-skills gap in the USA which we - unfortunately and with the present data available - can not quantify yet.

This is confirmed by the higher than average weighted wage increase for the ICT workforce from 1998 to 2007 at around 4.66% compared to the average wage increase for all occupations in the same period at around 3.59%.

There is some reason to believe that these above average growth rates as an indicator of a tight labour market would have been even more significant without the high number of H-1 B visa holders that helped to bridge the gap between demand and tertiary education supply.

The rather high demand for ICT professionals in the USA is underlined by the unemployment rates published by the BLS: In 2008, the unemployment rate for "Computer and Mathematical Occupations" was 2.6% compared to a general unemployment rate of 5.8%. From 2002-2008

the average unemployment rate for “Computer and Mathematical Occupations” was 3.51% compared to a general unemployment rate of 5.34%.

(Ninad Deshmukh from the University of California has been contributing to this report as National Correspondent for the United States)

6.2.3 Retirements and age structure

On the supply side the number of ICT professionals is increased by the inflow of young ICT graduates and decreased by the outflow of ICT professionals retiring or changing occupation. For Europe in general, no data could be identified on IT workers retiring or changing occupation. So far the only replacement rate of IT professionals and career changers per year that is available has been identified in the Netherlands. In 2007 it was calculated 2.3% of the professional ICT population (ROA).

While it remains an open question, whether this figure will be at comparable levels in other European countries or differ, a look at the age structure of the ICT workforce can be helpful to develop a rough estimate of the number of ICT professionals retiring in the coming years. A general notion is that the IT industry, and therefore the IT workforce are rather young. However, as based on data found in relation to the Mature@EU project the age structure in three countries was in 2002 as follows.

Exhibit 6-14: Age structure of the IT workforce in Germany, Netherlands and UK (2002)

	Germany	Netherlands	UK
15-24	10.4	8.2	12.1
25-34	30.8	40	42.9
35-44	36.3	31.1	27.2
45-54	17.1	16.9	14.1
55-64	5.4	3.7	3.2
	100.0	100.0	100.0

Source: Mature@EU project

Based on this information as well as Eurostat data on the age structure of Human Resources in Science and Technology in general, we carried out an informed guesstimate and would assume the following age structure of the IT workforce in 2007.

Exhibit 6-15: Guesstimate of age structure of the IT professional workforce in EU27 in 2007

Age	Share
39	62%
40-49	26%
50-59	11%
60+	1%

Source: eSkills Monitor estimation

This would mean that labour market exits could be situated in the broad range of around 1.5% of the 2007 workforce during the next few years, with a tendency to rise further until 2015.

6.3 e-Skills Demand

6.3.1 Excess Demand: hard to fill vacancies

Vacancy rates are considered as the most commonly used indicator for a labour shortage. Generally, vacancies occur due to the normal turnover and lags in filling open positions, which might be called frictional, as well as due to more structural shortages, i.e. a generally insufficient pool of skilled workers to be recruited in the short term (see chapter 3).

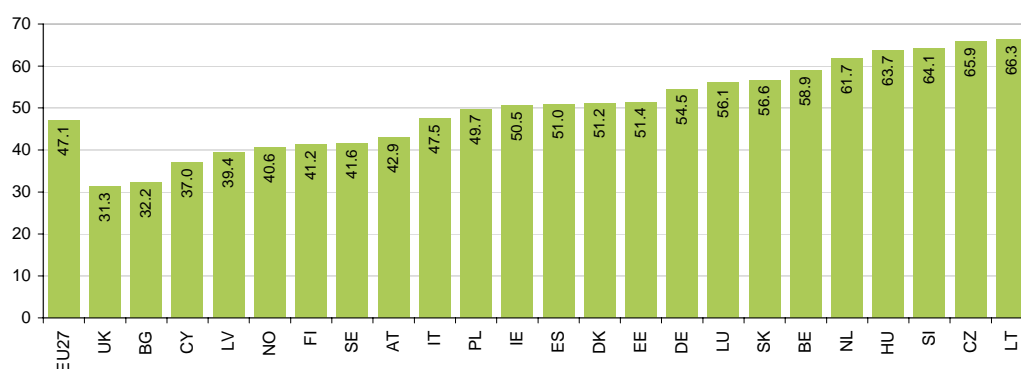
A substantial shortage of IT workers might cause a series of problems and incur additional costs. First of all, shortage of IT professionals could affect the development of high-tech industries and slow down the velocity of innovation, which consequently influences employment and productivity of the related industries. Consequently, a shortage of skilled IT labours would weaken a country's worldwide competition ability.

Secondly, scarcity of IT workers could force companies to merge with other companies which have the required skills base, whereby it could potentially change industrial organisation (the relevant market structure), and the concentration level.

Thirdly, and in order to obtain IT-related services (and probably even at lower costs) off-shoring may become an option for companies.

The unfilled demand for e-skills manifests in hard-to-fill vacancies on the side of employers, i.e. enterprises and organisations. Generally, 18 percent of the European enterprises employ ICT specialists, according to the enterprise surveys among private sector enterprises of 10 and more employees of 2007. Among large enterprises (250+) a majority employs ICT specialists, compared to 12% and 39% of small (10-49) and medium sized (50-249) enterprises. Knowledge intensive services such as computer related activities, banking or telecommunications have the highest share of IT specialist employing enterprises.

Exhibit 6-16: Percentage of enterprises, which had hard-to-fill vacancies for job requiring ICT specialist skills in Europe in the EU Member States during 2006



*Base: % of the enterprises which recruited personnel with ICT specialist skills
Source: Eurostat, ICT enterprise surveys database retrieval 04/2009*

Above all, with an average of 47% of the enterprises in the European Union that recruit IT specialist having difficulties in filling these open positions in 2006 there appears to be a severe problem of IT professionals over demand in Europe.

More than 30% of enterprises in the United Kingdom actively recruiting IT professionals claim that they had e-Skills recruitment problem with hard-to-fill vacancies for open IT professional positions. This leaves the United Kingdom among the "luckier" countries, while enterprises in

Germany and the Netherlands suffering even more from such labour shortages in more than 50% or even 60% of the enterprises in 2006.

Exhibit 6-17: Percentage of enterprises (10+ employees) which had hard-to-fill vacancies for jobs requiring ICT specialist skills in EU27 and its largest economies during in 2006

Base: % of the enterprises which recruited personnel with ICT specialist skills	EU27	DE	UK	FR	IT	ES	PL	NL
Total	47.1	54.5	31.3	:	47.5	51.0	49.7	61.7
10-49 employees	48.7	56.7	33.1	:	52.0	55.2	54.4	61.5
50-249 employees	42.0	46.9	27.0	:	39.3	45.2	42.6	56.2
250+ employees	50.0	58.1	32.0	:	34.9	41.4	49.3	73.6
Manufacturing	41.1	39.7	28.9	:	48.5	49.3	:	48.5
Construction	42.7	37.8	36.3	:	71.6	63.9	:	41.0
Services	49.3	59.4	31.6	:	43.5	49.3	:	64.7
Selected service industries				:				
Trade	45.1	54.6	32.5	:	58.7	34.1	:	62.0
Financial sector	45.0	41.6	42.6	:	19.9	23.7	50.7	79.7
Post and telecommunications	50.9	54.9	9.2	:	25.3	41.9	57.0	70.2
Business services w/o computer activities	49.3	68.6	30.7	:	30.7	47.8	50.0	57.2
Computer and related activities	56.4	58.1	34.0	:	34.0	72.2	64.2	78.2
Base: % of all enterprises								
Total	3.4	5.1	3.7	:	1.8	2.3	3.1	5.1
10-49 employees	2.5	3.7	2.9	:	1.5	1.8	2.2	3.7
50-249 employees	5.7	7.5	5.6	:	3.3	4.4	4.9	8.6
250+ employees	18.0	27.6	12.7	:	9.2	10.7	13.9	29.4
Manufacturing	2.2	2.7	2.5	:	1.6	1.8	:	3.3
Construction	1.0	1.2	1.1	:	1.3	1.3	:	0.3
Services	4.7	7.0	4.6	:	2.3	3.2	:	6.8
Selected service industries								
Trade	2.7	3.8	3.0	:	1.9	1.4	:	3.9
Financial sector	11.2	7.2	15.8	:	2.7	8.1	13.1	12.3
Post and telecommunications	13.2	11.7	1.7	:	4.5	4.8	28.8	25.7
Business services w/o computer activities	5.6	11.0	4.8	:	1.6	3.1	3.7	6.0
Computer and related activities	31.2	40.0	22.0	:	9.8	43.4	38.9	53.6

Source: Eurostat, ICT enterprise surveys database retrieval 04/2009

6.3.2 Types of e-Skills in demand

A recent INSEAD report concludes that "Europe's skills issue is not one of quality (of people) nor of quantity (of graduates and trained individuals), but rather one of matching (between what education systems produce and what industry and society need) and of fluidity (ability of the skills pool to undergo continuous change in its geographical and sector distribution, and to adapt to new challenges and concerns." (INSEAD: Who cares? Who dares? Providing the skills for an innovative and sustainable Europe, 2009, p. 16)

E-skills demand is very much focussed on specific e-skills and skill types which also vary across countries (cf. IDC, 2009; CompTIA, 2008).

The types of e-Skills required by employers vary constantly: what is highly demanded today might be outdated tomorrow, or the market might be saturated in this respect. Therefore any

data on skills requirements can be outdated very fast and should therefore be taken as a temporary indicator only.

The most recent comprehensive study on this topic has been carried out by CompTIA¹². The survey addressed more than 3,500 IT Managers in nine countries (Australia, Canada, China, France, Germany, India, Italy, Japan, The Netherlands, Poland, Russia, South Africa, U.K., and U.S.). They were asked to name the areas where they perceived the widest gap between the skills needed and the skills proficiency in the IT workforce, i.e. their own IT employees. The clear frontrunners here are the e-skills relating to “security/firewalls/data privacy” followed by “soft” skills (customer service, sales, project management, communication etc.), “non-specific server technology” and “general networking, network infrastructure” for which an excess demand exists (CompTIA, Skills gaps in the world’s IT force, 2008, p.5).

Exhibit 6-18 Most important e-skills and gaps in 2007

Thinking of your organization’s IT employees, please rate the importance of each of the following skills, on a 1-7 scale. (Percent saying 6 or 7) How proficient are your IT employees in the following areas, on a 1-7 scale? (Percent saying 6 or 7). Gaps are calculated by subtracting “proficiency” from “importance.”

Overall: IT Skills in Respondent's Organization	% Important (n=3578)	% Proficient (n=3578)	Gap
Security/firewalls/data privacy	74%	57%	17
General networking, network infrastructure	66%	59%	7
Operating Systems (Linux, Windows, XP, Vista, etc.)	66%	65%	1
Hardware skills/knowledge (including printers, PCs, etc.)	57%	60%	-3
Non-specific server technology (including DB, storage, maintenance, administration, etc.)	57%	49%	8
“Soft” skills (customer service, sales, project management, communication, etc.)	56%	45%	11
Application-level (architecture, design, development, programming, integration, etc.)	54%	47%	7
Specific programming languages (non-MSFT, Java, etc.)	40%	40%	0
Web-based technologies (Web2.0, SOA, SaaS, RIAs, Ajax, etc.)	40%	34%	6
RF mobile/wireless technology	27%	26%	1

Source: CompTIA: Skills gaps in the world’s IT force, 2008, p.6.

According to a survey by IDC of 533 organisations across Europe conducted in February 2009 (cf. IDC Insight, March 2009: Enterprise Investment Reality Check 2009: European Customers Switch Out Vendors With Inadequate Skills), “networking” and “security” skills were the most difficult to find, but systems architects and project managers were also challenging in some countries.

As another result of that survey IDC states that - despite the economic downturn - “almost 30% of respondents expect that it could still be difficult to find the right skills in 2009.” (...) “In our view, the survey results show real differences in skills availability in the different countries and that, as of 2008 at least, there are still real IT skills gaps in European countries.” It remains to be seen however, if this estimation holds true for 2009 as well. While in 2008 a third of respondents were not expecting to hire in 2009, of the remainder, nearly 30% expected some difficulties in finding the right qualifications (IDC Insight, March 2009, p. 1 and 3).

¹² CompTIA: Skills gaps in the world’s IT force, 2008

Exhibit 6-19 Difficulties hiring IT professionals in 2008 by skill type and country

Difficulties Hiring in 2008 by Skill Type and Country

Q: During 2008, have you experienced difficulties in finding staff with the right qualifications in any of these areas?
(% respondents saying yes)

	U.K.	Germany	Spain	Italy	Benelux	Nordics	France	Total
Help desk or end-user support functions	11.7%	11.8%	15.4%	9.5%	19.5%	19.7%	18.8%	15.2%
Datacenter specialists	16.9%	15.8%	21.8%	19.0%	13.4%	13.2%	10.0%	15.7%
Network specialists	29.9%	26.3%	28.2%	31.0%	29.3%	10.5%	25.0%	25.9%
Storage specialists	11.7%	14.5%	15.4%	6.0%	15.9%	9.2%	26.3%	14.1%
Security specialists	26.0%	14.5%	21.8%	23.8%	17.1%	21.1%	25.0%	21.3%
Application designers or programmers	19.5%	14.5%	19.2%	10.7%	25.6%	17.1%	12.5%	17.0%
System architects	24.7%	15.8%	16.7%	10.7%	19.5%	21.1%	5.0%	16.1%
Project managers	18.2%	7.9%	16.7%	7.1%	18.3%	17.1%	7.5%	13.2%
Other	1.3%	0.0%	0.0%	0.0%	1.2%	2.6%	1.3%	0.9%
We have not been hiring any staff	37.7%	44.7%	25.6%	34.5%	43.9%	39.5%	32.5%	36.9%

n = 553

Source: IDC European Services Survey, 2009

Source: IDC Insight, March 2009: Enterprise Investment Reality Check 2009: European Customers Switch Out Vendors with Inadequate Skills, p.3.

7 Conclusion

In the long term, the demand for ICT professionals in the workforce is on the rise, as the use of ICT spreads across all branches of the economy. On the supply side however, the number of students graduating from and enrolled into ICT related subjects such as computer sciences seems to be declining. The combination of the long term increase in demand and decrease in supply of computer science graduates might therefore produce a supply-demand gap in the long run.

In the upcoming years however, the effects of the current crisis on the labour market will prevent a lack of ICT professionals. Instead, the flagging economy might even produce a temporary oversupply of ICT professionals with unemployment rising for some two to three years similar to the period after 2001.

Nevertheless, as soon as the economy starts to pick up again, it will be crucial for the European Member States to have at hand a large enough pool of highly skilled ICT professionals that are well prepared to match the economic demand and employer's needs. They will be crucial for Europe to fully make use its innovative potential, which, if realised, will contribute to a fast recovery of the economy.

In order to avoid a lack of ICT professionals when they are needed most, when the economy has to reinvent itself in order to recover from a deep recession, several courses of action can be envisaged:

First of all, it seems advisable to reinforce the promotion of computing studies and other related ICT subject matters as soon as possible. The time delay between a policy decision, its uptake and implementation, the first effects - in this case the uptake of computing studies - and the outcome - in this case the graduation of computing students - will be of at least three years or longer. That means that action taken today will most likely only take effect once the crisis has been overcome.

Secondly, in order to both keep highly qualified ICT professionals in their jobs in Europe and to stimulate the economy in a sustainable way, the promotion of highly innovation ICT areas (e.g. green ICT), that has already been integrated in some of the national stimulus packets, seems to be a promising measure.

In the same vein, the reasons leading European companies to off-shore their ICT related activities should be examined critically. Since the potential for future expansion of off-shore activities in India and China seems limited (see chapter 5.1.3), and some companies already decide to return their activities to European countries, near-shoring might be promoted as an alternative form of the international division of labour that could help to make utmost use of the differing characteristics of the European Member States' economies and keep the ICT jobs inside Europe.

What the present study also suggests is that the real problem of ICT demand and supply might not be so much of a quantitative nature. Qualitative mismatches between the ICT skills provided by the workforce and those demanded by employers seem to be nearly unavoidable at the current state of affairs and therefore seem a much more pressing problem address.

Hence, finally and maybe most importantly, the issue of education and training of ICT professionals needs to be tackled. An innovative and rapidly changing market environment such as the field of ICT requires ICT professionals to be highly flexible at all times. This flexibility is even more essential in the aftermath of a crisis, when employees might have to adapt quickly to a restructured working environment.

This means that both the “basic” education and continued education and training have to be adapted in order to avoid a substantial mismatch between the skills required by employers and the skills provided for by university courses.

At present, most companies expect universities to provide their graduates with exactly the skills they need most at that point of time. This, however, is not feasible. Due to the time lag between enrolment and graduation, the time needed to adapt university courses to rapidly changing demands of the ICT industry, as well as the manifoldness of ICT specialisations, it is virtually impossible to avoid mismatches under the current system. A possible solution would be to devise ICT professional education as a two-tiered system:

1) “Learn how to learn”

The universities and other institutions of higher education should provide a broad basic knowledge. The definition of this basic knowledge should take into consideration that the ICT skills needed most in Europe do not relate to production and manufacturing -which takes place mostly outside Europe and is decreasing in importance - but to ICT services, especially to advanced services. In addition, as described in the last chapter, soft-skills are gaining rapidly in importance, even in the ICT professions that are presumable oriented towards “hard” technology-related skills. For this reason, the main aim of university education should be to “learn how to learn” in order to enable students to adapt to rapidly changing working environments and to shift from one specialisation to another when this becomes necessary.

To this more stable basic curricula could and should be added specialised courses that could be provided by ICT practitioners from the active ICT workforce, bigger companies or vendors. These courses could be scheduled shortly before graduation and provide the skills being “en vogue” at that time, thus enhancing the students’ chances on the labour market and providing employers with the skills needed most.

2) “A life long learning mentality”

In addition, the idea of life long learning has to be promoted with students, employees and employers alike. On the one hand side, students and employees should accept the notion that they have not “finished” their education once they leave higher education. On the other hand, instead of expecting to receive perfectly educated employees at any time from universities and the overall workforce - which will result in mismatches that limit the companies output - employers have to take on the responsibility to form and train employees according to their needs. This means that on the one hand sufficient courses for continued ICT education have to be available, which could be provided as certificate courses by vendors or by other public or private educational institutions. On the other hand, employers have to grant their employees the time needed to enhance and update their qualifications. Costs are also an issue. The employer benefiting from the newly acquired skills could and should contribute at least a certain share of the costs. Matching funds could be provided by governmental agencies and the employees themselves.

Van der Zee et. al. (2009:129) propose a similar solution: ICT sector organisations and trade unions should join forces with public authorities, training organisations and universities in order to develop joint programmes of lifelong learning for the ICT sector, that should be tailored in particular to the specific needs of small and medium enterprises.

A well established system of continued ICT education including commonly accepted certificates and diplomas could also help to re-integrate either longer-term unemployed ICT professionals or re-activate ICT professionals having resorted to different occupations in times when demand is rising faster than graduation numbers (for example after a recession when the economy is picking up again). The importance of a customized and flexible ICT education and training that is adapted to the needs of the labour market is supported by the following country report about supply and demand of ICT professionals in Japan (see next page).

Japan

Supply

The stock of IT professionals in Japan (in the category JSCO 06 corresponding to ISCO 213) shows a steady growth over the past decade. Compared to 604,354 IT professionals in 1995 and 777,487 in 2000 the figure has risen to 819,984 in 2005, the most recent figure available. This accounts for a 36% increase over 10 years. Together with the computer associate professionals (JSCO 31 corresponding to ISCO 312) the figure is 1,008,301 IT professionals in 2005 compared to 911,296 in 1995, i.e. an increase of 11% in one decade.

Engineering graduates from universities can be seen as the largest group of e-Skills "supply" inflows. However, Japanese statistics do not explicitly provide figures for these graduates but include computer sciences in the engineering category. The number of graduates in engineering graduating from tertiary education as undergraduates in Japan has increased from 80,136 in 1990 to 103,156 in 2000. From 2003 onwards a steady decline can be observed to 96,153 in 2007, the latest official statistics available. The development of enrolments in engineering runs in parallel, again steadily declining from 456,700 in 2002 to 418,713 in 2007.

Furthermore, on the supply side, Japan is fortunate to have a highly educated labour market, where 41.7% have attained a tertiary degree. The challenge facing Japan, however, is addressing some mismatches in the supply chain leading to the development of IT practitioners. On the pre-employment education dimension, the Japanese education organisation and curriculum are not well aligned with the needs of companies. Organisationally, Japanese universities are based on general "faculties" that hinder the critical mass for creating new specific "departments" like computer science. A general education approach worked well in the days when companies assumed the burden for training workers. Now companies find they are less able to train workers and are shifting the burden onto universities.

Demand

In light of a faith in market forces for maintaining an equilibrium in the stock of ICT practitioners the e-Skills debate has been relatively absent in Japan. Only during the bubble asset economy years in the late 1980s did manufacturing companies publicly complain about a shortage of technical staff because many of the new engineering graduates were seeking higher paid jobs in the financial services sector.

The e-Skill debate did not re-emerge until 2005, when the MIC's (Ministry of Internal Affairs and Communications) Information and Communications Policy Bureau issued a report on ICT human resources. They estimated at that time there were 987,000 workers employed in ICT-related jobs (MIC 2005: ICT jinsai kyōiku ni kan suru chōsa. Tokyo 2005). 556,000 of these workers are in non-professional ICT-related jobs and 431,000 of them in professional (manager, technician) ICT-related jobs. The MIC estimates, however, that the private sector actually requires 706,000 non-professional ICT workers and 782,000 professional workers. This would mean that the demand exceeds the current supply of IT practitioners by 50%. This demand estimate figure has become an unquestioned assumption since it came out in 2005.

Among the shortfall of 351,000 ICT-related professional jobs, 124,000 are technicians and 227,000 are managers. The MIC report does not clearly distinguish whether this is a shortage, gap, or mismatch issue. Instead it vaguely implies that there is a little of all three. Given the serious shortcomings of Japanese occupational statistics, it seems the 2005 MIC report was more of a rallying cry to mobilize companies and workers in support of the government's new e-Japan strategy than built on solid evidence. The recent ICT Hatoyama Plan on "Digital Japan Creation Project" (MIC 2009) mentions the need to create 300,000 to 400,000 new ICT-related jobs over the next three years. This suggests the 2005 estimated shortfall of 501,000 ICT-related workers was on the high side.

Dennis Tachiki from Tamagawa University in Tokyo as the national correspondent of this study for Japan concludes that on the demand side, companies seem to expect a greater need for professionals than non-professionals. Although companies are able to fill their professional positions, there is a particular concern that many of the system engineers do not meet the skill requirements for this occupation, and existing managers are not well equipped with the skills to meet the challenge of emerging new ICT markets.

(Dennis Tachiki from Tamagawa University in Tokyo has been contributing to this report as National Correspondent for Japan)

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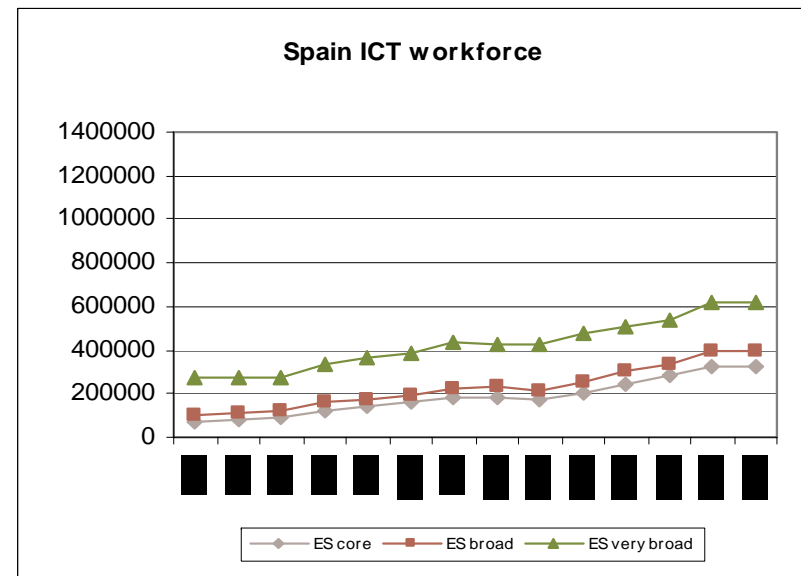
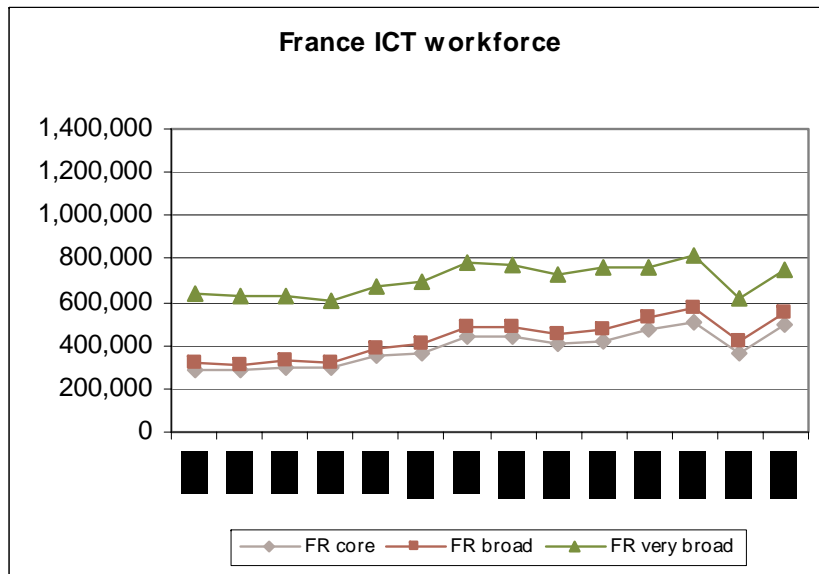
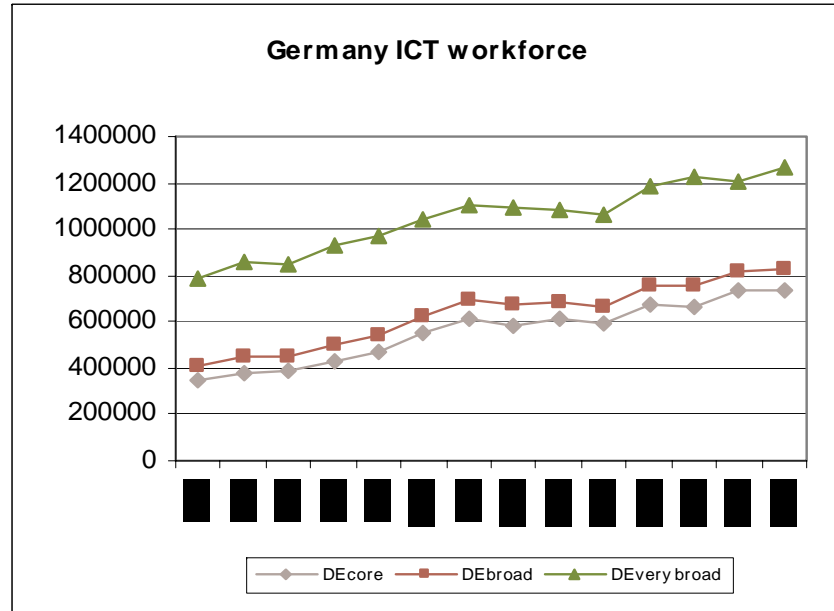
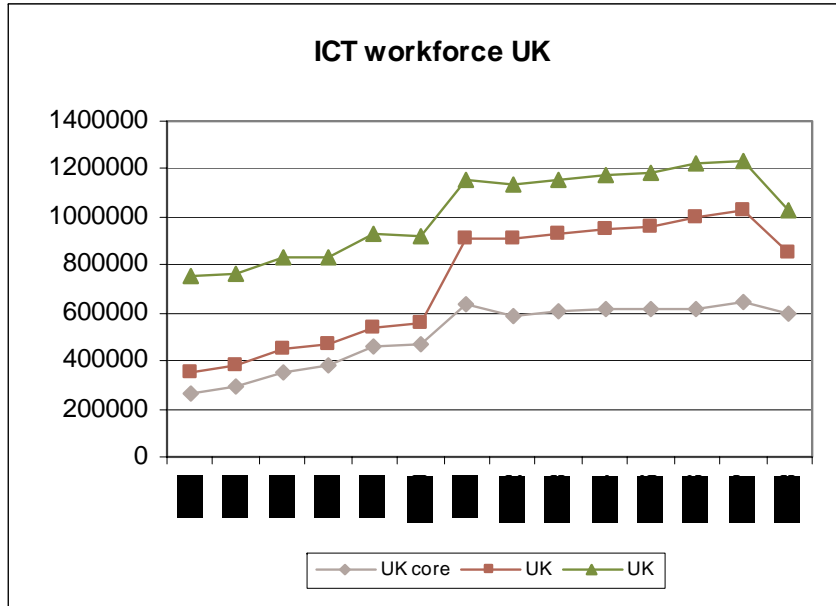
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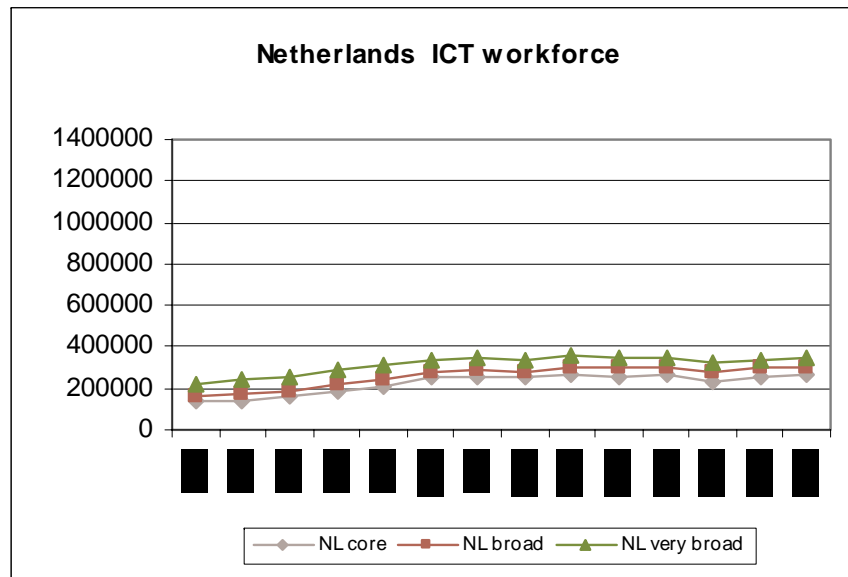
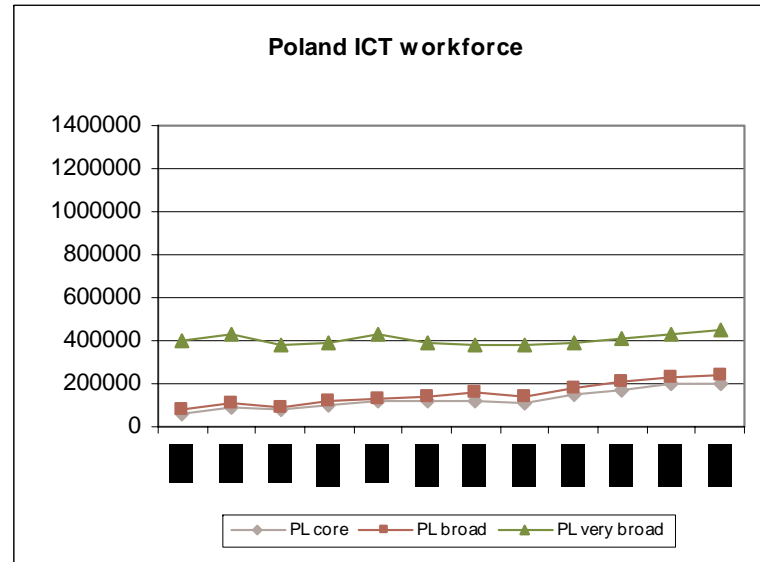
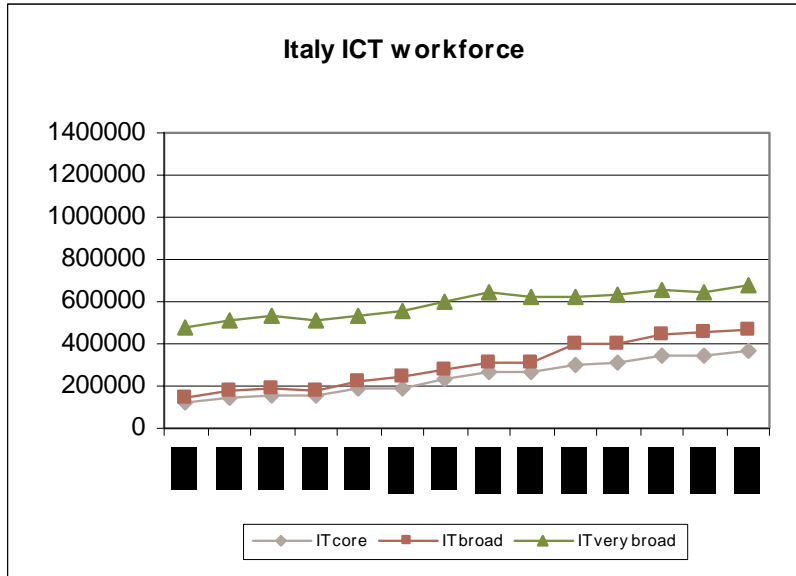
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9 Annex: ICT workforce in the seven largest markets

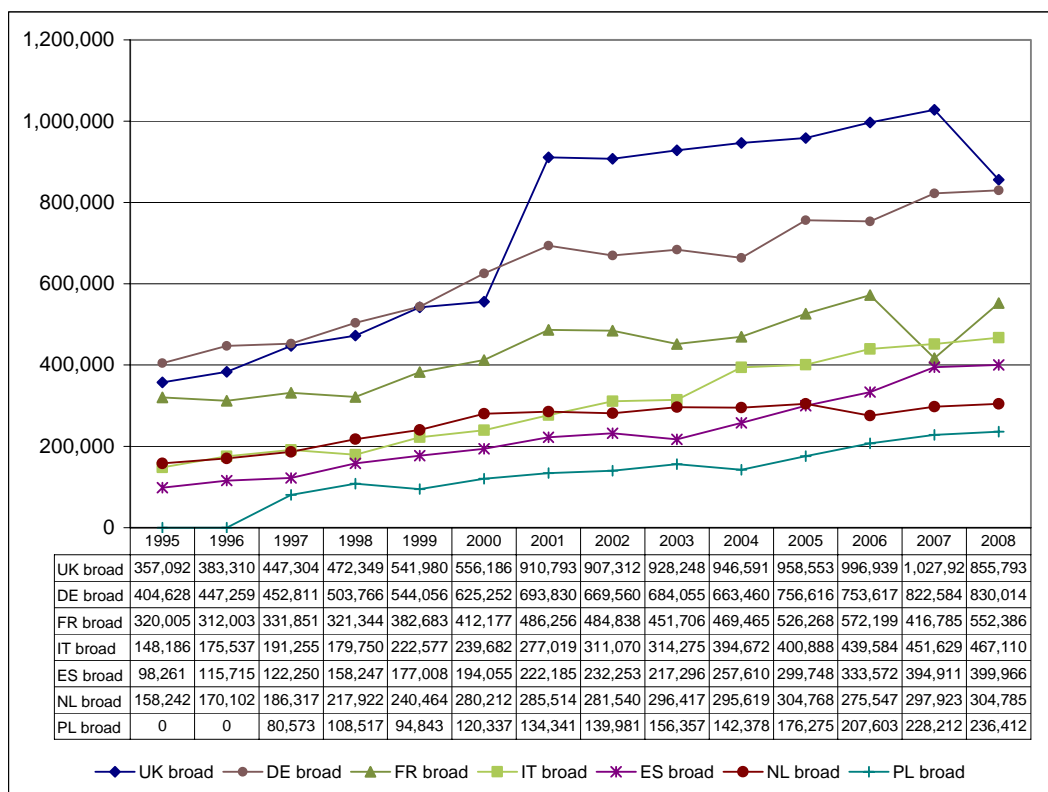




Source: Eurostat LFS

Source: Eurostat LFS

Exhibit 9-1 ICT workforce in the seven largest employer Member States (Broad definition) 1995 - 2008



Source: Eurostat LFS (data made available upon request by Eurostat)

Exhibit 9-2 ICT workforce in the seven largest employer Member States (Very broad definition) 1995 - 2008

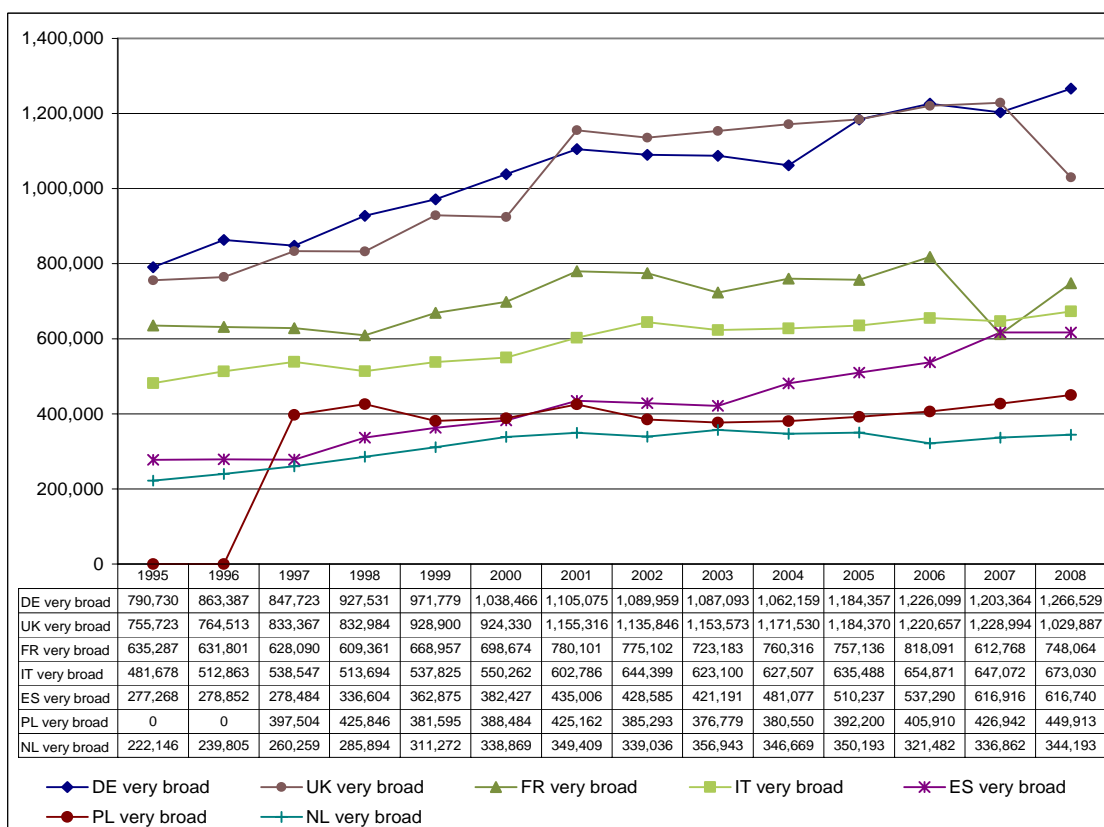
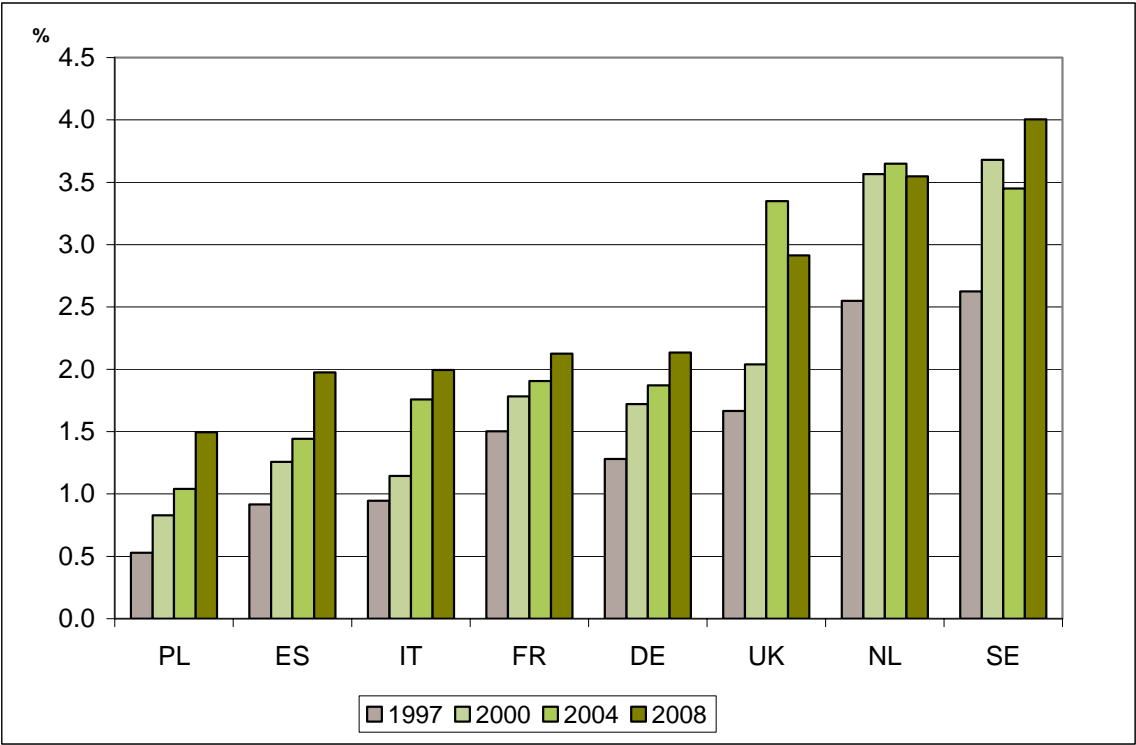
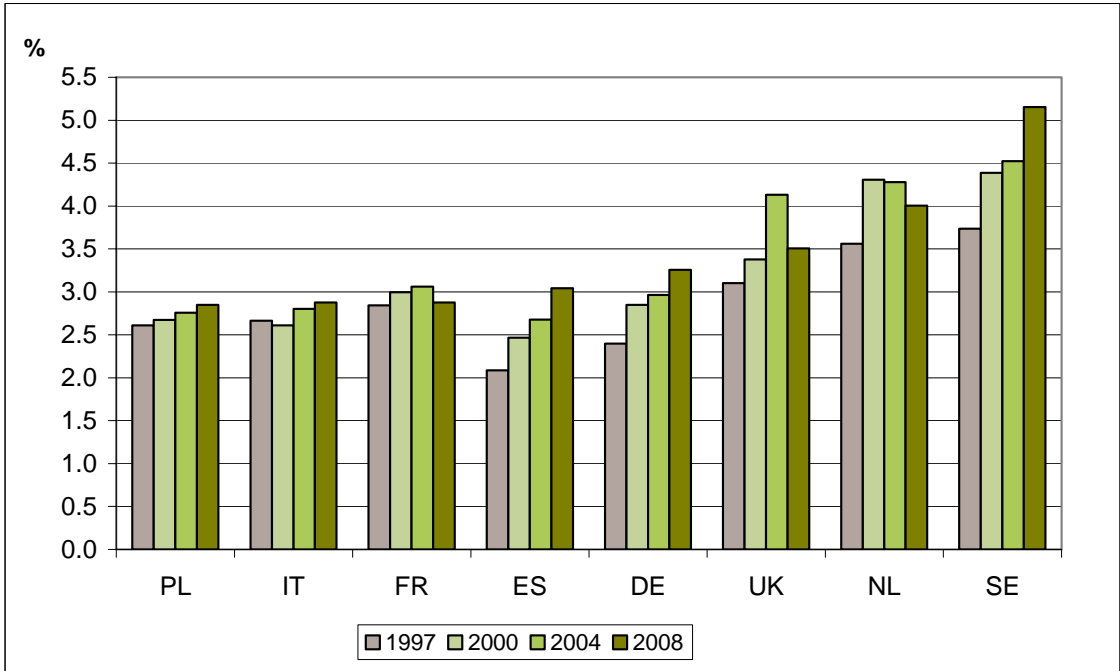


Exhibit 9-3 ICT professionals (broad definition) as % of total workforce in selected countries



Source: Eurostat LFS (data made available upon request by Eurostat)

Exhibit 9-4 ICT professionals (very broad definition) as % of total workforce in selected countries



Source: Eurostat LFS (data made available upon request by Eurostat)

