eSkills Demand Developments and Challenges

Sectoral e-Business Watch
Study Report No. 05/2009

Impact Study No. 05/2009

e-Skills – Demand Developments and Challenges

A Sectoral e-Business Watch study by
empirica GmbH

Final Report

Version 2.1

December 2009

About the Sectoral e-Business Watch and this report

The European Commission, Enterprise & Industry Directorate General, launched the Sectoral e-Business Watch (SeBW) in 2007 to study and assess the impact of ICT on enterprises, industries and the economy in general across different sectors of the economy in the enlarged European Union, EEA and Accession countries. SeBW continues the successful work of the *e-Business W@tch* which, since January 2002, has analysed e-business developments and impacts in manufacturing, construction, financial and service sectors. All results are available on the internet and can be accessed or ordered at the SeBW website (http://www.ebusiness-watch.org).

This study explores the demand for different types of ICT-related qualifications ("e-skills") in companies. This includes the demand for ICT professionals, ICT user skills and e-business skills. The underlying assumption is that e-skills matter for the competitiveness of enterprises and thus represent a relevant factor to create comparative advantage. The study explores whether companies experience shortages in the supply of professionals, the strategies they use to have the right e-skills in place, and what they see as the main trends in this area. The study is based on company case studies (including companies from the ICT services as well as from ICT using industries) and statistical data stemming from representative enterprise surveys.

Disclaimer

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information. The views expressed in this report are those of the authors and do not necessarily reflect those of the European Commission. Nothing in this report implies or expresses a warranty of any kind. Results from this report should only be used as guidelines as part of an overall strategy. For detailed advice on corporate planning, business processes and management, technology integration and legal or tax issues, the services of a professional should be obtained.

Acknowledgements

Contact

For further information about this Sector Study or the Sectoral e-Business Watch, please contact:

empirica Gesellschaft für Kommunikations- und Technologieforschung mbH Oxfordstr. 2, 53111 Bonn, Germany info@empirica.com	**European Commission** Enterprise & Industry Directorate-General Unit D4 "ICT for Competitiveness and Innovation" entr-innov-ict-ebiz@ec.europa.eu

Rights restrictions

Bonn / Brussels, December 2009

Table of Contents

Executive Summary

Key findings at a glance

Company case studies and ICT decision-maker surveys do not indicate a general quantitative shortage of ICT practitioners in 2009/10. The situation could change in the course of the economic recovery; for 2015, analysts anticipate a shortage in the supply of about 8% of demand (IDC/empirica, 2009).

The shortages currently experienced by companies concern very specific skills, according to the case studies carried out for this report. ICT services companies reported a demand for more university graduates with the right mix of skills and competencies for their **consulting** branches. ICT managers in ICT-using sectors pointed towards a rising demand for **ICT systems & process architects** and for specialist in developing **open source** software solutions.

Furthermore, interviewees argued that specific **competencies** should be paid more attention in the training of ICT practitioners. They pointed to the following areas:

Interviewees said that ICT practitioners often lacked **communication and presentation skills**;

Project management skills were seen as very important.

For many positions both in ICT services and user companies, ICT practitioners should have a thorough understanding of **business processes**, which is not always the case;

University programmes should include more **practical training** in standard business software systems.

A general trend emerging from case studies is that skills requirements of user companies and ICT services companies are becoming more and more different. This may need to be reflected in future ICT training curricula.

About this study

This study aims to contribute to a better understanding of current and expected **ICT-related skills requirements of companies**. This in-cludes "ICT practitioner skills", "ICT user skills" and "e-business skills". The study considers all three dimensions, but focuses on the requirements for ICT practitioners.

The underlying assumption is that e-skills matter for the competitiveness of enterprises and thus represent a relevant factor to create comparative advantage (see Section I.1.1). The study focuses on the **demand side,** and here on individual companies (case studies). The study explores to what extent companies experience shortages in the supply of ICT professionals, the strategies they use to have the right e-skills in place, and what they see as the main trends in this area.

The study is embedded in the **e-skills policy framework** of DG Enterprise and Industry (see Section I.1.2) and aims to contribute to the evolution of this framework and the resulting agenda.

Data sources

The study is mainly based on the following sources (see Section Section I.2.2):

- **Company case studies** including companies from ICT-using manufacturing sectors and from the ICT services industry.

- **Representative enterprise surveys** by Eurostat and the Sectoral e-Business Watch about the demand for different types of ICT-related skills.

- Results of a forecasting **study by IDC / empirica** (2009) which estimates the supply and demand of e-skills in Europe in 2010 and 2015 for different scenarios (see References).

The demand for ICT practitioners: mismatches with regard to specific qualifications and competencies

Total aggregate demand

Analysts estimate the total demand for ICT practitioners in the EU in 2010 at about 3.9 million (according to a narrow definition), and at about 4.9 million for a broader definition of practitioners (IDC/empirica, 2009). About 40%

of computer professionals and associates –a proxy for "ICT practitioners"– are employed in the ICT services sector itself and 60% in ICT using industries (Eurostat Labour Force Survey 2007). (see Section II.1.1)

The **economic crisis** unfolded its impact on the demand for ICT practitioners and the services of the ICT department quite differently in the case companies. While the majority of companies (both ICT services and user companies) have reduced their ICT budget up to a total recruitment freeze, others reported that the interest in the services of the ICT department (as a means to improve the efficiency and save costs) had increased due to the crisis. e-Business units are challenged as companies refocus their strategy from growth back to cost saving.

Skills shortages and mismatches with regard to specific qualifications

Currently, there is no evidence for a general quantitative shortage of ICT practitioner skills in the market. At the aggregate level, **demand and supply** are roughly **in balance**. If at all, a shortage is mainly experienced by ICT service providers rather than for ICT using companies.

Looking ahead, however, there are forecasts that the demand for practitioners might increase stronger than supply in the next five years, resulting in a shortage of about 8% of demand (IDC / empirica, 2009).

Even if there is no quantitative shortage, the case studies point towards some shortcomings with regard to **specific qualifications** and competencies (see Section II.1.2). The main mismatches and gaps experienced by companies are:

- **Soft skills**: IT managers said that the importance of "soft skills" was often underestimated. They suggested that communication and presentation skills should be better trained in ICT studies.
- **Project management** skills were seen as very important for many ICT practitioners.
- **Consulting skills and know-how in business process design**: One of the main challenges for ICT services companies is apparently to find qualified staff for their consulting divisions, rather than for product development (ICT consultants can account for 60% of open positions in ICT

service companies). Graduates trained in business process design and in management are particularly rare.

In addition, interviewees mentioned some specific skills where it was difficult to find people and where they expected increasing demand in the future:

- **Open source**: interviewees from the ICT using industry reported an increasing demand for practitioners with special skills in open source software development.
- **e-Business software**: ICT service providers stressed that it was difficult to find graduates with practical experience and know-how in standard e-business software systems (for their consulting branches).
- **Systems architects**: There appears to be a shortage of practitioners with specific qualifications in ICT systems and process architecture. This qualification was seen as increasingly important, in particular for large user companies with their typically complex legacy of ICT systems.

An interviewee from a large ICT service provider said that his company typically could not fill about **one in four positions** they offered due to **mismatches** in the qualification profiles of applicants such as those mentioned above.

Finally, an important overall trend clearly emerging from the interviews is that the skills expected from ICT practitioners in ICT using companies are different to those of their colleagues in the ICT services sector. The question arises whether this should be reflected in curricula of ICT studies more than at present.

Recruitment strategies & staff turnover

If companies announce job openings for ICT practitioners externally, they use predominantly **online channels** such as internet career portals and special IT forums. Traditional ads in print media are hardly used anymore. For special positions, the services of recruitment agencies are sought.

Web 2.0 communication has rising importance for recruiting purposes, even if not yet consistently used. The ICT sector is probably a frontrunner where the "online footprint" of applicants (e.g. their activities in ICT forums) could become an important part of their profile besides the "formal" CV (see Section II.1.2).

The case studies indicate some **differences between countries** in hiring practices: in some countries, companies focus on hiring university graduates from relevant ICT programmes; in other countries, companies often hire external ICT consultants who have already been working for the company for some time on a specific project.

Salary requests of applicants are currently not experienced as a problem for recruiting new staff. Interviewees broadly agreed that applicants mostly had realistic expectations about their salary. In a vast majority of cases, consequently, qualifications were the crucial issue and not money.

Most of the case companies stressed that they had a very **low staff turnover** in their ICT units. The number of their job openings for ICT practitioners in 2008 typically corresponded to 5-10% of the total ICT staff employed. However, several of the larger companies interviewed mentioned "**demographic change**" as an important issue to be considered in human resources and skills planning. They anticipate that a significant number of their ICT staff will retire in the next 5-10 years and are confronted with the challenge to manage the knowledge transfer within the company.

ICT user skills: no major difficulties encountered

While the number of ICT specialists is limited in most companies, many more jobs require computer and software user skills. In most cases, this means operating basic office applications such as text editing and spreadsheet calculation, communication tools (e-mail) and the web. Depending on the department they work in, employees may also be users of specific applications such as the ERP or CRM system or a procurement system, or design tools (CAD/CAM).

In the Sectoral e-Business Watch surveys of 2009, conducted among ICT-decision makers, a majority of the respondents felt that the demands on employees regarding their computer and software skills "have noticeably increased" in the past few years. However, it appears that the vast majority of **employees can cope well** with the (rising) requirements. Only few respondents said that many employees in their company experienced difficul-

ties in this respect. This was broadly confirmed by the detailed case studies conducted for this study, where ICT user skills were not found to be a problem (see Section II.2.1).

% of companies observing that many / some / a few employees have problems because of insufficient computer skills (glass, ceramics and cement industry – 2009)
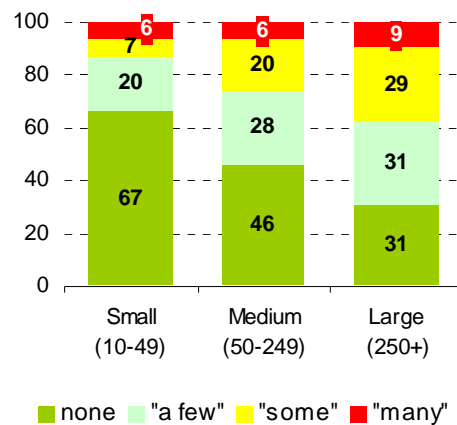
Source: e-Business Watch Survey 2009

A specific trend and challenge for the future which was mentioned by several interviewees will be to find the right approach and balance in using new web-based communication tools (such as chat and messenger functions) and **Web 2.0 applications**. This can be a difficult trade off between ensuring the ICT security requirements of a company and not impeding the creativity of employees, particularly the younger ones (see Section II.2.2).

e-Business skills: translating business requirements into ICT solutions

Many large companies have a dedicated e-business manager, often heading a unit within the ICT services department. His or her job is to explore opportunities for using ICT to support the marketing and sales activities of a company. Often they are responsible for developing the functionalities of the company's ERP system and extranet, as these are central platforms for data exchanges with customers and for service provision.

In sharp contrast to most other units within the ICT department where technical ICT skills are central, staff working in e-business units need not have a strictly technical background in an

ICT domain. Instead, many have their background in marketing and sales.

Key qualifications for e-business managers are in particular

- excellent management skills (including project management),
- a thorough understanding of the company strategy and its operations, and
- some practical experience with e-business software such as ERP systems.

Typically, however, there are only few positions in a company with this profile, even in large companies.

e-Business departments need people who know how to **translate business processes into ICT requirements**, in particular in large companies with advanced e-business practices. Interviewees mentioned that they experienced a lack of young talents with these competencies, because graduates with a specialisation in ICT would often lack the understanding of the business context and requirements. Therefore, with a view to ICT training programmes, an interviewee suggested that curricula should place more emphasis on business process design and communication skills. This confirms recommendations made by other interviewees with a view to ICT consultants.

However, the case studies also showed that the requirements differ considerably between companies in dependence on their e-business approaches.

Conclusions

General implications for e-skills policy

There are some issues emerging from this study that could be considered when revising and enhancing the e-skills policy framework. A central consideration is that the **e-skills requirements of ICT-using companies** and those of **ICT service providers** are in many ways quite different, and that this trend will probably be reinforced. Thinking with foresight, it might be useful to consider this dichotomy in an elaborated definition of "ICT practitioners".

- ICT services companies, when asked about e-skills requirements, make a distinction between ICT consulting and product development. This could also be considered in the framework; the consul-

tants are a "link" between ICT user and service companies.

- A similar distinction can be made in ICT using industries, where "information managers" (including e-business managers) translate business requirements into ICT solutions, which are then implemented and maintained by the ICT systems units.

Implications for ICT studies at universities

The study results point towards some issues to be considered in the planning of ICT training curricula, in particular at universities:

- Training of ICT practitioners should properly take into account the importance of "soft skills", notably **communication & presentation skills**.
- Evidence indicates demand for (more) university programmes combining the provision of (technical) ICT skills with **business and management skills.** A thorough understanding of business processes is a particularly relevant competency for many ICT professionals, both in ICT using sectors and in ICT consulting.

Finally, an issue related to ICT training concerns the **lack of transparency** how different programmes compare to each other (even for graduates with the same degree such as "bachelor"). Human resources managers in ICT services companies said they would appreciate structured information (e.g. on an internet platform) them to assess the qualifications which applicants of specific programmes have acquired during their study. European e-skills policy could consider measures to improve this transparency, e.g. by establishing a portal that provides such overview information.

Section I: Context and approach

I.1 Background and objectives

I.1.1 Why e-skills matter – the study rationale

It is widely agreed that information and communication technologies (ICT) can have significant **economic impacts**, in particular for productivity growth and employment (cf. OECD, 2004). First, there are **direct effects**, as the ICT sector[1] itself has been a major growth market in the past 15-20 years, with increasing significance for GDP growth and employment. Second, there are **indirect effects**, as ICT have become a general purpose technology that is widely applied for a variety of business purposes in all industries.

Therefore, a lack of skilled people[2] in the labour market who possess the ICT qualifications which are required by businesses (whether in ICT-producing or in ICT-using industries) poses a **risk** to economic development. The growth potential of the ICT industry may not be optimally exploited, if demand for products and services surpasses capacity (due to unfilled vacations), and ICT-based innovation processes in user industries can be slowed down, with negative implications for productivity growth and competitiveness. Moreover, as ICT and e-business are developing rapidly, e-skills need to be constantly updated, and the demand for individuals with higher-level conceptual e-skills increases.

Viewed from an **opportunity** perspective, the adequate supply and use of ICT-related skills ("e-skills") represents a relevant input factor to create comparative advantage.[3] e-Skills can be regarded as a factor condition for European companies to stay competitive; in particular in markets where the capability for continuous innovation and productivity growth are essential.

The issue itself is to a large extent **cyclic**. In recent periods of economic growth, and notably during the boom time of the internet economy (1995-2001), the demand for people with professional ICT skills surged and definitely exceeded the supply. Back in 2000, at the height of this development, EITO estimated that there were about nine million "equivalent IT jobs" in Western Europe (in 1998), and that about 500,000 of these remained unfilled due to a shortage of appropriate skills (EITO, 2000, p. 52-53). After the end of the new economy hype, the ICT skills gap diminished (if not disappeared altogether). A study conducted by RAND Europe (a think tank) in 2005 for DG Enterprise and Industry concluded that "the best evidence available confirms that there were, in 2004, no widespread significant shortages of ICT (or IT) Practitioner skills within the EU" (RAND Europe, 2005, p. xvi).

---

[1] The "ICT sector" includes, in the widest sense, the ICT manufacturing industries (e.g. computers, consumer electronics, network equipment) the ICT services industries (e.g. consulting, hosting, programming), telecommunications and the software industry.

[2] The lack can be a quantitative shortage of people trained in ICT, or a competence shortfall between current and needed competence levels of (employed) personnel.

[3] Cf. Michael E. Porter (1990). The Competitive Advantage of Nations. Porter argues that the availability of resources and skills is one of the ingredients that contribute to a national or regional comparative advantage.

The skills shortage emerged again, however, as an issue in the economic growth period of 2004 to the first half of 2008. A survey of over 700 European organisations across seven countries/regions by IDC, a market research firm, found that a third of these organisations had projects delayed by their suppliers because of a lack of skills, and that almost half the companies expected difficulties hiring staff with the right skills in 2008 (IDC, 2008). IDC concluded that there was an acute shortage of skilled IT practitioners in the EU –estimated at about 500,000[4] – and that this skills gaps would grow still further, with significant implications for the competitiveness of European enterprises.[5]

With the dramatic decline of economic activity due to the global financial and **economic crisis** looming since 2008, however, the situation has once again completely changed. Other, more urgent (short-term) issues have taken the place of the e-skills debate on the agenda of economic policy.

However, there is also a **long term trend** beyond business cycle developments and the resulting up-and-down of the demand for ICT professionals. In contrast to most other economic sectors, growth rates of the ICT sector have rarely turned negative in past recessions, at least until the current crisis. The structural change of modern economies towards the information and knowledge economy is still in process; the longer-term trend is therefore still characterised by an overall increase in the demand for ICT-related skills, despite the current slump.[6]

Although policy is well aware of the strong cyclic nature of the ICT skills gap, there are good reasons that the **policy response** to this challenge[7] should *not* be cyclical but follow a *longer-term approach* (see next section). First, there is no immediate remedy for the shortages once they occur. Measures such as innovative training programmes with new curricula need to be implemented years in advance before they become effective. Second, all evidence indicates that the ICT industry and the services it provides will remain important drivers of growth and employment in the future, and that any economy is well-advised to create the right framework conditions for gaining a large share of this market. Finally, the rapid technological development in ICT, together with their role as a general purpose technology in the information society, requires a constant monitoring of general demand trends (irrespective of the business cycle), so that the necessary adaptations on the supply side (e.g. development and implementation of new curricula) can be initiated.

---

[4] Presentation by Marianne Kolding, IDC, at the e-Business Watch Conference 2008 ("Understanding the e-Economy"), Brussels, 19 May 2008.

[5] IDC is one of the service providers contributing to the Sectoral e-Business Watch.

[6] Cf. EC study "Monitoring e-Skills Demand and Supply in Europe" by IDC/empirica (Synthesis Report, 2009, forthcoming)

[7] The principle consideration whether there is a rationale for a policy response, or whether the development could/should be entirely left to the market, is not an objective of this study.

I.1.2   The policy context

Against this background, policy has dealt with the **ICT skills gap** since the late 1990s, typically in the broader context of economic policy and information society policy.[8] DG Enterprise and Industry has been explicitly addressing the issue for years, with the objective "to contribute to improve framework conditions in Europe for the provision of a world-class e-skilled workforce to achieve stronger productivity, economic and social benefits (…)".[9]

> *"It is estimated that there are 4.2 million ICT practitioners within the EU and that approximately 180 million people are using ICT at work. (…) Shortages of ICT practitioner skills have been endemic due to technological innovation and the fast growth of ICT activity in comparison with the relatively low supply and availability of new employees and entrepreneurs with relevant educational qualifications.*
>
> *(…) The continuous development of ICT and changes in the corresponding e-skills requirements provides a complex, moving target for policy-makers."*
>
> *(from: Communication from the Commission: "E-Skills for the 21st: Century: Fostering Competitiveness, Growth and Jobs", COM(2007) 496 final, 07.09.2007).*

The study is embedded in the **e-skills policy framework** of the European Commission's **DG Enterprise and Industry**.[10] In particular, the study uses definitions and working concepts that have been established and adopted as part of the e-skills policy framework. This includes, as a central concept, the e-skills definition that was developed by the e-Skills Forum in 2004 and which distinguishes between "ICT practitioner skills", "ICT user skills" and "e-business skills" (see Section I.2.1).[11] The case studies consider all three dimensions, but the focus is on the **requirements for ICT practitioners**.

It is acknowledged that this framework, while it has been useful to structure the debate and activities in the past few years, needs to be **revisited** and might be elaborated or revised in the light of new empirical evidence. In particular, there is probably a need for a better and **more practical classification** of different types of "ICT practitioners", which can be derived from the ISCO classification[12] if taking into account practicability issues. Stakeholders are currently engaged in an intensive debate how to structure the different skills profiles and requirements in a way that this classification (or framework) can be practically applied, for instance for improving curricula of ICT-related studies at universities, or in other education and training initiatives. It is way beyond the scope of this study to develop such a new framework. However, the case evidence presented in this study, the views of IT managers of large companies with regard to the qualifications their company needs, and the shortages in the supply they experience, provide some insights that help revising and adapting the existing framework with a view to new policy

---

[8]   Information society policy has also focused on the social dimension of e-skills. A lack of ICT skills hampers the employability of citizens and increases therefore the risk of unemployment. The social dimension is not the subject of this study, however.

[9]   DG Enterprise and Industry, at http://ec.europa.eu/enterprise/ict/policy/ict-skills/main_en.htm (accessed in December 2008).

[10]   see http://ec.europa.eu/enterprise/ict/policy/ict-skills.htm

[11]   European e-Skills Forum (2004). E-skills in Europe: Towards 2010 and beyond. Synthesis report of September 2004 of the European e-Skills Forum, established by the European Commission, DG Enterprise and Industry.

[12]   International Standard Classification of Occupations

requirements (see Section III.1). For the purpose of this study, the existing framework was still concise enough and has still proven to be practical for structuring the interviews and information collection.

A key challenge for policy is that there are no easy fixes to adjust demand and supply through ad-hoc short-term measures, simply because of the cyclic and longer term nature of the issue. A systemic perspective is needed. DG Enterprise and Industry has therefore stressed the importance of a coherent e-skills policy framework with a longer term policy strategy. This was documented in the Communication on "**e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs**" (on 7 September 2007), which presented a long term e-skills agenda and including five major action lines at the European level. This Communication was a major milestone in the e-skills policy of DG Enterprise and Industry. The effectiveness of its implementation is going to be evaluated in 2010.

A central element of the e-skills policy agenda has been the systematic **cooperation with the ICT industry**, in particular with the **e-Skills Industry Leadership Board** (ILB) set up in June 2007 by leading ICT companies. The e-Skills ILB works in partnership with other industry sectors, SMEs and further stakeholders. It builds upon the European Commission recommendations and other reference initiatives on e-skills.[13]

The Commission points out that improving the availability of e-skills involves actions both at European and national level, and in several areas: education, training, industrial and labour policies primarily, but also in other domains such as immigration, taxation and research. At the European level, DG Enterprise and Industry has specified the following main action lines for the next few years:

1. **Promoting long-term cooperation and monitoring progress**. This includes a regular dialogue with Member States and stakeholders and monitoring annually the supply and demand of e-skills.

2. **Developing supporting actions and tools**. Activities include supporting the development of a European e-competence framework, promoting a European handbook on e-skills multi-stakeholder partnerships, the Europass initiative and the development of an online e-skills self-assessment tool, the development of an e-skills and career portal, quality criteria for e-skills industry-based certifications, and supporting the development of e-competence curriculum guidelines.

3. **Raising awareness for e-skills**. This includes exchanging information and good practices for the promotion of science, maths, ICT and e-skills.

4. **Fostering employability and social inclusion**. This includes the e-inclusion initiative launched in 2008, encouraging corporate social responsibility and partnerships between providers of e-skills.

5. **Promoting better and greater use of e-learning**. This includes a report in 2008 with recommendations for targeted e-learning initiatives, promoting the develop-ment of e-learning courses, and supporting the networking of training centres.

---

[13] In mid 2009, members of the e-Skills ILB included the British Computer Society, CEPIS, Cisco Systems, CompTIA, ECDL Foundation, ECONET, EITO, euroCIO, European Schoolnet, European Software Association, EXIN, Global Knowledge Network, HP, INLEA Foundation, Intel, Microsoft, Oracle, Prometric and Siemens Enterprise Communications. The e-Skills ILB is mainly structured as an umbrella organisation, connecting many individual initiatives. It is open for new entries in line with the key e-Skills ILB principles as expressed in the Founding Declaration. For more information, see http://www.e-skills-ilb.org/

This study aims to contribute mainly to the first two actions, in particular to the sub-task "monitoring annually the supply and demand of e-skills" (as part of action line 1), but also to the further development of the e-competence framework and related curriculum guidelines (actions of action line 2), by providing real case evidence about actual employer requirements.

I.1.3 Study objective and focus

The **main objective** of this study is to contribute to a better understanding of current and expected **e-skills requirements of companies**. The study aims to fill gaps in the available empirical evidence by focusing on the **demand side** from a **micro-perspective.** This is in contrast to most of the existing market studies on e-skills which focus on providing aggregate figures about the skills shortage, but do not look at the challenges of individual enterprises. The study explores the demand for different types of e-skills in companies from different sectors, including examples from the ICT industry (service providers) and other sectors (user industries). The study focus is characterised by two main aspects:

- The study focuses on **demand side issues**, i.e. on the company's requirements with regard to e-skills. The study will not deal with the development of the e-skills supply side, such as assessing numbers of university and college graduates in ICT and e-business related studies, or analysing the curricula of respective courses in universities. The study only indicates potential supply side issues, as interviewees were asked to make recommendations for education and training programmes in ICT.

- The study provides **micro level** evidence based on company interviews and will not assess skills gaps from a macro-perspective, i.e. by providing aggregate figures of how many people with a certain qualification are needed / missing in the market. The macro dimension of demand and supply is currently analysed by another much more comprehensive study commissioned by DG Enterprise and Industry.[14]

The lack of such evidence was confirmed by the quoted RAND Europe study (2005), which analysed the available evidence, qualitative and quantitative, on the supply and demand of e-skills in Europe. The study clearly showed that the available information was not sufficient for painting an adequate picture of the e-skills landscape in the EU.

Research questions

Within this framework, the study addresses the following research questions:

- **Company demand with regard to ICT practitioners**: How many "ICT practitioners" do companies typically employ, and which skills specifically do they need? What are the recruitment paths they use to hire practitioners? Which kind of formal qualifications and certificates do they expect? Do they encounter difficulties in finding the right people? What kind of training schemes do companies offer to their ICT practitioners? The findings are presented in Section II.1.

---

[14] "Monitoring the Supply and Demand of e-Skills in Europe", Study by DG Enterprise and Industry, see Call for Tender No ENTR/2008/018. The study was commissioned to IDC and empirica.

- **Company demand and challenges with regard to ICT user skills**: How important are ICT user skills for the company, notably in ICT-using industries? What are the requirements in this regard, and how significant are the challenges experienced in this context (if any)? What kind of ICT training do companies offer to their workforce? The findings are presented in Section II.2.

- **Company demand and challenges with regard to e-business skills**: What is the e-business strategy of the companies interviewed? What is the organisational approach of e-business, how is this linked or integrated with the traditional ICT department? What are the requirements for people working in this field? Which trends in e-business do they see, and what are the implications for skills and qualifications needed? The findings are presented in Section II.3.

Based on the findings with regard to these specific questions, conclusions are drawn as to which extent the challenges reported by companies connect with the e-skills policy framework of DG Enterprise and Industry, and indicative recommendations are made how the framework could be optimised (Section III). This is meant as an input to ongoing or planned actions (whether by the public or private sector) with regard to e-skills development. It is not a goal to come up with entirely new proposals for action, as this would be beyond the scope of this study.

Target audience

The study addresses mainly policy makers and those stakeholders who are directly affected by a shortage or mismatch of e-skills. These are, in particular, the ICT industry, IT managers in companies from user industries, and people involved in planning and implementing curricula for ICT training programmes.

I.2   Study approach

Conceptual framework

The overall study approach is shown in Exhibit I-1. The working definitions of key terms and the data sources on which the assessment is based are introduced in the following sections.

As Exhibit I-2 shows, the study distinguishes between "ICT practitioner skills", "ICT user skills" and "e-business skills". This distinction has been a foundation of the e-skills policy framework used by DG Enterprise and Industry in recent years[15] and has proven to be a useful for the analysis and debate. The following section introduces this concept and explains how the terms are used in this study.

---

[15]   See http://ec.europa.eu/enterprise/ict/policy/ict-skills.htm

Exhibit I-1: Study approach
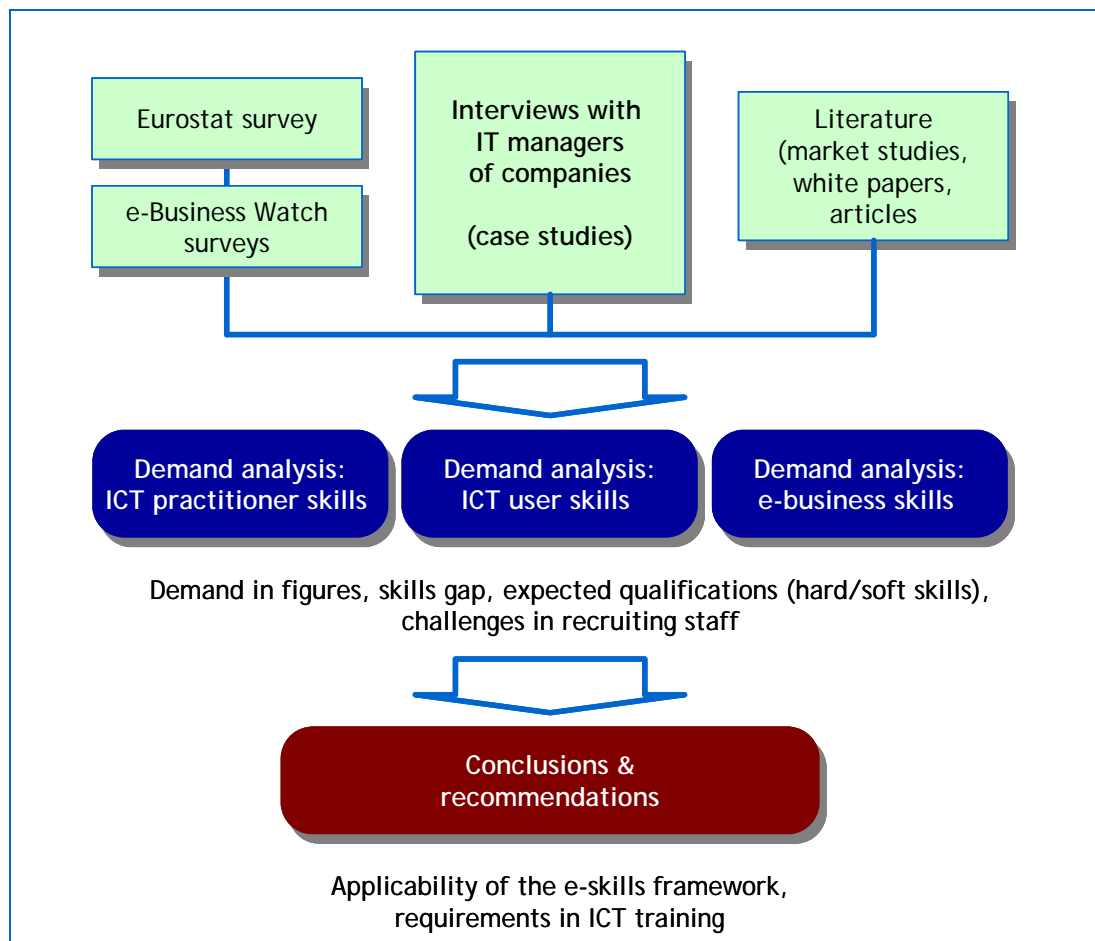
I.2.1   Definitions of key terms

ICT practitioner skills

"ICT practitioner skills" are the capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems. In this study, the terms "**ICT practitioners**", "**ICT specialists**" and "**ICT professionals**" are used as synonyms.

When trying to define ICT professionals on the basis of the ISCO classification, there are different and changing opinions on which occupations to include. Unfortunately, existing labour force statistics are mostly still based on the older ISCO-88 version; in 2008, the new version ISCO-08 came into force, with new groups and classes for ICT-related occupations that are of course much more up to date. A **narrow definition** of ICT professionals which has been used by the OECD in earlier publications, includes only those ISCO categories that most certainly have ICT professional skills: software and applications developers and analysts, database and network professionals, and ICT operations and user support technicians (ISCO-08 specifications). Group 2511 ("systems

analysts") includes ICT consultants,[16] such as consultants who specialise in advising companies in the use of specific business software systems (e.g. SAP). They represent a significant share of employment in ICT service companies. In addition, information and communications technology service managers (ISCO-08 133)[17] could also be considered as ICT professionals in the narrow sense.[18]

Due to the enormous diversification of occupations requiring ICT skills over the past 10-15 years, however, there might be additional occupational groups with ICT professional skills. A **broad definition** of ICT professionals therefore could also include telecommunications, broadcasting and medical imaging technicians.[19] An even wider definition might add electrical and electronic equipment installers and repairers. In this study, ICT practitioners are entirely people working in the core occupations as specified by ISCO-08 codes 251, 252 and 351 (see Exhibit I-2).

Exhibit I-2: Definition of ICT professionals based on ISCO - narrow and broad definitions, correspondence ISCO-88 and ISCO-08

Definition	ISCO-88 codes covered		ISCO-08 codes covered	
Narrow	213	Computer professionals	251	Software and applications developers and analysts
	312	Computer associate professionals	252	Database and network professionals
			351	ICT operations and user support technicians
	1236	Computing services department managers	133	Information and communications technology service managers
Broad	313	Optical and electronic equipment operators	352	Telecommunications and broadcasting technicians
			3211	Medical imaging and therapeutic equipment technicians
Very broad	724	Electrical and electronic equipment mechanics and fitters	741	Electrical equipment installers and repairers
			742	Electronics and telecommunications installers and repairers

[16] In the ISCO definition, tasks covered by ISCO code 2511 include "(…) identifying and analyzing business processes, procedures and work practices; identifying and evaluating inefficiencies and recommending optimal business practices, and system functionality and behaviour (…)", which is a fairly adequate description of what business software consultants do. In fact, "systems consultants" are mentioned as one of the occupations included in this group.

[17] Their tasks usually include "consulting with users, management, vendors, and technicians to assess computing needs and system requirements and specifying technology to meet those needs; formulating and directing information and communication technology (ICT) strategies, policies and plans; directing the selection and installation of ICT resources and the provision of user training; directing ICT operations, analyzing workflow, establishing priorities, developing standards and setting deadlines; overseeing the security of ICT systems; assigning, reviewing, managing and leading the work of systems analysts, programmers, and other computer-related workers; evaluating the organization's technology use and needs and recommending improvements, such as hardware and software upgrades; establishing and managing budgets, controlling expenditure and ensuring the efficient use of resources; establishing and directing operational and administrative procedures; overseeing the selection, training and performance of staff; representing the enterprise or organization at ICT related conventions, seminars and conferences.

[18] Some studies consider ICT service managers as "ICT practitioners" in the broader definition, but not as part of the narrow/core definition (e.g. IDC/empirica, 2009).

[19] These definitions follow the approach of the EC study "Monitoring e-Skills Demand and Supply in Europe" by IDC/empirica (2009, forthcoming)

ICT user skills

"ICT user skills" are 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)".[20] In this study, company requirements with regard to ICT user skills are analysed on the basis of interviews with companies from the **ICT using industries,** and here with reference to employees working in non-ICT departments (see Section II.2). The interviews with ICT service providers focused entirely on their requirements for ICT practitioners.

e-Business skills

"e-Business skills" are the capabilities needed to exploit business opportunities provided by ICT, notably the Internet. The main related objectives are to save costs by improving the efficiency of business processes (within and between enterprises), and to exploit new business opportunities (e.g. by using e-commerce to access new markets, or to reach new customers). A key element of e-business is the electronic data exchange between a company, ideally based on widely accepted standards for data exchange. This facilitates the internal computer-based processing of related data. The concept is mainly applied to companies in the manufacturing industries with complex physical supply-chains. Service industries also use e-business (prime examples are tourism, financial services and real estate), but in a different way. In this study, the requirements of companies with regard to e-business skills have been discussed with representatives of two companies from the **ICT using industries** (both in the manufacturing industry) which make intensive use of e-business in their daily operations. The interviews with ICT service companies did not discuss e-business skills, because in this industry, a distinction between e-business and ICT practitioner skills is hardly possible.

Shortages, gaps, mismatches

A lack of e-skills can have different causes. The European e-Skills Forum proposed to make a principle distinction between the following possible deficiencies:[21]

- A **"skills shortages"** refers to an insufficient number of skilled people in the labour market or in an occupational segment.

- A "**skills gap**" is a competence shortfall between the current and needed competence levels of individual staff within organisations.

- A "**mismatch**", finally, refers to possible differences between the competences of a trainee or graduating student and the competences expected and needed by the (prospective) employers. Mismatches can arise from curricula misalignment.

---

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

[21] Ibid.

I.2.2   Data sources

At the core of this study are company case studies based on semi-structured interviews with IT and human resources managers in companies. The information obtained from these cases is combined and compared with quantitative information about the demand for different types of ICT skills, as available both from primary and secondary sources (see overview of sources in Exhibit I-3).

The method of deriving general conclusions from this mix of cases and complementary information can be compared to building a "mosaic", where the picture is composed by systematically arranging the individual pieces. In this study, the interviews represent the "pieces", and the analytical synopsis of the interview results in the "mosaic". The study was not based on pre-defined working hypotheses. The questionnaires were designed with regard to the research questions (see above).

The sources used for this study include primary data collection by way of semi-structured interviews (with companies and industry experts), and various secondary sources, including in particular the 2007 Eurostat ICT survey among enterprises, market studies, white papers of stakeholders, academic research papers and other literature. Exhibit I-3 provides an overview of the main data sources and for what purpose they will be used.

Exhibit I-3: Overview of data sources for this study

Primary sources	Description	Type
Interviews with ICT and e-business managers (case studies)	Interviews with human resources managers and ICT managers of companies from various sectors. Interviews were conducted face-to-face or by telephone as semi-structured interviews.	**qualitative** & quantitative
e-Business Watch Surveys	Representative surveys in specific sectors; the surveys of 2009 were conducted in the glass, ceramics and cement sector and in the energy supply sector; both surveys contained a module on e-skills.	**quantitative**
Secondary sources	Description	Type
Eurostat ICT survey among enterprises (2007)	Eurostat conducts an annual survey about ICT usage in enterprises in all EU Member States. In its 2007 ICT survey, Eurostat included a specific module in the questionnaire (Module E) on e-skills.	**quantitative**
Studies	available market studies and academic research about the demand for e-skills and about the ICT skills gap, including studies commissioned by DG Enterprise and Industry or DG Information Society.	both qualitative & quantitative
Other literature	Includes a potentially wide range of publications such as white papers and position papers of stakeholders (e.g. employers' / employees' associations), articles in the ICT press.	mostly qualitative

Company interviews / case studies

The company interviews were conducted as **semi-structured interviews**. While a structured interview has a formalised, limited set questions, a semi-structured interview is a flexible format, allowing new questions to be brought up during the interview as a result of what the interviewee says. The interviewer generally has a framework of themes to be explored. Only this framework (the relevant issues to be discussed) are specified in

advance and communicated to the interviewee prior to the interview. The interviews thus allow for focused, conversational, two-way communication.

The interviews were mainly conducted **face-to-face**; in a few cases, and to clarify open issues, telephone interviews were arranged. The target persons for the interviews were senior IT managers in the IT and e-business department (if existing). In most companies, at least two interviewees (representing different functions) participated in interviews. The average interview length was 40-60 minutes per interview, adding to about 90 minutes per company.

As some of the information (e.g. about the number of staff employed in the various departments, and about internal procedures) was sensitive, the companies participated in the interview only on the condition that the results would be presented in an **anonymous** way. The companies cannot be named. Exhibit I-4 provides an overview of the companies with whom case studies were conducted and the function of the individual interviewees in these companies.

Exhibit I-4: Overview of companies that participated in the study

Company	Type of company	User / service provider
A	Large stock-listed European manufacturing company (>5,000 employees), with international operations, in a traditional manufacturing sector - **Interview A1**: Head of IT Infrastructure - **Interview A2**: Head of e-Business unit	ICT-using company (manufacturing sector)
B	Multinational, stock-listed European manufacturing company (> 30,000 employees), global operations. - **Interview B1**: Head of the e-business unit - **Interview B2**: Senior manager in IT infrastructure governance	ICT-using company (manufacturing sector)
C	Large ICT service provider (> 2,000 employees), subsidiary of a manufacturing company that provides services mainly to its parent company, but also on the market. - **Interview C1**: Head of department, senior IT manager	ICT service provider
D	Large European manufacturing company (>30,000 employees), with global operations, in a high-tech industry - **Interview D1**: Head of Information Systems	ICT-using company (manufacturing sector)
E	Large European software company (>2,000 employees), with an international presence - **Interview E1**: Head of human resources	ICT service provider (software industry)

Statistical data sources

Most of the statistical data presented in the following sections are the result of representative surveys conducted by Eurostat (in 2007) and by the Sectoral e-Business Watch (in 2009) among ICT decision makers. These methodology of these surveys is explained in Annex II.

I.2.3 A note on sectoral and geographic specifics

The perception and actual situation of e-skills shortages, mismatches and gaps can differ between countries and sectors and also depends on the size of a company.

With regard to **geographic differences**, the lack of ICT professionals is determined by several factors, in particular the industry structure in the respective country or region. An economy with a relatively more important ICT industry is likely to pay more attention to the supply of e-skills than an economy where traditional sectors with a lower demand for ICT professionals dominate. The magnitude of the perceived lack of ICT professionals can also depend on how advanced regions are in general in their ICT use. Companies in regions which lag behind in their "e-readiness" may have (on average) less sophisticated ICT needs than companies in the most dynamic and innovative (i.e. "e-ready") regions. In reality, structural factors and the e-readiness of enterprises will be closely interlinked. SMEs in ICT or other high-tech clusters will typically have different requirements for e-skills than their counterparts in rural areas with mostly traditional manufacturing companies. A commonly used indicator for the diffusion of ICT in a region is the amount of job vacancies requiring e-skills. Unfilled vacancies are then the measure whether there is sufficient supply.

The same principle applies to **sectors**. Section I.2.1 describes the shares of ICT professionals that are employed in different industries. Obviously, the ICT services industry is the largest employer, accounting for about 40% of all ICT professionals. But there are also differences between user industries. Companies in ICT-intensive industries such as financial services and high-tech industries (electronics, automotive) need typically relatively more professionals than companies from other sectors. However, a company's own demand also depends on its outsourcing strategy. A company that makes intensive use of ICT may outsource most of the services to external service providers and only employ few practitioners itself (see Company B in this study as an example).

In the context of this study, it is unfortunately not possible to systematically analyse all these geographic or sectoral differences, in particular on the basis of the case studies. The sample of cases does not allow breaking down the results by country or sector, which is a common shortcoming of a case study approach. Still, the study claims that it is possible to identify some **general issues and trends** in the demand for e-skills that do not necessarily depend on the sector or country. It does not claim to provide *statistics* about the demand in specific sectors or countries. The focus is on *qualitative* trends in the e-skills demand. Whenever specific issues were raised in a case studies which might be related to the specific situation in a country or sector, this is mentioned in the analysis.

From this perspective, the results claim to be representative for large part of the European Union, but not necessarily beyond, and certainly not for economies in developing countries. They identify some issues that could / should be considered when working on a new framework for the future e-skills policy in the EU.

Section II: Results

II.1 The demand for ICT practitioners

This chapter focuses on companies' demand for ICT practitioner skills. In the ICT industry, this can be software programmers, engineers and IT consultants. If employed in ICT-using industries, these are mostly employees whose main responsibility is to take care of the company's ICT infrastructure (hardware, software, communications systems), including the planning, development and maintenance of the infrastructure.

II.1.1 Statistics

Notes on the data sources

The quantitative estimates regarding the demand for ICT practitioners in the European Union are based on a **current study by IDC/empirica** conducted for DG Enterprise and Industry (2009).[22] The results of this study are further substantiated and illustrated with data from **representative surveys** among ICT decision makers in companies, conducted by Eurostat (in all sectors and EU countries) and by the Sectoral e-Business Watch (in specific sectors and countries). These surveys are:

- The **Eurostat Community survey on ICT usage by enterprises**;[23]

- The Sectoral e-Business Watch Surveys of 2009 in the **glass, ceramics and cement industry** and in the **energy supply industry**.[24]

More information about these surveys is available in Annex II. In addition, the results of earlier e-Business Watch surveys (conducted with the same method) are occasionally referenced, provided that the same survey questions were already used in the earlier surveys. Structural differences of the sectors should be taken into account, however, when comparing results. The glass, ceramics and cement industry has a much higher percentage of employment in the SMEs than the energy supply sector.

Aggregate demand for ICT practitioners in Europe

IDC / empirica (2009) have estimated the demand and supply of ICT practitioners in the EU in 2010. The total demand for practitioners is estimated at about 3.9 million according to the narrow definition (see Section I.2.1, Exhibit I-2) and at about 4.9 million according to the broad definition of "practitioners". For 2010, it is estimated that aggregate demand and supply are in balance.

---

[22] Monitoring e-skills demand in Europe: Foresight Report (2009). Study conducted by IDC / empirica for the European Commission, DG Enterprise and Industry, October 2009.

[23] This is a large scale survey of more than 60,000 EU enterprises which has been conducted annually since 2001. The survey of 2007 included a specific questionnaire module on e-skills.

[24] Both surveys included questions on e-skills requirements. The survey in the glass, ceramics and cement industry comprised 676 companies from six EU countries (Germany, France, Italy, Poland, Spain, UK), the survey in the energy sector comprised 351 companies from the same six EU countries.

The study offers five scenarios how demand and supply could develop in the next five years, depending mainly on the assumptions concerning the overall economic framework conditions. Estimates are that aggregate demand will increase to 4.0-4.7 million in 2015 (narrow definition, depending on the scenario) and 5.0-5.9 million respectively if the broad definition of practitioners is applied. In the mid-range scenario ("back to normal"), a shortage in the supply of practitioners of about 8% of demand is forecast.

The study provides figures also at the country level and stresses that the situation differs significantly between countries, in particular in the current economic situation: "(…) there are countries where, given the most negative scenario in economic terms, the crisis may lead to some temporal level of unemployment among ICT practitioners (Spain, France and Poland) while others will still show excess demand (Germany most notably)." Concerning the supply of practitioners, the study points out that there are structural differences between countries in terms of the sustainability of their e-skills reproduction. Poland, for example, was found to train an "enormous number of ICT graduates compared to their domestic demand", while other countries, such as Italy, would produce far too few ICT graduates.

Whether narrow or broad definition, ICT practitioner skills are required both by ICT service providers as well as in user industries. Therefore, it is crucial to distinguish between "ICT practitioners/professionals" and the "ICT sector". According to the Eurostat Labour Force Survey 2007, about 40% of computer professionals (and associate professionals, in ISCO-88 codes) were employed in the computer services sector, 60% in user industries. Obviously, an individual company from the ICT services sector employs much more IT professionals than a user company of the same size.

Exhibit II-1: Computer professionals and associate professionals in the EU 27 workforce 2007
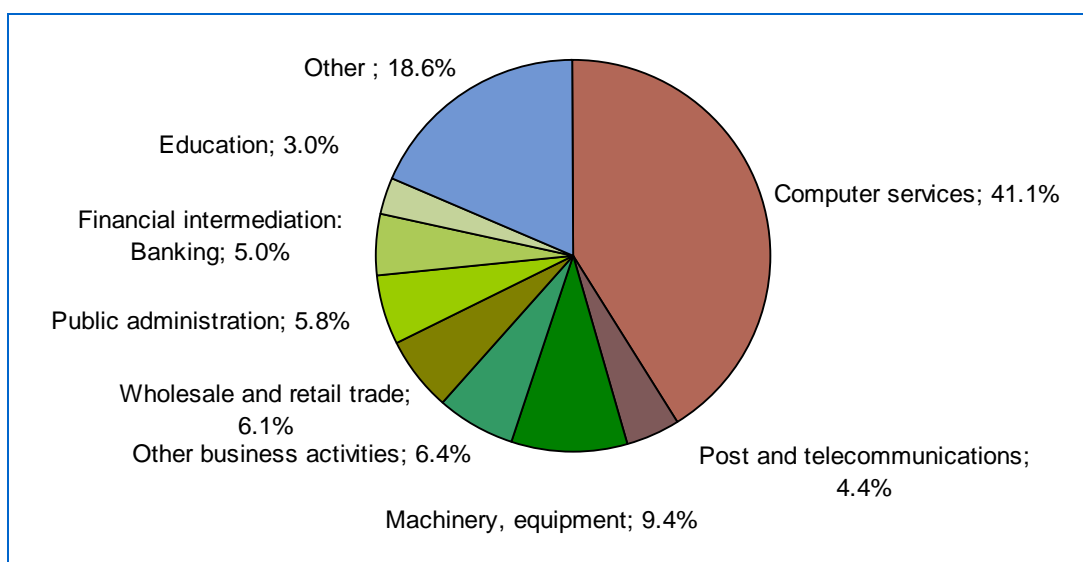
Source: Eurostat LFS 2007(made available on request by Eurostat); quoted from the study "Monitoring e-Skills Demand and Supply in Europe" by IDC/empirica (2009, forthcoming)

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

For the ICT sector, a recent study by the OECD (2009) confirms that employment has been affected by economic crisis, albeit to a lesser extent than in many other sectors. The study concludes that "employment is continuing to drop in the ICT sector – notably in the ICT goods sector and is remaining mostly flat in ICT services. Overall, in the second quarter of 2009, employment in ICT manufacturing in all reporting countries slumped by around 6-7% year-on-year." (p. 5). Announcements by the 80 ICT firms analysed suggested that employment would drop by an additional 2-3% by the end of 2009. Some niche industries such as green IT and cloud computing, however, were promising to develop new employment despite general job losses.

The case companies interviewed for this study have been selected from both ICT services companies (Companies C and E) and ICT using companies (Companies A, B and D), in order to explore differences in the demand, and the shortages in the supply experienced.
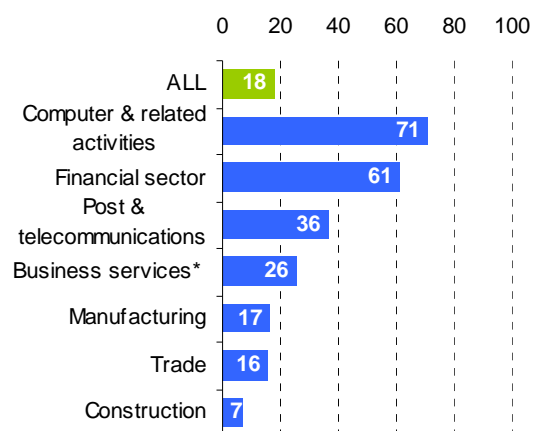
Which companies employ ICT practitioners?

When assessing the demand for ICT practitioners (in non-ICT companies), a clear distinction must be made between larger companies that typically have their own ICT department (and thus employ ICT specialists) and other mainly smaller companies have mostly outsourced ICT services and therefore do not employ ICT specialists on their own. The skills-related challenges they may experience are quite different. Companies with their own department and staff may directly suffer from a shortage of ICT specialists (e.g. software programmers, ICT consultants). Those companies that do not employ practitioners themselves are only indirectly concerned by skills shortages, for example in the way that procuring or outsourcing ICT services can become more difficult or expensive.

In ICT services sectors, almost by definition, a relevant share of employees in primary business functions can be expected to be ICT practitioners, for instance software programmers or IT consultants. In user industries, most IT specialists are employed in medium-sized and particularly in large enterprises.

According to the Eurostat survey of 2007, only about **18% of all companies** in the EU with at least 10 employees said that they employed ICT specialists at that time. The picture varies widely by sector, however: in computer related activities and in the financial services sectors, 60-70% of all companies employ ICT staff, while in construction only 7% of the companies do so. These differences reflect not only the different nature of business activities, but to a large extent the industry structure: some sectors such as construction have a high percentage of small companies with 10-20 employees which are unlikely to employ IT specialists.

Exhibit II-2: % of enterprises employing ICT specialists (2007)

Sector	%
ALL	18
Computer & related activities	71
Financial sector	61
Post & telecommunications	36
Business services*	26
Manufacturing	17
Trade	16
Construction	7

Base: enterprises with 10+ employees using computers
(* without computer services)

Source: Eurostat ICT Survey

Among **large companies** (with at least 250 employees), about **70%** had their own IT staff (see Exhibit II-2). This picture is validated by the recent Sectoral e-Business Watch surveys (2009), even if there are some variations between sectors, reflecting structural differences. For the glass, ceramics and cement industries, the findings are fairly consisted with those of the Eurostat survey for the total population of enterprises from the sectors covered (see Annex I). Among energy supply companies, the percentage of companies with IT specialists is significantly higher; this reflects the lower number of SMEs, but also the higher-than-average general importance of ICT in this industry.

Looking at the results in more detail, the figures also raise some questions whether the terms "ICT practitioner" and "ICT specialist" are properly understood by the respondents. If employing ICT practitioners / specialists is used as a proxy for having an IT department, it comes as a surprise that 'only' 70% of large companies report that they employ practitioners. One would assume that any company with 250 or more employees must have at least 1-2 people mainly charged with IT-related tasks; typically, a large firm with several hundred employees will have an IT department in the range of 4-10 people.[25] However, 3 out of 10 large enterprises reported that they did not employ any practitioners. It can be speculated that the term "ICT practitioner" in itself is not intuitively clear, even if a short definition is offered. For example, some respondents that fill in the questionnaire (or respond to the respective question on the phone) may not count their PC and network administrators in, although they are mainly charged with ICT tasks.

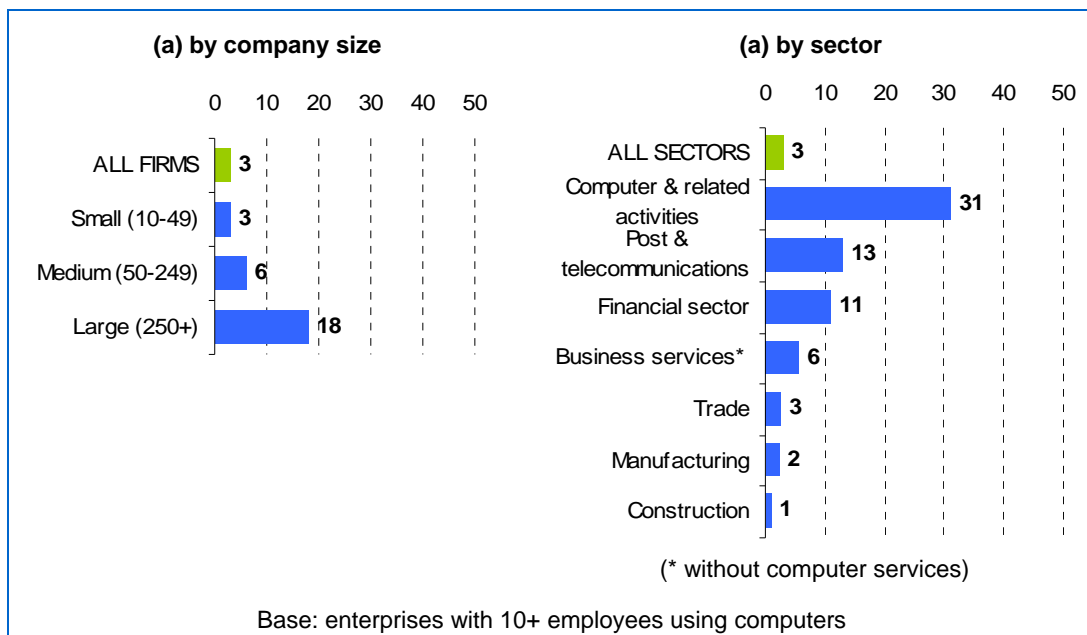## Recruitment activity and challenges experienced

The IDC/empirica study on e-skills (2009, see above) estimates, based on figures available for 2007 ("baseline") and a forecast model considering economic framework conditions, that demand and supply of ICT practitioners in the EU will be roughly matching each other in 2010. Due to the economic crisis, the shortage experienced during the growth period of 2004-2007[26] has almost completely disappeared. In other words, on the aggregate level, there is currently no shortage of specialists according to the IDC/empirica study. However, as stated above, there can be significant differences between countries and sectors, for example between companies in ICT services and ICT using industries.

The general assessment can be substantiated by results of the Eurostat and Sectoral e-Business Watch surveys. Companies that actually employed practitioners were asked whether they had had job vacancies for IT staff in the past 12 months, and if they had experienced difficulties in finding qualified people for any of these positions. According to the Eurostat survey, about 3% of all companies and 18% of the large ones reported **difficulties in finding qualified people** (see Exhibit II-3). About half of the companies with ICT practitioners said they had no job openings for such positions in the past 12 months (see red and blue segments in Exhibit II-4).

---

[25] These are typical numbers given by human resources managers of companies of that size interviewed for this study and at events. In the survey, the average number of practitioners was 4 (for large companies; interviewees were asked how many ICT practitioners their **Company Employs**).

[26] Germany may serve as an example how the situation has changed. Back in 2007, according to BITKOM, the German Association for Information Technology, Telecommunications and New Media, out of 43,000 ICT vacancies at least 4,000 could not be filled. 50% of the ICT companies considered the skills shortage to be a "large" or a "very large" problem (quoted from Deutsche Bank Research, 2 September 2008, p. 2).

Exhibit II-3: % of enterprises with difficulties in finding qualified staff (2007)
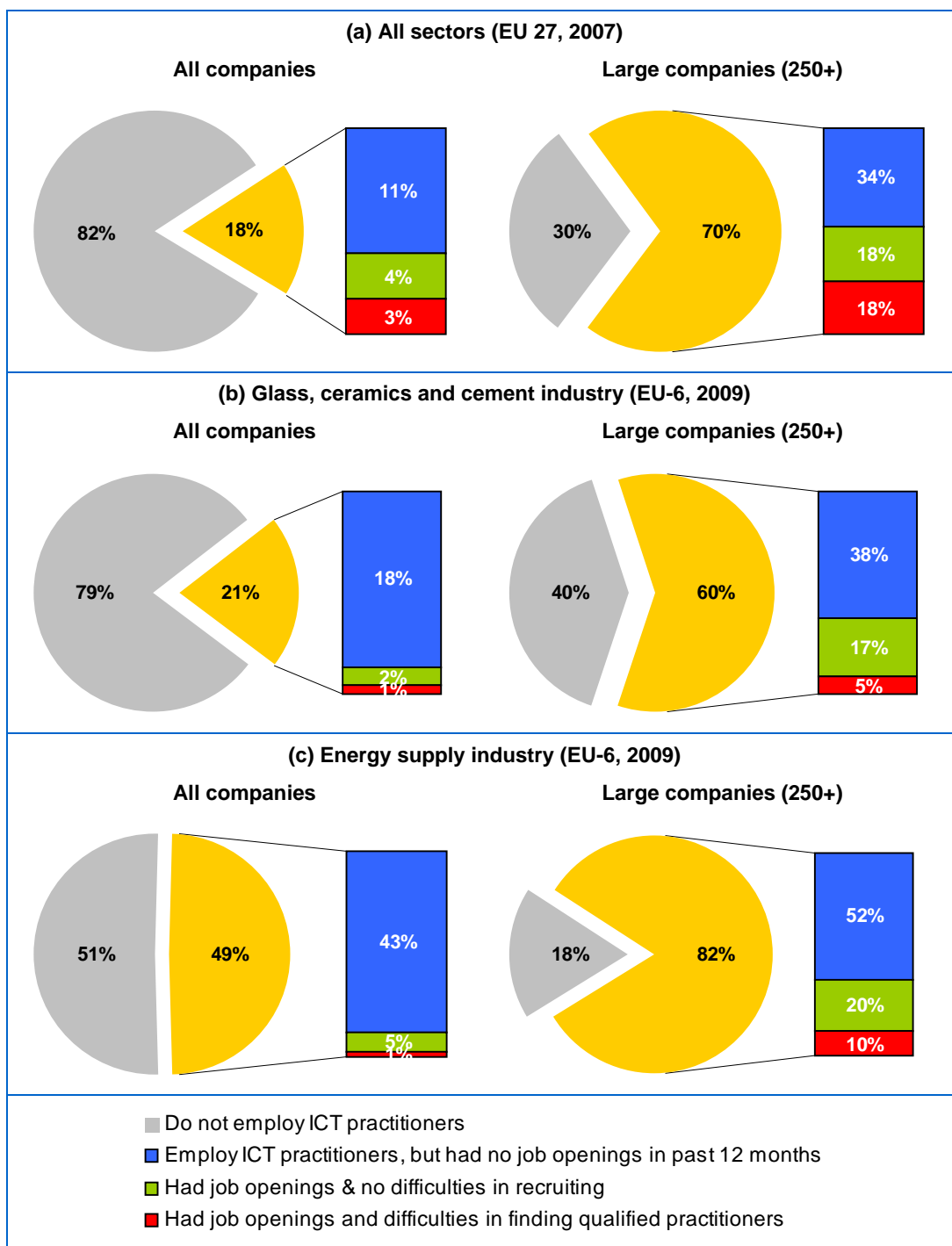

(a) by company size

ALL FIRMS	3
Small (10-49)	3
Medium (50-249)	6
Large (250+)	18

(a) by sector

ALL SECTORS	3
Computer & related activities	31
Post & telecommunications	13
Financial sector	11
Business services*	6
Trade	3
Manufacturing	2
Construction	1

(* without computer services)

Base: enterprises with 10+ employees using computers

Source: Eurostat ICT Survey

The corresponding figures from the e-Business Watch surveys of 2009 are quite similar (see Exhibit II-4 b and c), in particular for the glass, ceramics and cement industry – a traditional manufacturing sector with many SMEs. There is one difference to the Eurostat figures from 2007, though: the percentage of larger companies which report difficulties in finding the right ICT specialists is lower (5% in the glass/ceramics/cement industry, 10% in the energy supply industry). This is probably related to the dramatic change in the economic framework conditions. As outlined in the introduction, the ICT skills gap is largely cyclic; while the Eurostat survey was conducted during a period of strong economic growth, the e-Business Watch survey was conducted at height of the global economic crisis in March 2009. Many companies had reduced or generally frozen on further recruitment at that time.

It should also be considered that many mid-sized companies which employ some ICT practitioners will normally not have job openings every year. If they need additional IT expertise for specific projects (and for a limited time period), they will rather contract an external service provider for these specific tasks. Only very large companies (by rule of thumb those with more than 1000 employees) have such a large ICT department that recruiting new ICT staff is a routine. They are the ones (in the ICT-using industries) who are primarily affected in case of a skills shortage.

Exhibit II-4: % of companies employing / recruiting ICT practitioners

(a) All sectors (EU 27, 2007)

All companies — Large companies (250+)

(b) Glass, ceramics and cement industry (EU-6, 2009)

All companies — Large companies (250+)

(c) Energy supply industry (EU-6, 2009)

All companies — Large companies (250+)

Legend:
- Do not employ ICT practitioners
- Employ ICT practitioners, but had no job openings in past 12 months
- Had job openings & no difficulties in recruiting
- Had job openings and difficulties in finding qualified practitioners

Data sources: Eurostat ICT Survey 2007 (for "all companies"), Sectoral e-Business Watch surveys 2009 (for glass / energy sector); charts developed by empirica.

In the Eurostat survey, companies that reported difficulties in filling vacancies for ICT specialist jobs were asked for the main reasons. Several possible reasons were offered (see Exhibit II-5), but the results are rather unspecific. It is therefore probably a combination of different factors that create challenges. These factors are also linked with each other. A lack of specific qualifications in the market will reduce the number of applicants for a certain position, and at the same time drive salary requests of those specialists who possess the rare qualifications.

Exhibit II-5: The main reason for hard-to-fill vacancies for ICT specialist jobs was ... (2007)

... lack of applicants with ICT skills	71
... lack of qualifications	61
.... salary requests too high	54
... lack of work experience	63
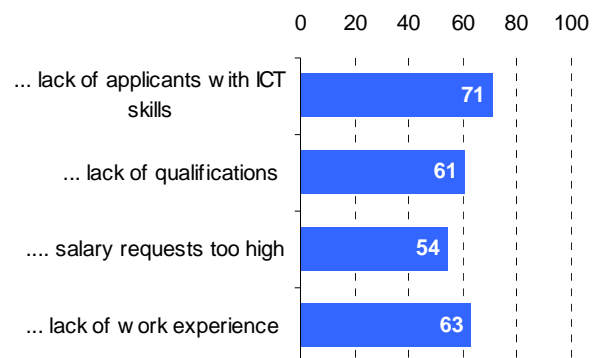
Base: enterprises which reported difficulties in filling their vacancies for ICT specialist jobs

Source: Eurostat ICT Survey

In summary, the IDC/empirica study as well as the survey data indicate that a majority of companies in most sectors are at least not directly affected by a shortage of ICT practitioners at this point. When going into the details, however, the picture is more complex, as the case studies in Section II.1.2 will show. Companies in the ICT services industry do experience challenges, for example to find ICT consultants. Results show that qualitative issues matter which may be obscured when only looking at aggregate figures.

Formal education levels expected from IT staff

The Sectoral e-Business Watch asked those companies which employed ICT specialists (in 2009) which type of formal education they expected from their ICT staff. The results showed some variations by sector and firm size; in general, the requirements of large companies where higher than those of smaller firms. In the energy supply industry, a third of all companies said that they expected a **university or college degree** for most positions, and close to 80% at least for some positions in the IT department (see Exhibit II-6). Nearly half of all companies expected a concluded **vocational training** from applicants for most positions, and more than 80% for some positions. **Certified training programmes** are also relevant: more than 50% said that these are required for some positions.

In the glass, ceramics and cement industry, relatively fewer companies have strict requirements with regard to formal education. About 50% expect a university or college degree at least for some positions, and about 60% a concluded vocational training. The difference to the energy supply industry is partly due to the higher share of SMEs in this sector. The requirements of larger companies are more similar to those reported by the energy industry.

Exhibit II-6: Qualifications expected from ICT practitioners (2009)
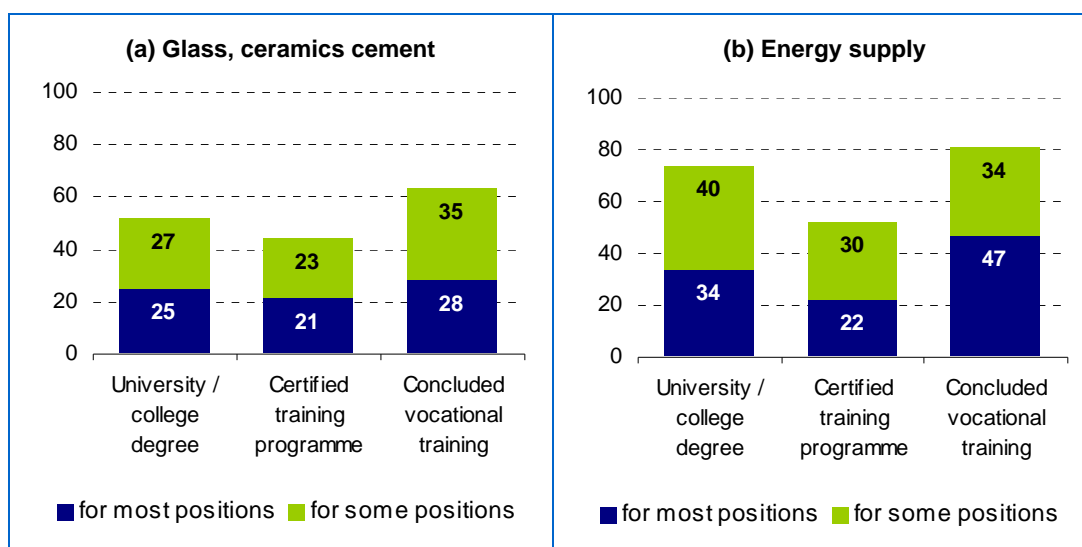
Base: enterprises employing ICT practitioners (N ~ 180 in both sectors)

Source: Sectoral e-Business Watch survey 2009

II.1.2   Case studies

This section presents the results of the personal interviews conducted with IT and e-business managers specifically for this study. At the time when this interim report was prepared, five managers from 3 companies were interviewed (see overview in Section I.2.2). The companies asked not be named; results are presented anonymously.

Organisational structure and employment of ICT practitioners

Company A

Company A is a stock-listed European manufacturing company in the size category of 5,000-10,000 employees, maintaining international operations in more than 20 countries. Its "corporate IT services" department is located at the company headquarter and has a staff of about 50 employees. The department consists of six units (see Exhibit II-7): Infrastructure, Services (with the focus on e-business) Organisation (for specific IT projects), Development (software development), Middleware (databases) and Business Intelligence (reporting). In addition to the central IT department, there are ICT specialists at the various production sites which the company operates in different locations and countries (36 sites in total). On average, there are 1 or 2 employees at each site (about 60 in total) who are responsible for the maintenance of the local ICT infrastructure at the site. The IT infrastructure units at the production sites are managed by the central Infrastructure unit.

For this study, interviews in Company A were conducted with the heads of the of the Services unit (= *Interviewee A1*) and of the Infrastructure unit (= *Interviewee A2*). *Interviewee A1* provided mainly information about the demand for ICT practitioners, *Interviewee A2* about the company's e-business activities and related skills requirements (see Section II.3.1).

Exhibit II-7: Organisational structure of the IT department at Company A
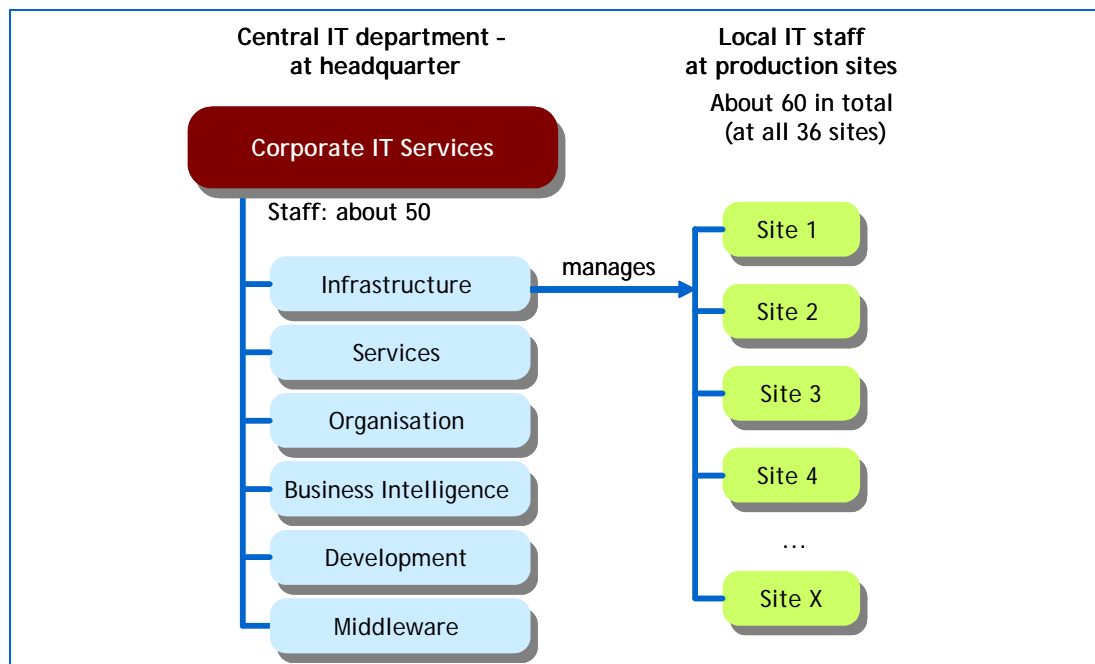
Company B

Company B is a large, **global manufacturing company** with more than 30,000 employees worldwide, maintaining operations in all continents. The central IT department at the company headquarter is responsible for **IT governance**, a corporate governance function that focuses on planning the company's information systems in the broadest sense and monitoring their performance and risk management. IT governance can be defined as "the leadership and organisational structures and processes that ensure that the organisation's IT sustains and extends the organisation's strategies and objectives."[27] In Company B, this includes responsibility for the governance of enterprise systems, architectures, enterprise data management, e-business and standardisation issues. In total, about 120 employees are directly employed in one of the five units of the IT governance department. *Interviewee B1* is a senior manager in the technology & architecture unit (about 20 employees); his team is responsible mainly for planning and managing the PC client infrastructure. He explains that, although there are units for specific areas, the work organisation is mostly project-based; project teams that are set-up for specific assignments. *Interviewee B1* argues that a project-based organisation is the best way to cope with the constant changes in the ICT domain and the fast pace of the development.

In addition to IT governance, Company B has about 120 **information managers** working either at the company's headquarter (about two thirds of them) or at other company sites in Europe. They must possess a good knowledge of ICT issues, but they need not be ICT specialists in the narrow sense, as they are not implementing technology themselves. Information managers are working "at the interface between business and IT" (*Interviewee B1*). They are employed in different functions and departments of Company

---

[27] IT Governance Institute 2003, "Board Briefing on IT Governance, 2nd Edition". http://www.isaca.org/Content/ContentGroups/ITGI3/Resources1/Board_Briefing_on_IT_Govern ance/26904_Board_Briefing_final.pdf (accessed in July 2009)

B but are not part of the IT governance department from an organisational perspective. However, the information managers are of course key contact points for the IT governance team in the various departments.

Thus, the company's total ICT headcount is relatively small (about 150 people, if information managers are included) in relation to the size of this multinational company. The reason is that Company B has nearly completely **outsourced IT operations** to external IT service providers, most of it to a service provider which is a 100% subsidiary of Company B. The staff directly employed by Company B focuses on IT governance and strategy development and manages the contracting and cooperation with external service providers. User support and help desk functions have also been outsourced to the service company.

Exhibit II-8: Organisational structure of the IT department at Company B
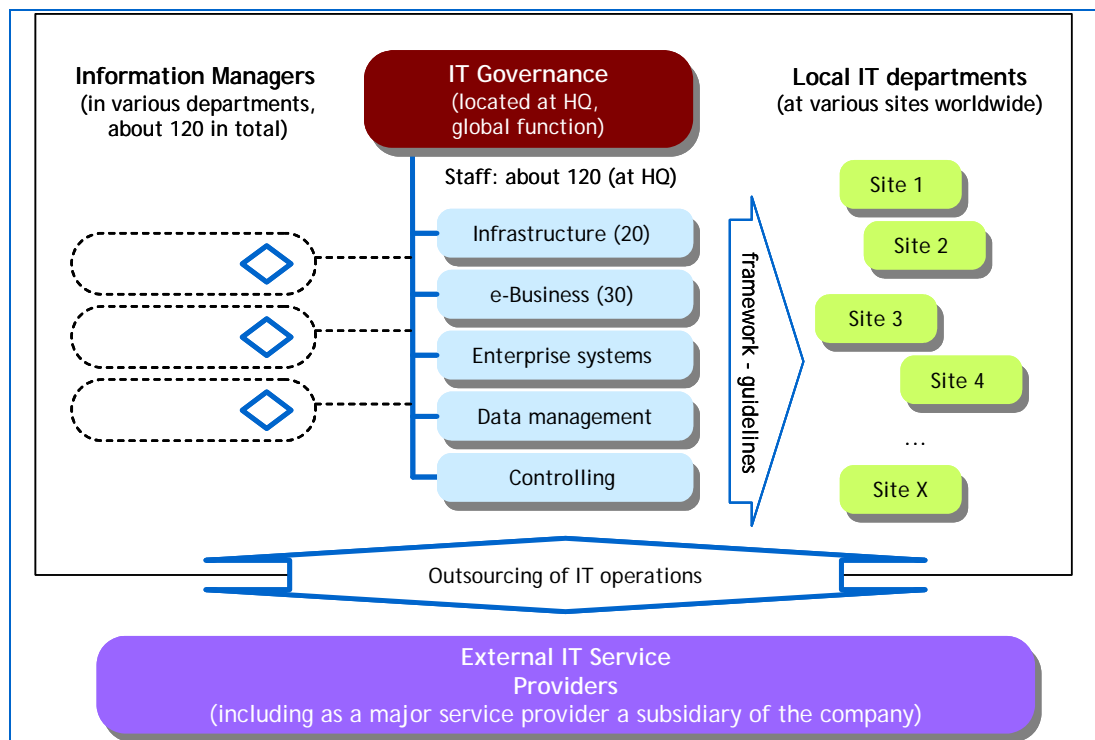
Company C

Company C is a **large ICT service provider** with more than 2,000 employees in Europe. The company is specialised in providing services to clients in the process manufacturing industry. The service portfolio covers consulting services, the design and realisation of solutions, and managed services (including helpdesk services, messaging and network services, security services). It is organised along the "plan, build, run" model, with three main areas (business solutions, development centre, ongoing services[28]); in a second layer, there two marketing divisions aiming at the acquisition of new customers in support of the service divisions (see Exhibit II-9). Within the main services divisions, about 60% of the employees work in the ongoing / managed services division, and about 20% in each of the other two divisions. *Interviewee C1* is a manager in the Business Solutions unit, responsible for a team of about 50 people.

---

[28] "Ongoing services" comprises four divisions: service management, customer & workplace services, application services and information processing & network services.

Exhibit II-9: Organisational structure of the IT department at Company C
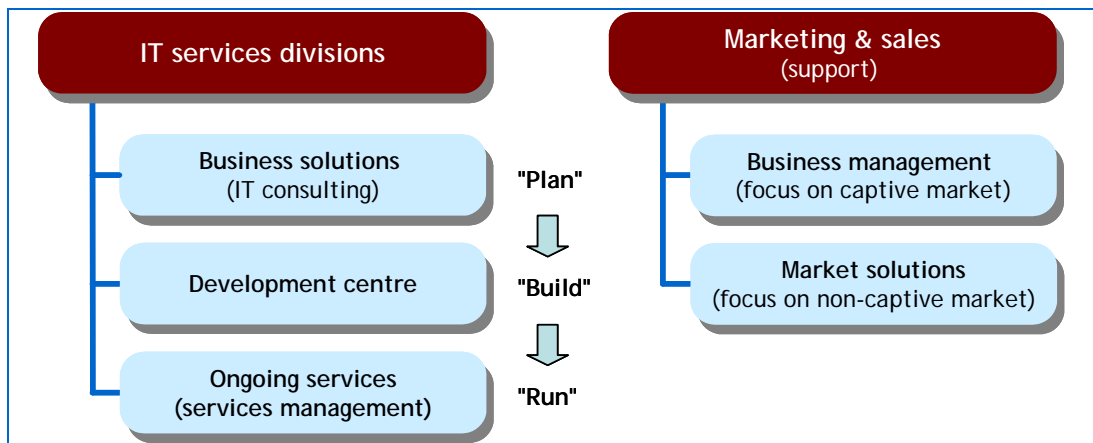
In contrast to IT using companies (such as Companies A, B and D), where relatively few ICT practitioners are employed, at Company C most of the employees (about 90%) are ICT professionals. The other 10% include secretarial assistants of managers or work in support functions such as administration and controlling.

Company D

Company D s a **global manufacturing company** from the transport sector with more than 30,000 employees and an international presence. It is an intensive user of ICT, in particular to support its advanced supply-chain and logistics system. Company D's ICT division is structured into five main organisational units: governance (responsible for resource and competence management), horizontal operations, and three units for specific functional areas (purchasing, sales, finance) – see Exhibit II-10.

Exhibit II-10: Organisational structure of the information systems division at Company D
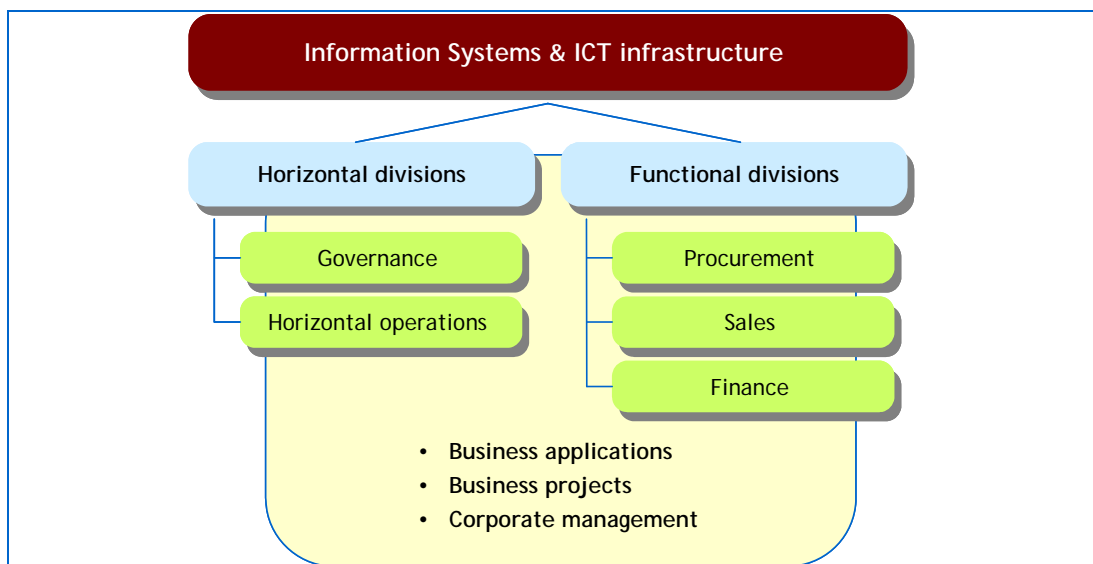
In total, more than 1,000 ICT practitioners work in these divisions. In addition to the primary structure, there is a secondary structure which describes the content of the work rather than the functional area: about 700 ICT professionals work in the area of "business applications", about 300 on business projects, and the remaining ones (about 100) in corporate management. The latter category has mostly non-ICT specialists who are preparing strategic reports based on data delivered by the company's information

systems. Thus, Company D has a kind of matrix structure to manage its ICT infrastructure and information systems. *Interviewee D1*, who is in head of competence management in the IT Governance division, explains that the company was in the process of changing the organisational structure at the time of the interview.

Company E

Company E is a **large ICT service company** with more than 3,000 employees, with offices in more than 50 countries. It provides services to business customers from different sectors, focusing on software for enterprise integration. About a quarter of the employees are based in the country of the headquarter. The business activities of Company E can be divided into two main fields: software development, and IT consulting services. Most of the employees in these primary business functions are ICT practitioners; about 1,500 practitioners work in software development, about 600 in the consulting division. In addition, ICT practitioners work in support functions (back-office support, finance) and –to a lesser extent– in marketing & sales.

Recruitment activities and strategies

Company A has on average about 5 job openings for ICT practitioners per year (for any of the six units). Some of these positions are replacements, others (in recent years) have been new jobs resulting from the growth of the company and the Corporate IT Services department. The recruitment procedure for ICT practitioners is managed by the IT department and not by Human Resources. The basis for recruiting new staff is a job description. The qualifications expected from applicants are derived from the job description. Company A uses different channels to announce job openings, depending on the position. In most cases, the initial announcement is limited to online media, which includes special **IT forums** and **online career portals** such as "Monster". "We find most of our people by announcing job openings online," says *Interviewee A2*, and states the main reason for preferring online forums: "In those forums, one gets immediately an excellent picture of the specific experience and skills of a candidate; you just have to look at the contributions and articles he has posted." This observation demonstrates the rising importance of Web 2.0 for recruiting purposes. At least in the ICT domain, the "online footprint" of specialists can be expected to be as important as their "formal" CV in the future.

Traditional employment ads in print media are only placed as a second measure if the search via online channels was not been successful. Sometimes, in particular for international recruitment activities, agencies are used; for example, if the company opens or expands a production site in another country and needs staff to run the local IT infrastructure there.

Interviewee A2 explains that the recruitment of new staff is often triggered by specific **projects**. "Our IT department is highly project-driven. If we realise that we need specific skills or additional resources for a project, and if we think that we may need these skills beyond the lifetime of the project, we will probably try to hire somebody with these skills." If specific skills are only needed for a short time in a specific project, the support of external service providers or freelancers will be sought. At the time of the interview, Company A hat concrete plans to hire 2-3 additional people for planned projects. *Interviewee A2* said that the announcement of the positions would mostly focus on the country in which the company is headquartered, but some international contacts would also be informed about the positions.

Most interviewees said that it was very difficult to attract experienced ICT specialists which are employed in other companies. The staff turnover in ICT positions is generally low in many companies, in particular with regard to senior positions. In Company A, **salary requests** of applicants are not experienced as a problem (or only in exceptional cases). "Most of our applicants have very realistic expectations about their salary", says *Interviewee A2*. "It is really a matter of the qualifications and not of the money in the vast majority of the cases."

In **Company B**, the recruitment of ICT practitioners for the IT governance is not a big issue, due to the relatively small number of people (about 20 in total) and low staff turnover, according to *Interviewee B1*. In the infrastructure team, for example, there was a single job opening in the past two years. As for information managers, these are mainly recruited internally from existing staff. It is of course an advantage for an information manager, hence he knows the working routines of the department from his own experience.

Company C, the IT service company, had about 10 job openings at the time when the interview was conducted. The total number of job openings per year is difficult to specify because the figures can differ significantly from year to year. *Interviewee C1* mentioned that there were about 30 job openings in 2008 for a division which employed about 440 people in total. Thus, the number of job openings corresponded to about 7% of employees. He explained that most job openings would concern **IT consultants,** in particular with a strong background in **business processes**: "We concentrate our recruitment activities much more on the consulting skills than on the purely technical skills."

Company D, a global manufacturing company, had about 120 open positions for ICT practitioners at the time when the interview was conducted. This corresponds to more than 10% of the total ICT workforce. For these positions, the company planned to recruit about 70 external professionals (i.e. new staff), while about 50 positions were planned to be filled internally (i.e. with existing staff). *Interviewee D1*, Head of competence management in IT Governance, explains that the situation was substantially influenced by the company's strict cost reduction programme, which was issued in response to the economic crisis. In some countries (including Germany), the management issued a complete freeze on further recruitment until the cost reduction programme is fully imple- mented. However, the situation differed between countries, he explained: "To give an example, in Germany we first have to terminate 8 positions in the ICT department before we can actually recruit new staff. In France, by contrast, we still plan to hire about 70 new people. In the UK, we replace people who leave the company but do not hire additional staff."

In 2008, the total recruitment balance was a net loss of 10 ICT practitioners: the company lost about 95 ICT practitioners and hired about 85 new ones. *Interviewee D1* stresses the important **difference between standard staff turnover and unforeseen events** for planning the recruitment activities: "We can cope very well with the standard turnover, as we can anticipate the demand and plan in advance; what it makes the whole business difficult are internal restructuring activities, mergers & acquisitions and fast changes in the economic environment such as the current crisis."

There are also **differences between the countries** with regard to the typical recruitment paths and strategies, as *Interviewee D1* explains. In Germany, Company D would

typically hire university graduates from relevant ICT programmes,[29] while in France, a dominant recruitment process would be to hire external consultants who have already been working for the company for some time on a specific project. Thus, formerly external service providers are "insourced".

For Company D, a very important objective in this context is how to position itself as a preferred employer for young ICT practitioners. *Interviewee D1* said that this was very important to attract talent, in particular with a view to the next 5-10 years, when a significant number of senior staff will have to be replaced. As an internationally well known high-tech company, Company D is facing a specific challenge in that respect according to the interviewee: while it is relatively easy to attract skilled engineers for its core (or primary) business functions, it appears to be more difficult to attract young people to work in support functions such as information processing.

With regard to the preferred channels for recruitment, Company D is largely in line with the approach described above for Company A. "We practically do not use ads in print media to announce open positions at all", says *Interviewee D1*. The company uses mainly **e-recruitment platforms** (job and career portals). Furthermore, **personal networks** are very important to get in contact with potential candidates who have specific skills.[30] "Often, we have already potential candidates in our pool; either because they have sent us an application before, or from our contacts to universities." The close cooperation with a local university (see also following sections) has been particularly important for Company D. "We hire many ICT practitioners directly from this university", says *Interviewee D1*, "and fill a good deal of our positions this way." In particular the "planned" part of the vacancies (the standard staff turnover, see above) can be mostly filled through the cooperation with the university.

Company E, a software and IT consulting company, had relatively few open positions for ICT practitioners at the time of the interview – globally about 40. This corresponds to about 2% of its total ICT practitioner workforce. About half of these positions were in the country of the headquarter. *Interviewee E1*, Head of Human Resources[31], explains that the **economic crisis** has had a significant impact on the demand and subsequently on recruitment activities. The company focuses currently mainly on its consulting activities and on marketing its products services. Most of the 40 open positions are for jobs in these domains. There are only very few open positions for software developers. The situation is similar in the back-office support, where staff leaving the company is not necessarily replaced at the moment.

Besides the economic crisis, there is another special situation which has an important influence on the recruiting activities. Company E has recently made a major **acquisition** (another ICT services company) and is currently in the process of integrating and aligning the services of the two companies. Against this background, the company has been very cautious with hiring new external staff, as it is possible that ICT professionals from

---

[29] Typically either from information sciences ("Informatik") or business informatics ("Wirtschafts-informatik", a programme that combines business, management and information sciences modules). The latter has been successfully established as an academic discipline (including bachelor, master and diploma programmes) in particular in Germany, Austria, Switzerland and the Netherlands.

[30] This was also mentioned by *Interviewee B2* for the recruitment of e-business managers (see Section II.3.1).

[31] *Interviewee E1* is responsible for several European countries, including the home market. There are other Heads of Human Resources, with responsibility for specific areas each.

specific units of the acquired company might be transferred to their new parent company during the integration and restructuring process.

In 2008, Company E issued about 100 job openings for ICT practitioners in total (worldwide). Of those, about 95% could be filled with qualified practitioners. About 60% of the positions were in the consulting branch (the remainder for product developers or in the back-office support), and most of the positions were for jobs in the main markets of the company. *Interviewee E1* said that the market situation (the supply) was quite good at that time, and that the company was satisfied with the results of its recruiting activities, for instance only very few of the newly recruited people left the company during the trial period. The figures of 2008 (regarding demand and supply) are quite representative for the past few years for Company E.

Interviewee E1 said that the **staff turnover** in those divisions/departments where ICT practitioners are mainly employed (software development, consulting, internal ICT infrastructure) was very low, at least in their main markets. Staff turnover was significantly higher in marketing & sales, but this concerns to a lesser extent ICT practitioners. In the country where the headquarter is based, the annual staff turnover was about 5% (for the total company). However, *Interviewee E1* also said that there were considerable differences between countries with regard to the average staff turnover.

With regard to the preferred channels for recruitment, Company E uses basically the same approach as Companies A and D (as described above). Traditional ads in print media are used only in exceptional cases.[32] Open positions are announced on the internet in **e-recruitment platforms** (job and career portals). "We do not yet use Web 2.0 strategies for recruiting personnel", says *Interviewee E1*. The company participates regularly in career events at **universities** to get into contact with potential applicants, and has a specific department for cooperation with universities. For example, the company supports and arranges joint lectures in cooperation with universities.

Company E also pays actively attention to **employer rankings** and aims to position itself as a preferred employer. Similarly as Company D (see above), the company image is seen as a very important factor to attract young talent in the future.

Expected qualifications and shortages experienced

Company A

Company A has 12 **standard job descriptions** for ICT practitioners in the infrastructure unit. These are the basis for job openings; the descriptions can be adapted to the specific requirements for a position. These include job descriptions for: System administrator & IT support, network and security specialists, systems engineers for various functional areas (e.g. Microsoft, Networks, Linux), IT Support / Helpdesk. In addition, there is a development team within the Infrastructure unit which focuses on developing open source solutions for the company. For some positions, a university or college degree is expected, for others, a concluded vocational training in the relevant field is expected.

---

[32]   Mainly for non-ICT-related positions such as secretarial work or accounting.

Exhibit II-11: Job profiles for ICT practitioners at Company A (examples)

Job Profile Title	Formal requirements	Expected technical qualifications
System Administrator / IT Support	Completed vocational training	Networks (TCP/IP, LAN, WLAN) MS Active Directory MS Server W2K/2003 MS Win XP MS Outlook XP/2003 MS Exchange 2K/2003
Systems Engineers (in various functional areas, e.g. Network / Linux)	(examples) Completed vocational training in engineering 3 years working experience in complex ICT architectures	(examples) Experience in LAN/WAN, Computer centre management, Scripting, Windows/Linux Server, MS Exchange, System Management. Experience in project management and as team manager
Network and security specialist		
Microsoft specialist	Windows OS / Exchange SMS	Several years working experience in the maintenance of MS systems Certification or university degree in engineering

The expected **formal education** level is not always the same for any of these generic job descriptions, but depends on the specific position as well. "We are not too strict in the requirements for formal education; we do not mind if somebody acquired his qualifications by studying at a university programme or through equivalent working experience," explains *Interviewee A2*. "A main reason why we add formal education requirements to our job announcements is that we would otherwise be confronted with hundreds of applications in many cases. Thus it is mainly a practical thing, a filter. It is not so much the university education itself that matters."

This is confirmed by *Interviewee B1* for Company B, who says that working experience or the actual proof of skills, for example on the basis of projects in which a job applicant has been involved. This is considered more important than the formal education (e.g. a university or college degree). Also, industry certifications such as the Microsoft Certified Systems Engineer (MCSE) are normally not a formal requirement from applicants. They can help to demonstrate skills in a certain field, but are not seen as a suitable criterion for structuring the search for qualified people.

Interviewee A2 confirms that the IT department of Company A is confronted with some skills-related challenges. This includes internal **skills gaps** (a competence shortfall between the current and needed competence levels of individual staff within organisations) as well as, occasionally, a lack of applicants that have the required qualifications for specific positions. Internal competence shortfalls can be the result of company acquisitions, as *Interviewee A2* explains: "We are confronted with skills gaps because we take over employees when making acquisitions; it is our philosophy and company culture not to simply replace employees because of a skills gap. Rather, we try to train them so that they acquire the expected qualifications. However, it is not always possible for us to directly take action centrally. Thus, we know that some skills gaps exist and we cannot do much about it; it is probably a fact for any internationally operating company."

Asked about challenges in the recruitment of new staff, *Interviewee A2* said that the main challenge was to find people who have a broad background in ICT ("generalists") in addition to their specific qualifications in a given area. The company prefers to hire people with generalist ICT skills rather than pure specialists. In terms of specialisations, the most acute shortage in the market was seen in the domain of **network specialists** with **network development** skills. "Ideally," says *Interviewee A2*, "we would need network specialists with a perfect knowledge of the existing "of-the-shelf" systems and solutions, but who also have the skills to develop specific components of the network themselves and not just use the available commercial solutions, in order to find a better, more cost efficient solution."

Company B

The skills requirements differ for staff who actually develop and implement technologies (e.g. programmers, developers) and for ICT and e-business managers (e.g. in IT governance), who have to understand the business potential of the technology rather than the technical details. *Interviewee B1* provides a practical example: "I am a trained engineer. 15 years ago, I was able to repair a PC. Now, I cannot. But that is no longer important in my actual position. What matters for me today is to know the trends, assess the functionalities, and have the generalist know-how to understand how different trends link with each other."

The developers and programmers, on the other hand, have to bother about the details in the domain in which they have specialised. Asked about relevant skills for ICT practitioners, *Interviewee B1* stresses the importance of **soft skills** complementary to the technical ones. He believes that communication, negotiation and project management skills are particularly important. He experiences skills gaps among ICT staff. "In my experience, most employees have excellent technical skills. If there is a skills gap, it's not so much the ICT part, but the communication skills." He recommends that soft skills should be paid more attention in the ICT curricula of universities and colleges.

Company B also has standard job descriptions. These are derived from an internally developed and applied competence framework (see below).

Company C

At Company C, the expected formal education level and the expected job experience clearly depend on the specific position. However, there is a marked difference between positions in the consulting domain and other areas, as Interviewee C1 explains: "In the consulting area, I estimate that a university degree is required for about 70% of our positions. By contrast, if we look at help-desk functions or PC maintenance, there are only few positions where higher education is required, I would say fewer than 10%."

In the consulting branch, the Company D has a strong demand for SAP advisors (see also section on recommendations for ICT training). Interviewee C1 mentioned some specific applications and areas were it was particularly difficult to find business advisors; these included Business Warehouse (BW) and Advanced Planner Optimiser (APO). "It is always the most recent applications and issues for whom it is most difficult to find consultants." For other SAP modules, which exist for many years, it can be much easier to find consultants. This example demonstrates that the skills requirements of IT services companies can really be highly specific and change quite fast.

Asked about vocational training for IT practitioners, Interviewee C1 provided figures for a division which employs about 440 people. He said that about 75% of the staff would attend at least one external training scheme with a 12 months period, for example one of

the trainings offered by large software companies such as SAP. In addition, Company C offers internal training opportunities in different skills domains, for instance project management.

Company D

Interviewee D1 said that his company, in the information processing domain, made a basic distinction between ICT professionals with mostly **technical ICT skills** and those which combine ICT-skills with **business & management skills**. In terms of qualifications and job profiles, Company D has defined three focus areas for the career development of its ICT staff: project management, ICT architecture, and services management. Service managers are responsible for the smooth cooperation with the external IT service providers. For Company D, these include in particular IBM and Hewlett-Packard, with whom the company has significant contracts.

Typical career paths in Company D would start either as systems developers or systems administrators, i.e. to support the ongoing operations, for a period of 3-5 years. Then, the ICT practitioners would increasingly be charged with planning and management functions such as specifying the company's ICT architecture requirements for a specific unit, and managing the interface between the company's internal users and the external service providers. According to *Interviewee D1*, this perspective would gradually substitute the former static job profile categories such as "database administrator" or "system administrator". "We have to go one step before," argues Interviewee D1: "We need to understand and properly specify the requirements, and once the application or service has been implemented, we need to continuously control the performance." He said that the technical levels (such as systems implementation and maintenance) would increasingly be taken care of by the external ICT service providers; the critical task for the ICT practitioners employed by Company D was to manage the requirements and to the contracts & cooperation with the service providers.

Interviewee D1 said his company experienced a **lack in the supply of trained ICT staff** with a university degree. However, he said that the situation would differ between countries. In Germany, he observed that the supply of university graduates who have specialised in systems integration was somewhat better than the supply of graduates specialising in systems development, although the lack concerned both types of qualifications. The main difference between these qualification profiles is that the training of systems developers focuses on software engineering (for specific systems), while integrators should acquire a broader understanding of different systems and how they interoperate (at the cost of depth with regard to specific systems). Interviewee D2 recommended that efforts should be made to increase the number of university graduates in information sciences and related studies, and also made some recommendations with regard to the curricula (see below).

The major skills shortage in the market, according to *Interviewee D1*, concerns **systems architects** and **process architects**. "There is practically no supply of ICT professionals with this qualification profile", says *Interviewee D1*. "Even people who use this job title themselves mean completely different things, and often it is not what we would expect from a systems or process architect." Company D still uses IT platforms that were set up in the 1970s and have then been transformed (or "reengineered") into newer architectures. However, this is a complicated process, and often the knowledge how the older platforms work lies with a few people in the company, typically older engineers. When these people leave the company, it creates problems. Company D has an urgent need for ICT practitioners with expertise how to set up "architectures of information

systems, aligned with the business processes of the company, and taking into account the historical evolution of the existing architectures", says *Interviewee D1*. "Out of our more than 1000 ICT professionals, we have only two who fulfil with these requirements." Company D has recently implemented a specific task group to work on this challenge.

Asked about internal training activities, *Interviewee D1* stressed that training was an absolute priority at Company D. It is also planned to further strengthen the cooperation with universities in the provision of vocational training. About 90% of the ICT trainings in which ICT practitioners take part are product-specific, typically provided by the respective solution provider (e.g. Cisco, Oracle, SAP). In addition, the company offers specific training programmes in IT project coordination. Currently, about 50 employees are attending this programme.

Company E

ICT practitioners in Company E are mostly software developers, ICT consultants or take care of the internal infrastructure. In the **consulting branch**, a university degree is required for about 80% of the positions. ICT consultants are often hired directly from the university and then trained on the job. For management positions in consulting (project management, team leaders), working experience is required as well, the amount depending on the position. Managers in the consulting branch are preferably recruited internally. Important skills include business process management.

In **software development**, the prove of the practical (software-related) skills is more relevant than a formal education; for many positions, working experience (ideally of at least 4-5 years) is required. Important ICT skills for many positions in Company E include expertise in programming with Java (Java EE / J2EE) and SOA (Service Oriented Architecture) expertise.

In general, Company E is quite satisfied with the supply of ICT practitioners with regard to their ICT competencies. *Interviewee E1*, the human resources manager, said that applicants for open positions, notably university graduates, had typically very good ICT skills which complied with the company's requirements. The company has not experienced a shortage of talent in this respect, at least in its major markets in Europe.

Interviewee E1 said that the challenge was rather that applicants often lacked soft skills, which is a problem in particular for ICT consultants. "We often interview candidates who have excellent ICT skills, but with major deficits in their **communication and social skills**. This is really a pity, because we simply cannot employ such people as consultants, where they would be in direct contact with customers most of the time." The main shortcomings observed are difficulties in expressing oneself properly, a lack of self-confidence, or even bad manners. "I remember applicants who received and answered calls on their mobile phone during the interview", provides *Interviewee E1* anecdotal evidence.

A specific challenge mentioned by *Interviewee E1* was how to keep ICT practitioners in employment who have worked for the company for many years and specialised in an areas which have lost in importance over time.

Recommendations for ICT training

Interviewee A2 pointed at a challenge with regard to **open source skills**. He said that there was an increasing demand for ICT practitioners with special skills in open source software development: "At least in our company, open source will definitely become a more and more important issue." However, it was difficult to identify and find people in

this domain, not only due to a lack of skills in the market, but also because of a lack of formal criteria to specify the requirements. Currently, open source skills are often self-taught; university or college degrees or certifications of ICT vendors are therefore not a useful indicator or search criterion. *Interviewee A2* recommended that open source skills should take a more important role in the curricula of ICT training programmes or in certified trainings. It would make it easier for companies to work creatively with open source if there were more certified specialists. He mentioned the SUSE certification as an example that goes into this direction.

Interviewee D1 explained that Company D cooperated closely with a university in the region of the company headquarter, with the objective to innovate and adapt curricula and offer a new type of ICT training. A group of CIOs specified skills requirements; together with the university, these were translated into curricula for a new study programme which starts in autumn 2009. The longer-term objective behind this commitment is to train young people to become a new generation of IT managers. Thus, **business and project management skills** are seen as very important besides technical ICT skills. However, this is a recent project and there is no experience yet to assess its effectiveness and results. "We know what we need and what we would like to get", says Interviewee D2, "but it is not certain yet what kind of graduates exactly the new programme will deliver. We will know in 4-5 years." The major challenge is to anticipate which types of students will be attracted by this new programme, and how they are going to set their own focus. Interviewee D1 anticipates that will be increasing demand for graduates who were trained both in technical ICT skills and in management skills.

Asked about general trends and requirements in ICT training, Interviewee D1 argued that **programmes** that train students **for positions in ICT services companies should be different** from those that train students for positions ICT user companies. "I do not think that it will work in the future to train information scientists in a uniform way, who will only at the end of their studies decide whether they work for SAP [i.e. for an ICT service provider] or for a car manufacturer [i.e. for a user company]. We must make a difference between 'producers' and 'consumers'. The skills requirements for a systems developer at SAP are fundamentally different to those of the person managing the application at the site of SAP's customer. Interviewee D2 expects that this will be reflected in more distinct study programmes in the future. At least among large manufacturing companies, the requirements for IT managers are seen as quite coherent. Interviewee D2 conceded, however, that his vision of differentiated programmes was from the perspective of (very) large companies, and that he could not say to what extent this would also apply to SMEs from the user industries.

Interviewee E1 mentioned as a major difficulty for an internationally operating company the **lack of comparability between university degrees** in Europe, in particular from different countries. The company has experienced that a "bachelor" or "master" in information sciences from one university can often not be compared to the same degree from another university with an apparently similar programme, not only in terms of the quality of the education, but also in terms of curricula. This lack of transparency is a challenge not only for the hiring companies, but also for students when making decisions in their study plans. "When visiting universities, I am often asked by students whether they should go for a bachelor or for a master", says *Interviewee E1*, "but I just cannot make any such general recommendation." The interviewee does not have the solution to the problem, but says (s)he would appreciate any initiative at the European level to increase the transparency of how different programmes can be compared, and

mentioned as a possible approach to set up a central online database with an overview of European universities, their degrees and how they compare to each other.

The interviewee stressed the importance of **practical experience** from internships, in part due to the fact that the degree as such does not tell too much about the qualification of an applicant: "We look carefully at the practical experience of a graduate, for example in which companies he made an internship during his study. This is very important for us. A graduate, even a good one, without relevant practical working experience is much more difficult to integrate in the company."

Finally, *Interviewee E1* recommended that universities should also try to train the **communication and presentation skills** of their students, as this is an important aspect in many professions besides the technical skills (see above).

Anticipated trends and challenges

The e-business managers were asked to name some general trends and challenges which they observe in their area. While not all of these trends have direct implications for e-skills demands, they indicate issues which their units will probably have to deal with in the future.

Impact of the economic crisis: The case companies differed in how the economic crisis affects their ICT departments. The ICT infrastructure unit of Company A has not been negatively affected. On the contrary, the head of unit (*Interviewee A2*) said that it was a "very exciting period" for him as well as for the engineers, because the enormous time pressure that dominated their work during the growth period until 2008 has been relieved. They can now take the time to develop their own (and better) solutions, while in the years before, "everything had to be accomplished in a hurry, with little opportunity for developing innovative, creative solutions ourselves."

In Company B, the ICT budget has been decreased as a result of the crisis. However, there was no major disruption with regard to the overall organisation or goals. *Interviewee B1* points out that the company has always been very conscious about costs and highly result-focused in its IT spending. Benchmarking has been extensively used to measure the performance and impact of ICT projects. "Our budget used to be tight, and it is even tighter now," says *Interviewee B1*.

Demographic change: The interviewees of Companies D and E mentioned demographic change as an issue to be considered in human resources and skills planning. Both companies anticipate that a significant number of their employees will retire in the next 5-10 years and are confronted with the challenge to manage the knowledge transfer within the company. *Interviewee E1* mentioned in this context that the average period of employment in Company E was 14 years, with an average age of 42 years, which is quite unusual for a company in the ICT services industry.

II.1.3   Summary

This section analysed the demand for ICT practitioner skills, taking into account differences between companies in the ICT services industry and in ICT using industries. Key points emerging from the available data and case studies are:

Total aggregate demand	The total demand for ICT practitioners in the European Union in 2010 is estimated at close to 4 million according to the narrow definition, and close to 5 million for a broader definition of practitioners[33] (IDC/empirica, 2009). In purely quantitative terms, and for the EU as a whole, it is estimated that demand and supply of practitioners are in balance in 2010. However, there are differences between countries and sectors. It is estimated that about 40% of computer professionals and associates –a proxy for "ICT practitioners"– are employed in the ICT services sector itself and 60% in ICT using industries (Eurostat Labour Force Survey 2007).
	In a representative company survey by Eurostat (2007), about 3% of all companies (a sixth of those actually employing practitioners) reported difficulties in finding qualified personnel for the positions posted. There are differences by sector and size: In the computer services industry, about 30% reported difficulties, among large enterprises, 18%.
Low staff turnover	Most of the case companies stressed that they had a very low staff turnover in their ICT units. The number of their job openings for ICT practitioners in 2008 typically corresponded to 5-10% of the total ICT staff employed. Several companies mentioned that it was very difficult to attract and hire practitioners who were already employed at another company.
Job openings mostly posted online	If companies announce job openings for ICT practitioners externally, they do so predominantly on the web (e.g. on career portals and in special IT fora); traditional ads in print media are hardly used anymore. For special positions, recruitment agencies are employed. The case studies indicate some differences between countries, however, in hiring practices: in some countries, companies focus on hiring university graduates from relevant ICT programmes; in other countries, companies often hire external ICT consultants who have already been working for the company for some time on a specific project.
Applicants have "realistic salary expectations"	Salary requests of applicants for ICT jobs were generally not experienced as a problem by the interviewed companies (only in exceptional cases). They said that most applicants had realistic expectations about the salary, and that hiring decisions were therefore mostly "a matter of qualifications and not of money". This may be linked with the current economic framework conditions in which demand and supply of ICT practitioners are in equilibrium. The negotiation power of job applicants might increase if demand exceeds supply when the economy recovers.
Impact of the crisis is experienced differently	The economic crisis unfolded its impact on the demand for ICT practitioners and the services of the ICT department quite differently in the case companies. While the majority of companies (both ICT services and user companies) have reduced their ICT budget up to a total recruitment freeze, one of the (user) companies reported that the interest in the services of the ICT department (as a means to improve the efficiency and save costs) had increased due to the crisis. e-Business units are somewhat under pressure as companies refocus their strategy from growth back to cost saving.

---

[33] The narrow definition includes software and applications developers, database and network professionals, ICT operations and user support technicians, and ICT service managers. The broad definition also includes telecommunications, broadcasting and medical imaging technicians (see Section II.1.2).

Importance of communication and project management skills

Asked about shortcomings, several interviewees stressed the importance of complementary competencies of ICT practitioners. In particular, communication, presentation and project management skills were seen as critical. Interviewees said that many employees as well as applicants had excellent technical skills, but had deficits in the mentioned skills. They recommended that soft skills should be paid more attention in the ICT curricula of universities and colleges.

ICT consultants with a thorough understanding of business processes

Interviewees from ICT services companies said that their main challenge was to find qualified staff for their consulting branch. Typically, large ICT services companies (notably from the software industry) have a product development and a consulting branch. One of the ICT services companies said that about 60% of their open positions were for consultants; another one said that they focused their recruitment efforts "much more on the consulting skills than on the purely technical skills." Companies expect graduates who apply as an ICT consultant to have a strong background and understanding in business processes and in management. In addition, communication and social skills (as mentioned above) are particularly important for consultants.

Requirements for practitioners in ICT companies differ from those of using companies

An important overall trend clearly emerging from the interviews is that the skills expected from ICT practitioners in ICT using companies are different to those of their colleagues in the ICT producing industry. One of the interviewees argued that this should be reflected in ICT programmes of universities; there could/should be different training programmes in the future, as "the skills requirements for a systems developer at SAP are fundamentally different to those of the person managing the application at the site of SAP's customer."

Demand for specific skills expected to increase

Asked about trends, interviewees mentioned some specific skills domains which they expected to become (even more) important in the future, and / or where they experienced a shortage of skills in the current supply:

- **Open source software**: interviewees from the ICT using industry said that they had an increasing demand for practitioners with special skills in open source software development; they argued that this was a weakness of traditional ICT training programmes and recommended that training in this domain should be formalised.

- **Consultants** with expertise in specific modules of **e-business software**: ICT service providers stressed that it was particularly difficult to find consultants for the main e-business software

- **Systems architects**: There appears to be a shortage of practitioners with specific qualifications in ICT systems and process architecture. This qualification was seen as increasingly important, in particular for large user companies with their typically complex legacy of ICT systems.

Demographic change as an issue

Several of the larger companies interviewed mentioned "demographic change" as an important issue to be considered in human resources and skills planning. They anticipate that a significant number of their ICT staff will retire in the next 5-10 years and are confronted with the challenge to manage the knowledge transfer within the company.

II.2   ICT user skills

This section looks at issues concerning ICT user skills as defined in the e-skills framework. User skills are the capabilities required by employees to effectively use ICT systems and devices as a tool in support of their own work, i.e. to accomplish tasks. This includes the use of common software tools and more advanced, specialised tools (such as computer-assisted design). The analysis focuses on two issues: first, whether there is evidence for a lack of ICT user skills and to what extent this creates problems for companies and individual employees; second, to what extent companies support their employees in acquiring such skills.

II.2.1   Statistics

The statistical data in this section is mostly based on the e-Business Watch surveys of 2009 (see Section I.2.2 and Annex I), which included specific questions on ICT user skills in view of this study.

ICT user skills and PC workers

While there are comparatively few ICT specialists in most companies, many jobs require computer and software user skills. This covers a wide spectrum of activities and intensity of use. Some employees will only occasionally use computers, for example sales representatives who spend most of their time meeting customers, but use a CRM software to manage their customer contacts. Office staff, on the other hand, are mostly working at their desk in front of a computer screen ("PC workers").

An IT manager from a large manufacturing company with about 8,000 employees interviewed for this study said that about 2,500 of them (i.e. about 30%) were mainly "**PC workers**", i.e. they spend a significant proportion of their working time (if not most of it) at their desk, processing information with support of computer systems. Most of them use mainly basic office applications such as text editing and spreadsheet calculation, communication tools (e-mail) and the web. Depending on the department they work in, they may also be users of specific applications such as the ERP or CRM system or the procurement system. There is no special education or training needed to use these systems if the employee is "digitally literate", i.e. has learned how to use a computer in principle. A few people work with more advanced software tools, for example CAD/CAM programmes, which require more experience and special expertise. However, learning how to use these tools has typically been an integral part of their professional education and should therefore not constitute a challenge for them.

In manufacturing sectors, the share of PC workers and the ICT applications used are linked with the degree of automation in production. In highly automated sectors such as the electronics, automotive and chemical industries, relatively more people will use computer systems in their daily job routines than in labour-intensive sectors such as some segments of the textile and ceramics industries. In some service sectors, nearly all employees will use a computer to do their work, for example in knowledge intensive business services, in financial services or in the real estate business.

Rising demands – but no major difficulties experienced

In the e-Business Watch survey among companies from the glass, ceramics and cement industries, more than 50% of the survey respondents felt that the **demands** on employees regarding their computer and software skills "**have noticeably increased**" in the past few years. Interestingly, this view is more widespread the larger the company is (see Exhibit II-12). In the energy supply industry, which is more ICT-intensive than the SME dominated manufacturing sector, this feeling is even more pronounced. Here, even among SMEs, 70-80% of the interviewees confirm this perception.

Exhibit II-12: Increased demands regarding ICT user skills (2009)

"The demands on employees regarding their computer and software skills have noticeably increased in our company over the past few years."
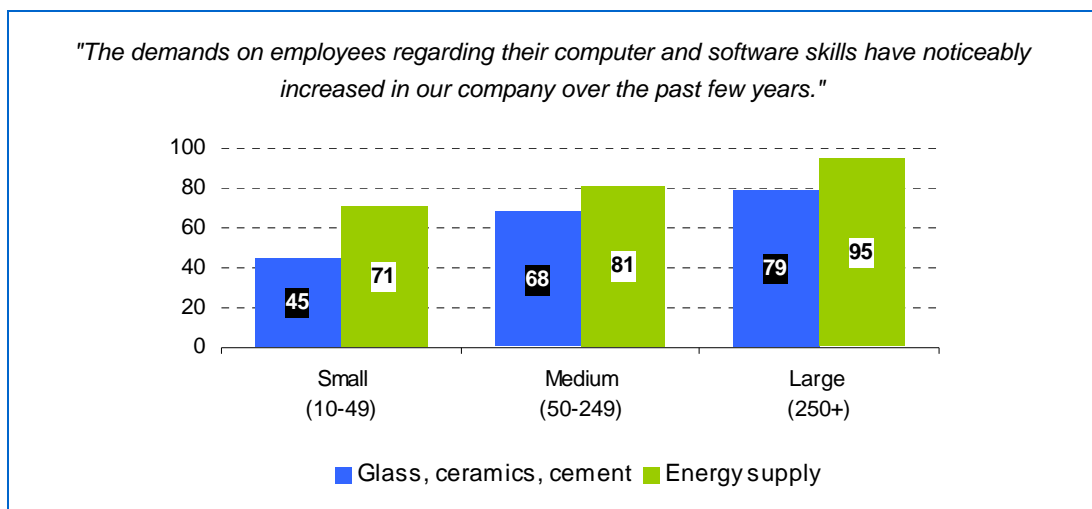
Source: e-Business Watch Surveys 2009

At the same time, however, most of the interviewees said that either no or only a **few employees had problems** in their job because of insufficient computer and software skills (see Exhibit II-13).

Exhibit II-13: % of companies observing that many / some / a few employees have problems because of insufficient computer skills (2009)
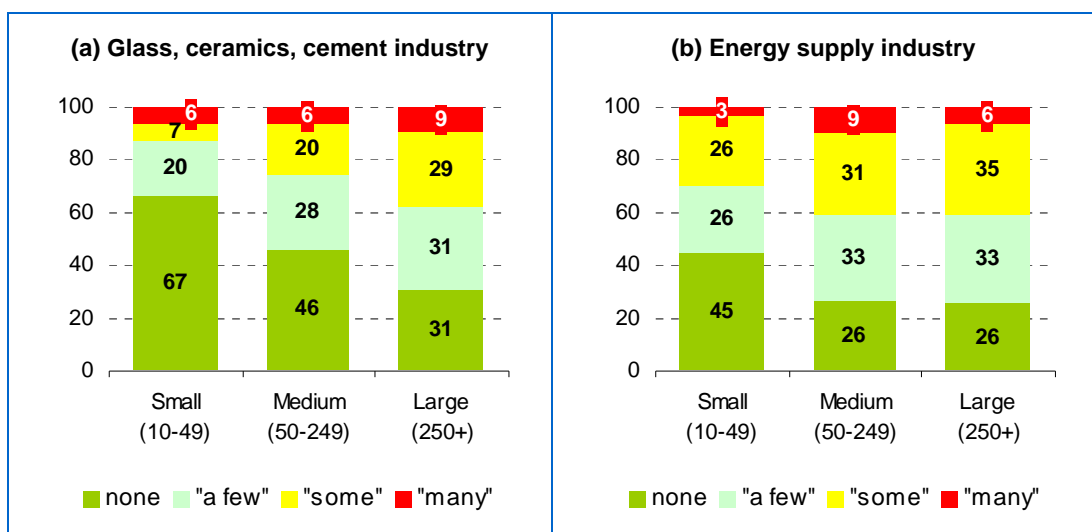
Source: e-Business Watch Surveys 2009

Even among the large companies interviewed, where more employees might be concerned, only few respondents (6-9% in the two sectors) said that "many" of their employees had problems because of insufficient computer skills. About a quarter of the companies in the glass/ceramics/cement industry and a third in the energy supply industry reported that "some" employees were challenged, the rest felt that this was not a problem or only for few employees.

Specific ICT user skills

The survey in the glass, ceramics and cement industry also explored whether it was difficult for companies to find personnel with specific, **advanced ICT user skills**, for example for operating design programmes such as CAD/CAM. In total, only 6% of the companies interviewed (representing 15% of the sectors' employees) had job openings for such positions within 12 months prior to the interview (Exhibit II-14). Among large firms, close to 30% said that they looked for new staff with such skills. In total, about a third of those firms that wanted to hire staff reported difficulties in finding people with the required user qualifications. Thus, the figures are quite similar to those for ICT practitioners. All in all, there is no evidence of a major, systemic problem in this area.

Exhibit II-14: % of glass/ceramics/cement companies with job openings requiring special ICT user skills (2009)

■ No job openings
■ Job openings - no difficulties to find
■ Job openings - difficulties to find
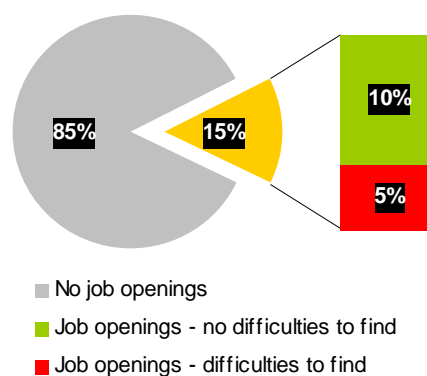
Base: companies with 10+ employees.
N = 676. Data weighted by employment.

Source: e-Business Watch Surveys 2009

In summary, these results suggest that the majority of the workforce in these sectors (and probably in other manufacturing sectors as well) is **sufficiently digitally literate** and has no major difficulties in using the software applications which they need in their daily work routines. There are certainly cases where individual workers have difficulties in adapting to new systems and working routines; but these are the exceptions and do not present a pressing business need that needs to be taken care of. Companies can handle such situations themselves.

II.2.2   Case studies

Skills gaps and ICT training measures

The case studies broadly confirm the evidence found in the e-Business Watch surveys as reported above. None of the companies interviewed regarded a lack of ICT user skills as a significant challenge or problem. The issue comes down to **individual cases** which are not at all representative and do not deserve special attention.

Interviewee A1 mentions as evidence the low demand among employees for trainings offered by the company in the area of basic office applications (such as text editing in MS Office or the development of presentations in MS Powerpoint): "We offer classes in MS Word and MS Powerpoint to our employees, but there are very few registrations for those. Obviously there is no skills gap or problem in this area."

Company A has an internal service centre that offers a broad range of training programmes, including ICT trainings. Employees are encouraged to make use of the offer and can register for selected programmes as part of their career development. The offer is available on the intranet and employees can register there, provided that his/her superior has authorised this. Asked whether employees make voluntarily use of this offer or rather have to be "pushed" by their superiors to participate in trainings, *Interviewee A1* said that it was mostly "bottom-up", i.e. the initiative comes mainly from employees. He also said that the offer currently exceeded the demand, which he attributed to the general workload: "I am the best example. I would have perfect opportunities to attend exciting management seminars which we organise, but make way too little use of it – there is always something 'important' to do in our day-to-day business, and the seminar becomes priority 2." However, he made clear that managers would generally encourage their staff to make use of training opportunities.

Basically, the need to train employees in their ICT user skills can be broken down into three main categories:

- **Updating skills**: the continuous update of one's ICT skills is seen as a requirement for many (or all) employees in the information society. Attending an ICT training is one possibility to do so (besides self-learning, learning on the job).

- **Specific improvements needed**: this concerns employees with good basic computer skills, but want or need to improve their skills in specific applications which are particularly important for their job (e.g. spreadsheet calculation in MS Excel). This is the ideal situation for specific ICT training programmes. In most cases, these skills gaps can easily be addressed.

- **Absolute lack of digital literacy**: in very few cases, employees have no computer skills at all. This concerns mostly older people. They have never used the computer and the internet in their job, but are suddenly required to do so. *Interviewee A1* mentions as anecdotal evidence a case where his company had hired a senior sales representative with more than 30 years working experience, but obviously missed to ask him about his computer skills in the recruitment process. It turned that this person had never used a computer in his previous positions. However, this is mandatory for sales representatives at Company A. In this special case, a lack of ICT user skills was a real problem. However, such cases are highly exceptional. Normally, it would be found out during the recruitment procedure.

Anticipated trends and challenges

Web 2.0 – company-internal Wikis and social networks: The Services unit in the ICT department of Company A has set up (and maintains) an internal Wiki for information sharing and informal exchanges among employees. About 800 employees have registered. This platform has never been officially announced in the company, but has gradually evolved. The success of this platform indicates the potential of Web 2.0 applications within enterprises, not only for knowledge management, but also to strengthen the company culture. Company B uses social networking tools internally for team-building and communication purposes. A special platform has been developed. However, both companies do not see any major skills implications stemming from these developments. They regard this as an evolutionary development.

Use of new communication tools: A specific challenge for the future which was mentioned by several interviewees will be to find the right approach and balance in using new web-based communication tools (such as chat and messenger functions) and Web

2.0 applications. It is a difficult trade off between ensuring ICT security ("security awareness") and not impeding the creativity of employees. The younger generation of employees has grown up with these communication tools (e.g. Skype, MSN) and wants to use them in their work for internal and external communication. However, it can be difficult to align this with the privacy and security requirements of a company. *Interviewee A1* is aware of this challenge: "We [Company A] are a very conservative company in our approach to communication and carefully consider security issues. We are fully aware of the challenge, however; young people in particular would prefer a more individual and open approach, with fewer restrictions, giving them the opportunity to use the full range of web-based tools."

Interviewee B1 confirms that this is an important issue also at Company B, but says that his company takes a progressive and active approach. "We are very active in this field and believe that it will be part of how we communicate in the future." The company believes that Web 2.0 is important both for internal and external communication. As a leading company in the use of e-business and e-communication tools, it pays much attention to developments in this field and is in the process of developing its skills in this area. Messaging, for example, is already actively used within the whole organisation.

II.2.3   Summary

This section analysed the demand for *ICT user skills* (as opposed to ICT practitioner skills), focusing on companies in ICT using industries. Key points emerging from the available data and case studies are:

ICT user skills requirements have increased …

A majority of survey respondents felt that the demands on employees regarding their computer and software skills "had noticeably increased" in the past few years. This concerns PC workers who spend a relevant proportion of their working time (if not most of it) at their desk. Most of them use mainly basic office applications such as text editing and spreadsheet calculation, communication tools (e-mail) and the web. They may also be users of specific business applications such as the ERP or CRM systems.

but no significant difficulties experienced

The statistical data as well as the case study interviews indicate that the majority of the workforce in the sectors covered (and probably in other sectors as well) is sufficiently digitally literate and has no major difficulties in using the software applications which they need in their daily work routines. Interviewees confirmed that there were cases where employees had difficulties due to a lack of ICT skills, but these were an exception.

ICT training is provided

Large companies typically offer a wide range of ICT training opportunities to their employees. One company said that the offer even "exceeded the demand".

Use of Web 2.0 in daily work routines as a trend and challenge

A specific issue and challenge for the future which was mentioned by several interviewees was to find the right approach and balance in using new web-based communication tools (such as chat and messenger functions) and Web 2.0 applications for business communication purposes (internally as well as externally). The challenge is to find the trade-off between not impeding the creativity of employees ensuring ICT security while. It is also a generation issue: the younger employees are highly familiar with Web 2.0 communication and expects to be allowed to use related tools in their daily work, while older employees often prefer traditional channels.

II.3   e-Business skills

This chapter explores which skills and qualifications companies expect from staff working in their e-business departments. These "e-business skills" as defined by the e-skills framework (see Section I.2.1) refer to the managerial understanding of e-business opportunities, and the capabilities needed to exploit them. In contrast to the previous chapters on ICT practitioner and user skills, the analysis in this chapter is entirely based on the case study interviews and not on results of representative surveys, as e-business skills were not specifically covered by the surveys referred to in Sections II.1.1 and II.2.1. The analysis focuses on the organisational approach the case companies have chosen for their e-business activity, the resulting skills requirements, and on the trends they expect in this field.

II.3.1   Case studies

Organisational set-up of e-business units / general role of e-business

In **Company A**, the e-business unit is named "Services" and represents one of six units within the "Corporate IT Services" department (see Section II.1.2). 13 people work in the Services unit (out of 50 in total who work in Corporate IT Services). The main responsibility of the e-business unit is to ensure that the company's ICT systems support marketing and sales activities in the best way possible. The key systems in this respect are the ERP systems and the extranet portal. The unit has the task to monitor and analyse the functions of these systems, identify new opportunities for their application, track difficulties, and to continuously optimise the systems and processes accordingly. They do not have to deal with the technology parts itself, but have to describe the functional requirements and oversee the process. In addition to planning and developing the functionalities in general, the unit provides help-desk support for users of these systems and manages security tasks (setting user privileges, i.e. who is authorised to use which functions of the system).

Interviewee A1 explains the typical e-business activities of his company, and how industry structure determines the scope of e-business. The company has two main divisions. One of them produces a raw material and sells it predominantly to SMEs which then manufacture articles out of this material. The other division also produces articles made of this material itself. The materials division practices advanced e-business (based on standardised data exchanges, using an industry-specific standard) with only about 30 customers; however, as *Interviewee A1* points out, these few customers account for a significant share of business, thus the volumes are substantial. This includes exchanges between the two divisions of the company (the converting division is a major customer of the materials division), which are fully conducted as e-business based on the industry-standard.

Many of the other companies are small companies, however, typically operating in a very traditional way. As a service for these customers, the company has set up an extranet portal that provides structured information about the status of their orders. Many of these companies do not have IT systems themselves which would be able to provide this analytical overview. In total, this portal has about 1600 registered users (from about 1000 companies). On average, about 200 users per day log in to actively access their customer account ("pull" mode). What is more significant, however, is that many users

have made use of the opportunity to register for an automatic report about the status of their orders ("push" mode). Thus they do not have to log in to the extranet and download data themselves, but get the structured information automatically sent to their mailbox. "We have been offering this function for years now," says *Interviewee A1*, "our customers use the service and are happy with it."

The other division produces articles itself. Their main business partners are large companies from the consumer goods and retail industry. The negotiation power of these customers is huge, and therefore they dictate the standards and processes to be used. Thus, in this division (with production facilities in 11 locations), e-business exchanges are much more heterogeneous than in the materials division, and the company needs to be flexible in responding to customer preferences.

As a result of this diverse customer structure, the two divisions of the company have different ERP systems in use. The materials division already uses a single system by TietoEnator (since 1999), while in the converting division, two ERP systems as well as other software solutions were used at the different production sites. At the time of the interview, the roll-out of a single ERP system (a Microsoft solution) for the entire converting division was in process. The unit manages this roll-out and the continuous development of the existing system.

Interviewee A1 summarises the situation as follows: "We are well prepared for e-business, we have our specialists in house as well as a subsidiary company who supports us in this field. The limiting factor, however, are the industry structures in our two main business fields. On the one hand, we have many SMEs as customers who are just not ready to switch to e-business; on the other side, our articles division depends on the preferences of our large customers." He thinks that e-business is, therefore, in many ways still "in a state of hibernation", and that his company would be prepared to go much further than they can at this point.

Company B, a multinational manufacturing company with more than 30,000 employees, is among the most advanced users of e-business in its sector worldwide. Since 2000, the company has made a massive investment in building a comprehensive infrastructure of e-business solutions to support its global business activities. e-Business is regarded as a central aspect of how global companies operate in the information society, going beyond purely transactional aspects (i.e. not just as an "additional" sales channel). Electronic transactions account for a significant proportion of trade already. The company uses different e-channels, including a highly sophisticated extranet portal for customers. The functions are similar to those provided by the extranet of Company A (see above). The principal dichotomy is also between doing business with other large companies and with small companies on the other hand. Thus, much of the observations on the role of industry structure apply here as well, although Company B is a different manufacturing sector.

The e-business activities of Company B are planned and managed by a global unit with highly strategic objectives within the information systems division (corporate IT governance, see Section II.1.2). Worldwide, the e-business unit has a staff of about 60; 30 work at the company's European headquarter, and another 30 at the main sites of the North America, Asia/Pacific and South American branches. Out of the staff working at the headquarter, six employees are responsible for the marketing of the solutions, i.e. "to bring e-business to our customers, whether internal or external customers" (*Interviewee B1*), and the remaining 25 or so take care of the technical aspects, i.e. planning, implementing and maintaining the functionalities.

Skills and competencies required

In sharp contrast to most other units within the ICT department where technical ICT skills are central, staff working in e-business units may have a background in marketing and sales (rather than in engineering disciplines). The percentage of marketing people vs. engineers depends on whether the unit is responsible for implementing its systems itself or not. This is an organisational issue which is closely linked with the size of the company and the unit.

In Company B, which has a much larger central e-business unit with 30 people, about 20 of them are ICT specialists, 5 have an affinity to ICT as they graduated from university or college programmes which combine ICT, economics and management skills, and 5 do not have an IT background at all. The head of the e-business unit is an engineer (but not in an ICT domain) and has an MBA.

In Company A, with a total staff of 13, the situation and tasks are quite different. First, there is a wide gap between the high-level competencies and responsibilities of the e-business manager(s) heading the department and most of the staff members who perform primarily help-desk functions. The **e-Business managers** need not necessarily come from a technical background (this applies to Company B as well). They have moved into this function from a position in marketing and sales. Requirements are excellent management skills, a thorough understanding of the company's strategy and its operations, and practical experience with e-business software such as ERP systems. Typically, there are only few positions in a company with this profile (no more than 1-2), even in large companies. There are often close links with supply chain management. Therefore, according to the interviewees, it would not make sense to develop training programmes specifically for e-business managers.

Interviewee A1 (head of the e-business unit in Company A) describes the typical job profile of **staff** working in his team (12 employees). A typical applicant is a young person with secondary school qualification (preferably from a commercial/business school) and some job experience in marketing or sales. A university degree is not necessary; on the contrary, university graduates are overqualified. Neither is it necessary to have experience in the sector in which the company operates when starting the position. The interviewee stresses the importance of "common sense" and the ability of applicants to perform tasks in an efficient way. To test applicants in this respect, this e-business manager has developed an assessment method using e-mail: applicants receive tasks by e-mail (item by item) and have to send back their answers by simply replying to the e-mail. "That is a very convenient method," says this manager, "I see exactly how long it takes each applicant to complete a given task and thus get a good impression about their working efficiency under pressure."

Recruitment activities & challenges experienced

For the e-business unit of Company A ("Services"), regular recruitment is not a big issue, as there is typically just one open position per year (if at all). As described above, the required qualifications for these positions are not highly specific, and the company can select from among the applicants. Only for specific, more advanced e-business projects, it can be difficult to find the right person. *Interviewee A1* mentions as anecdotal evidence a situation where he was looking for an accountant with advanced ICT / e-business skills (for a specific project). "I met my Waterloo. We were looking for such a specialist for more than half a year, but could not find anybody. It seems to be a very rare combination of skills; apparently, the vast majority of accountants does not have a proximity to ICT

issues." Those few experts that came close to matching the criteria had salary claims that were "completely out of scope". He believes that a **combination of accounting and IT skills** could be an interesting one in the future, not only for specific projects.

The (central) e-business unit of Company B had three job openings at the time when the interview was conducted, which corresponds to 10% of unit's total staff. After an acquisition, the company had to cut down on the workforce at the other company they had bought, and at the time of the interview, it was checked whether this included candidates for the new positions in the e-business unit.

For announcing positions, Company B uses the same **mix of channels** as described in Section II.1.2 for Company A: online forums, personal networks, online career portals and traditional job ads in newspapers or magazines. *Interviewee B2* also stressed the importance of **personal networks** to get in contact with potential candidates who have specific skills. External service providers, including business and software consulting companies, play an important role in this context.

Asked about e-business skills shortages or gaps, *Interviewee B2* said that the major gap he experienced were skills in **translating business processes into ICT requirements**. He said that he observed substantial communication problems in this area, leading to misunderstandings. He felt that that it was mostly experienced people who possess these communication skills and have the necessary understanding of ICT. Young graduates with a specialisation in ICT would often lack the understanding of the business context and requirements. Therefore, he was inclined to hire more experienced staff with a respective work record. It would be difficult people with these combined skills, however. He recommended university / college studies with a dual focus on ICT and micro economics or management in this context.

Training activities

In Company A, the e-business unit ("services") has also developed into a kind of training centre for the company, organising training in a range of subjects, not only in ICT-related fields (but also language classes, communication and management training). It has even been considered to develop a profit centre out of this activity (i.e. offer some of the programmes to external participants). Some of the ICT-specific programmes (about 10 courses per year) are held in cooperation with external service providers (in particular if the training concerns applications of specific ICT vendors). Other programmes teach how basic applications such as MS Outlook should be used for specific purposes in the company, e.g. for arranging a meeting. Participants are expected to be familiar with the application and are then shown the company-specific use of it.

Anticipated trends & challenges

The e-business managers were asked to name some general trends and challenges which they observe in their area. While not all of these trends have direct implications for e-skills demands, they indicate issues which their units will probably have to deal with in the future.

Impact of the economic crisis: In the case companies, the economic crisis has not significantly affected the e-business units. The e-business manager of Company A said that the crisis had rather driven the interest in the services which his unit provides (internally and among customers), as all stakeholders are seeking for ways to improve the efficiency of processes. In Company B, in spite of ICT budgets having been generally cut, the impact on the e-business department was modest. *Interviewee B2* said that the

crisis had mainly effects for the company's IT subsidiary which offers IT services to other companies, because of the decrease in demand.

e-Customs harmonisation: *Interviewee A1* points out the difficulties his unit has with managing e-customs processes: "Every country has developed its own proprietary system – this is a nightmare for multinational companies." He recommends that these systems should be harmonised within the European Union. In a way, the situation is similar to the one with cross-border e-invoicing. The technology as such is in place and could be used, but legal uncertainties and interoperability issues need to be addressed to make it really work. It has an implication for e-business units, as they will have to deal with complex technical and legal issues even more than in the past.

e-Intermediaries: *Interviewee A1* mentions the trend that large customers increasingly work with intermediaries for B2B e-business (for example for electronic invoicing). Company A is not at all happy with this development. It causes additional costs, because the transaction fees of the intermediary are mostly (or entirely) charged on the supplier, and because of confidentiality issues. For example, they would not let e-invoicing service providers archive the originals of invoices on behalf of their company. They try to convince their customers that they have the means to connect directly ("we can send the invoice in any format you tell us") and do not need the B2B service provider in between.

Video conferencing: The e-business manager of Company A said that the company makes use of video conferencing for organising training sessions for dispersed participants, e.g. for employees from different production sites. This is much more cost efficient than having the employees to travel. He says the experience is very positive, also for language courses, but there is still scope for expanding this instrument. Among managers, there are still reluctance to use video conferencing.

Recommendations

Interviewee A1 stressed the importance of the harmonisation of standards – EU should act as a coordinator in this area. e.g. for language education programmes.

Interviewee B2 suggested that ICT-related training programmes should place more emphasis on business process design and communication skills. He thinks it should be possible to teach a structured way of communicating and specifying user requirements, describing them as business processes, and then translating them into ICT systems. Some of the current programmes are possibly too much focused on the technical / engineering aspects. "*Many people can only talk about technical infrastructure and draw complex IT charts, and nobody understands what they mean; others can describe business processes very well, but often lack communication skills, failing to understand user requirements. Good business consultants combine these two skills: they quickly understand user requirements (by conducting interviews) and can translate them into processes in a structured way. And then there are the back-office IT people who do not conduct the interviews but develop the solution. It would be perfect to have people who combine all three elements in one person: the communication skills (talking to prospective users, understanding their requirements); the business process know-how; and the ICT skills.*" *Interviewee B2* believes that there is potential for optimisation in terms of communications to better cope with the existing challenges. He believed that this was one of the big issues for e-business departments, and that these skills (management of processes and interfaces) would generally rise in importance.

II.3.2   Summary

This section explored which skills and qualifications companies expect from staff working in their e-business departments, based on interviews with e-business managers in large manufacturing companies.[34] Although the small empirical evidence base does not allow to draw general conclusions for different sectors or countries, some of issues and trends that were raised in the interviews might apply to many large companies in manufacturing sectors. The findings are broadly in line with evidence of other case studies that were conducted for specific sector studies of e-Business Watch.

Skills profile of e-business managers

Many large companies have a dedicated e-business manager, often heading a unit within the ICT services department. His or her job is to explore opportunities for using ICT to support the marketing and sales activities of a company. Often they are responsible for developing the functionalities of the company's ERP system and extranet, as these are central platforms for data exchanges with customers and for service provision. e-Business managers need not have a strictly technical background in an ICT domain. Many of them are experienced marketing & sales experts. Key qualifications are excellent management skills, a thorough understanding of the company's strategy and its operations, and some practical experience with e-business software such as ERP systems.

Link between ICT and internal user communities

In ICT using companies with a dedicated e-business unit, this unit is often not a "technical" ICT unit in the strict sense. Its tasks are rather to monitor and analyse the functionality of the company's e-business systems, to identify new opportunities for their application, to track difficulties, and to suggest how the systems and processes could be optimised. Thus, the unit acts as a link between the core ICT department and the internal user community of the respective systems (e.g. marketing, sales, controlling and finance).

Translating business processes into ICT requirements

To accomplish this task, e-business departments need people that know how to translate business processes into ICT requirements, in particular in large companies with advanced e-business practices. One of the interviewees said that he experienced a shortage of young talents with these skills, as young graduates with a specialisation in ICT would often lack the understanding of the business context and requirements. However, the case studies also show that the requirements differ considerably between companies, depending on their e-business approaches.

University programmes combining ICT and business skills

Interviewees recommended to promote university & college studies with a dual focus on ICT and business/management skills. It was also suggested ICT-related training programmes should place more emphasis on business process design and communication skills in general, with a view to establishing a structured way of communicating and specifying user requirements, describing them as business processes, and then translating them into ICT systems.

---

[34]   Many companies, notably SMEs, do not have a dedicated e-business department. However, they also need to possess e-business skills, whether explicitly or implicitly. In their case, these skills requirements can be seen as part of the overall managerial understanding (see Section III.1 for implications of this). This study only focuses on explicit requirements of companies that employ specialists for developing and managing their e-business systems.

Section III: Conclusions

Issues to be considered

The concluding section aims to put the empirical evidence presented in this study in a **policy context**. Possible implications for an e-skills policy agenda and for ICT-related training (in particular for bachelor and master programmes of universities) are discussed. The limited evidence base and scope of this study do not allow to come up with detailed recommendations for specific actions. Instead, **issues** are suggested that may deserve being further discussed among stakeholders, as part of general considerations how to improve the framework conditions for the development of e-skills in Europe. Exhibit III-1 provides an overview of these issues.

Exhibit III-1: Policy issues arising from the e-skills case studies and surveys

Issue	Domain concerned	see Section
Making a clear distinction between *skills* and *occupations* (job profiles) in an e-skills policy framework	ICT practitioner skills (framework)	III.1
Considering different requirements of ICT services and ICT using sectors in an e-skills policy framework	ICT practitioner skills (framework)	III.1
Differentiating between *personal skills* (i.e. skills and competencies of individual employees) and *company skills* (i.e. the capabilities of the company as a whole)	ICT practitioner skills (framework)	III.1
ICT user skills: making a distinction between "digital literacy" at large and ICT user skills of employees; policy initiatives should focus on specific groups (risk groups)	ICT user skills (support measures)	III.2
Strengthening complementary competencies ("soft skills") in ICT training such as communication, presentation and project management techniques	ICT practitioner & e-business skills (training)	III.2
Strengthening practical experience (with business software) and business process know-how in ICT studies	ICT practitioner & e-business skills (training)	III.2
Supporting Human Resources managers in assessing how different ICT studies compare to each other	ICT practitioner skills (recruiting)	III.2

These issues are not addressed to a specific group of actors. It will require close **cooperation among all stakeholders**, involving policy makers, industry representatives, the educational sector and professional associations (such as CEPIS[35]) to effectively address them and –provided that they are supported and considered relevant– translate them into concrete actions. European e-skills policy could play an important role in this context as a facilitator, by initiating the deliberation of such issues among stakeholders and by coordinating resulting actions.

---

[35] CEPIS, the Council of European Professional Informatics Societies, is a non-profit organisation seeking to improve and promote a high standard among informatics professionals.

III.1 General implications for an e-skills policy framework

Considerations for structuring the e-skills policy domain

This study applied a conceptual framework which was initially developed by the e-Skills Forum in 2004.[36] This framework provides definitions for different types of e-skills, distinguishing between "ICT practitioner skills", "ICT user skills" and "e-business skills" (see Section I.2.1). The case study interviews conducted for this study proved that this **basic differentiation** is still **useful to structure the debate** of issues at stake. Indeed, the challenges and issues identified with regard to the demand for *ICT practitioner skills* are completely different from those concerning *ICT user skills*. It makes sense to keep these two domains (practitioners / users) apart when discussing and designing the e-skills policy agenda for the years to come.

The distinction between *ICT practitioner skills* and *e-business skills* is not as straightforward as the one between practitioners and users, because the categories overlap. It works quite well for large companies which have a dedicated e-business unit (which can be part of the overall ICT department as in the case of Company A), headed by an e-business manager and staffed with a team that plans and implements the e-business strategy of the company. However, one must be careful not to confuse the **organisational level** with the **individual skills level**. An e-business unit typically comprises staff with e-business skills as well as typical "ICT practitioners", in particular if the unit is responsible for running and maintaining ICT systems itself. The two e-business managers interviewed for this study, on the other hand, are perfect impersonations of the very model of experts with "e-business skills". Both do not have their main background in ICT (but in marketing) and would rather not consider themselves as "ICT practitioners".

The situation becomes much more difficult in companies which do not have a specific unit to plan and implement the e-business strategy. In this case, "e-business skills" cannot easily be matched with individual staff. But then, it becomes difficult to discuss specific qualifications and competencies needed and possible shortcomings experienced. The definition of skills requirements inevitably moves to the *company level* and becomes less tangible. It remains vague who exactly would have to acquire the skills and how.

An e-skills framework should therefore clearly differentiate between **personal skills** (i.e. skills and competencies of individual employees) and **company skills** (i.e. the capabilities of the company as a whole). The concept of "e-business skills" can be applied to both layers, but the issues are quite different respectively.

A matrix for the classification of ICT practitioners and their skills

An important aspect of an e-skills framework is how to structure the key category of ICT practitioners and, second, their skills. It is important to understand that these are different analytical levels: a segmentation can be made on the basis of *people* as referring to their function and occupation in companies, or on the basis of skills and competencies, irrespectively of the occupations these are associated with. Skills can be matched with specific occupations, of course, in the sense that an ICT practitioner with a certain occupation (e.g. in terms of ISCO) will need a specific set of ICT skills. Exhibit III-1 shows

---

[36] European e-Skills Forum (2004). E-skills in Europe: Towards 2010 and beyond. Synthesis report of September 2004 of the European e-Skills Forum, established by the European Commission, DG Enterprise and Industry.

two suggestions how to structure the domain of ICT practitioners focusing on their occupations.

Exhibit III-2: Classifications for structuring ICT practitioners and practitioner skills

Classifications	Main categories

ISCO-08 Classification codes	**Core**
	- Software and applications developers and analysts (251), including
	     - *Systems analysts*
	     - *Software developers*
	     - *Web and multimedia developers*
	     - *Applications programmers*
	- Database and network professionals (252), including
	     - *Database designers and administrators*
	     - *Systems administrators*
	     - *Computer network professionals*
	- ICT operations and user support technicians (351), including
	     - *ICT operations technicians*
	     - *ICT user support technicians*
	     - *Computer network and systems technicians*
	     - *Web technicians*
	- ICT service managers (133)

	Broad - Telecommunications and broadcasting technicians (352) - Medical imaging and therapeutic equipment technicians (3211)
	Very broad - Electrical equipment installers and repairers (741) - Electronics and telecommunications installers and repairers (742)
"Career profiles" developed by the e-Skills Career Portal	Definition of key job profiles for ICT specialists, derived from typical job announcements and job descriptions as used by companies. The e-Skills Career Portal describes 24 profiles:[37] Business Analyst, IT Security Coordinator, Logistics & Automation Consultant, Telecommunications Architect, Systems Integration & Testing Engineer, Enterprise Architect, Knowledge Architect, Consultant, Web Designer, Technical Writer, Project Manager, Network Administrator, Internet e-Commerce Specialist, Hardware Installation Coordinator, Data Analyst, Digital Media Designer, IT Trainer, Help Desk Supervisor, Security Adviser, Web & Multimedia Master, Database Manager, Enterprise Solutions Consultant, Software Developer, Information Systems Analyst

As Exhibit III-2 shows, the occupations defined by the new ISCO classification which came into force in 2008 match closely the profiles developed by the e-Skills Career Portal. In fact, the case studies conducted for this report **confirm** to a large extent that these categories are up-to-date and cover well the whole spectrum of occupations which require ICT practitioners. It is therefore difficult to see why and how a new / different classification other than the ones provided above would facilitate policy making. The only challenge is that the full spectrum of occupations covered by the above classifications, if broken down into such levels of detail, is quite complex if to be used as a basis for analysis and practical policy definition.

---

[37]   http://eskills.eun.org/web/guest/careerprofiles (accessed in October 2009)

Regarding **ICT practitioner skills** (as opposed to *occupations*), similar classifications could be established. However, there are two dimensions that would have to be considered: the technical skills and expertise, and other competencies such as communication and presentation skills. This study has clearly shown the importance of the second dimension, i.e. competencies which are not directly ICT-related. Interviewees pointed towards deficits among ICT practitioners and university graduates in this respect. It would probably be difficult to integrate both dimensions into a framework. The career profiles developed by the e-Skills Career Portal define both the required technical expertise and the competencies needed, as well as the education and experience typically required for a given profile. This could be the way forward. After all, it is the skills (and accompanying competencies) where policy has its main leverage: a shortage of ICT practitioners is a function of a shortage of skills available in the market and can only be addressed by training more people in these skills.

Based on the case studies summarised in this report, some suggestions for a revised framework can be made. The cases demonstrate that the e-skills requirements for practitioners in ICT-using companies (notably in manufacturing companies) are in many ways quite different from those of ICT service providers, and that the differences tend to increase. A future-oriented e-skills framework might take this into consideration.

The case studies also show that practitioners in *ICT service companies* can basically be grouped into three main functional categories: product developers (including R&D), ICT consultants, and staff providing back-office support (i.e. those concerned with running the internal ICT infrastructure). In *ICT-using industries*, a basic distinction can be made between information managers (including e-business managers) who translate business requirements into ICT solutions, and the units which then implement and maintain these ICT systems. While the latter have a similar function as their counterparts in ICT using companies, product developers and consultants have quite different job profiles requiring different sets of skills and competencies. In short, the skill and competencies which companies require could be arranged as a "plan-build-run" scheme and differentiate between the specification of user requirements (internal or external), product development and infrastructure maintenance.

Reflecting these considerations, an advanced framework for structuring ICT practitioner skills could be composed as a simple **four-field-matrix** (see Exhibit III-3): the first dimension considers in which sectors and companies the practitioners are needed and employed, with a basic differentiation between ICT using and producing industries. The second dimension considers the function within the company based on the plan-build-run model. Different skills and their profiles (such as those developed by the e-Skills Career Portal) can then be positioned within this matrix.

Exhibit III-3: ICT practitioner skills matrix (suggestion)

	ICT services industry	ICT using sectors
"PLAN" External consulting / information management / managing external service providers	• ICT consultants (in particular in the area of enterprise solutions)	• Internal information managers • Information systems analysts and systems architects • e-Business managers / e-commerce specialists • Business intelligence
"BUILD" Product development	• Software and applications developers • Web designers • Multimedia developers	• Systems developers • System integrators
"RUN" Internal infrastructure maintenance and back-office support	• ICT security specialists • ICT operations and user support technicians • Systems and network administrators • Database management • Web technicians	

Source: Sectoral e-Business Watch

The **European e-Skills Conference 2009**[38] has recently addressed, as one of the main themes, "the road ahead for a coordinated strategy to foster ICT professionalism". It will certainly be important in this context to be clear about the skills and / or competencies that need to be strengthened and to define clear targets of what is to be achieved. Frameworks such as those discussed above could be helpful in this context.

III.2   Implications for ICT training

Setting the right focus in promoting ICT user skills

In the domain of ICT user skills, e-skills and social inclusion policies have placed great emphasis that ICT skills should be promoted in Europe to help closing the digital divide. The eSkills Communication, for example, refers to the "persistence of digital illiteracy". It stresses that "the traditional notion of literacy needs to embrace the complete set of e-skills and media competences required in a knowledge-based economy" and defines "fostering employability and e-inclusion" as one of the five key components of the long-term e-skills agenda (European Commission, 2007b, p. 5).

In this context, it is very important to make a clear distinction between the digital literacy of the *population at large*, and the ICT user skills of *employees*. As for the latter, all evidence presented in this study indicates that the vast majority of the workforce (at least in the analysed companies) is sufficiently digitally literate and does not experience major difficulties in using the software applications which they need in their daily work routines. In other words, for people who are already in employment, ICT user skills are rarely a significant problem.

---

[38]   The conference took place on 20 November 2009 in Brussels, see http://www.eskills-pro.eu/ (accessed in November 2009)

This finding does not challenge the validity of social and employment policies to advance and improve ICT skills among **specific target groups**, such as unemployed people with a lack of ICT skills, or youths living in low-income households which cannot afford to provide them with computers and internet access. This is in consideration that a lack of ICT skills is a fundamental barrier to finding employment in the first place. A completely different policy domain, which does not strictly address skills but rather specific needs deals with "e-accessibility" issues.[39]

Broad and unspecific measures to promote ICT user skills in general, however, could be critically questioned. There is evidence that the development of ICT skills in general (i.e. the basic digital literacy) can be left to the market, at least in economies with an advanced status in information society development.

Acknowledging the importance of complementary competencies

Several interviewees both from ICT-using and ICT services companies recommended that specific competencies should be paid more attention in the training of ICT practitioners. They argued that the main shortcoming they experienced among practitioners was typically not the core ICT skills themselves, but rather complementary skills and competencies which are needed to apply their ICT skills in an effective and efficient way. In particular, the following competencies were mentioned as particularly important:

- **Communication and presentation skills**. Interviewees said that ICT practitioners had often difficulties in presenting their technical concepts and solutions to users in the right way. It is difficult to specify user requirements and translate them into solutions, if the users and technicians speak "different languages".

- **Project management skills** were also seen as a very important competency for ICT practitioners which scope for improvement.

- **Business processes**. An issue that came up again and again in the case interviews was the understanding of business processes. This was seen as a very important competency for many ICT practitioners, for example in ICT consulting, but also in ICT-using companies (to properly specify user requirements and plan solutions accordingly). Interviewees suggested that ICT studies should pay due attention to business process design and teach their students in using the respective methods and tools (similarly as for project management).

Expand practical training in standard business software in universities

Case study interviewees, in particular from the ICT services sector, expressed the wish that university studies should include more *practical* training in working with the most common business software systems so that they gain a better understanding of how these systems are practically used in enterprises when they start their job. Currently, according to the interviewees, most graduates have little practical experience in this respect. As a result, they have to be trained in how the systems work on the job, for example as junior members of consulting teams (if working in an ICT consultancy). Interviewees would ideally like to reduce this internal training period.

They suggested that such practical hands-on training for specific systems could be provided in cooperation between universities and the ICT industry. They argued that

---

[39] Policies aimed at ensuring that people with disabilities and elderly people can access ICT on an equal basis with others. This includes removing barriers for blind and partially sighted people.

there was high demand for ICT graduates who had acquired, *in addition* to their broad ICT skills, practical know-how with specific solutions of the main providers. They are attractive for both the ICT services industry (as consultants) and for ICT using companies who have the respective system in place.

Supporting HR managers in assessing how different ICT studies compare to each other

Finally, an issue related to ICT training which came up in interviews was the **lack of transparency** how different ICT studies (as offered by universities and colleges) compare to each other. Human resources managers, when hiring university graduates on an international basis, are confronted with the challenge that they cannot assess the actual qualifications of a graduate just from the name of the programme or from the degree (such as "bachelor" or "master"). One of the interviewees stressed how much it would be appreciated if unbiased, structured information was available that provides an overview of the different programmes and how they compare to each other (e.g. on an internet platform). This would help them to assess the qualifications which applicants of specific programmes have acquired during their study. Policy could consider to establish such an information portal with support from the ICT industry and stakeholders from the education sector. This would provide a European added value to existing national information systems.

There is already a good example of a European e-skills information portal which has been established in cooperation of different stakeholders: The "**eSkills career pilot**" (http://eskills.eun.org/web/guest/home) was set up under the leadership of the e-Skills Industry Leadership Board (ILB) and supported by the European Commission's DG Enterprise and Industry. It aims to "demystify careers in the IT industry" by providing IT-related learning resources and guidance on qualifications in the field. The portal is an information point mainly addressing young people, providing them support in choosing their path for ICT careers.

It could be considered to establish another portal which addresses the "counterpart" of young people with an interest in ICT careers, namely their prospective employers (more specifically the HR managers). This portal would provide guidance to them about different ICT-related degrees in Europe, thus having a matching function between graduates and their potential employers.

References

Literature

Cepis et al. (2007). Thinking Ahead on e-Skills for the ICT Industry in Europe. Study by Cepis, PREST and Eurochambres, commissioned by the European Commission, DG Enterprise and Industry.

Deutsche Bank Research (2008). "STEM professionals: Between cyclical shortage and structural change". 2 September 2008

Drucker, Peter (1985). Innovation and Entrepreneurship. New York: HarperCollins Publishers.

EITO (2000). "Skills requirements for the internet economy", p. 52ff.

empirica (2007). Benchmarking policies on multi-stakeholder partnerships for e-skills in Europe. Study by empirica, commissioned by the European Commission, DG Enterprise and Industry.

European Commission (2006): Mid-term review of industrial policy. A contribution to the EU's Growth and Jobs Strategy. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. COM(2007)374. Brussels, 4 July 2007.

European Commission (2007a): Sectoral e-Business Policies in Support of SMEs. Innovative approaches, good practices and lessons to be learned. Final Report of the study "Benchmarking Sectoral Policy Initiatives in Support of e-Business for SMEs". A study by empirica, Databank and Idate.

European Commission (2007b): e-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. COM(2007)496 final. Brussels, 7 September 2007.

European Commission (2008a). Communication from the Commission on the European Competitiveness Report 2008. COM(2008) 774 final, 28.11.2008.

European Commission (2008b). European Competitiveness Report 2008. Commission Staff Working Document, SEC(2008) 2853, 28.11.2008.

European Commission (2009). Europe's Digital Competitiveness Report. Main achievements of the i2010 strategy 2005-2009. Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions. COM(2009)390 final. Brussels, 4 August 2009.

IDC / empirica (2009). Monitoring e-skills demand in Europe: Foresight Report (2009). Study conducted for the European Commission, DG Enterprise and Industry, October 2009.

IDC (2008). "End Users Postpone Investments as a Result of Skills Gap". IDC Insight, prepared by Mette Ahorlu.

IDC (2005). Networking skills in Europe: will an increasing shortage hamper competitiveness in the global market? IDC White Paper, based on a study commissioned by Cisco Systems.

OECF (2004). The Economic Impact of ICT. Measurable Evidence and Implications.

OECD (2006). Information Technology Outlook 2006, Chapter 6: ICT skills and employment.

OECD (2008). Information Technology Outlook.

OECD (2009). The impact of the crisis on ICT and ICT-related employment.

Porter, Michael E.; Sala-i-Martin, Xavier; Schwab, Klaus / World Economic Forum (2008). The Global Competitiveness Report 2007-2008. Palgrave MacMillan, New York.

Rand Europe (2005). The supply and the demand of e-skills in Europe. Study by Rand Europe, commissioned by the European Commission, DG Enterprise and Industry.

Selhofer, Hannes (2000). "Skills shortage vs. Job Creation: A Review of Empirical Evidence on the Issue of ICTs and Employment," in: Vierteljahreshefte zur Wirtschaftsforschung, DIW Berlin, Heft 4, 69. Jahrgang, 2000, p. 510-526

Interviews

Interview A1 with an e-Business Manager of **Company A**, a large stock-listed manufacturing company in Europe (>5,000 employees), 30 April 2009

Interview A2 with an IT Manager at **Company A**, a large stock-listed manufacturing company in Europe (>5,000 employees), 30 April 2009

Interview B1 with an e-Business Manager at **Company B**, a multinational, stock-listed European manufacturing company (> 30,000 employees), 11 May 2009

Interview B2 with an IT Manager at **Company B**, a multinational, stock-listed European manufacturing company (> 30,000 employees), 11 May 2009

Interview C1 with an IT Manager of **Company C**, a large ICT service provider (> 2,000 employees), 3 June 2009

Interview D1 with the Head of Information Systems at **Company D**, a large manufacturing company in Europe with an international presence (> 30,000 employees), 25 September 2009

Interview E1 with the Head of Human Resources at **Company E**, a large software company in Europe with an international presence (> 2,000 employees), 1 October 2010

Annex I: About the Sectoral e-Business Watch

Mission and objectives

The Sectoral e-Business Watch (SeBW) studies the adoption and impact of ICT and electronic business practices in different sectors of the economy. It continues activities of the preceding "*e-Business W@tch"* which was launched by the European Commission, DG Enterprise and Industry, in late 2001, to support policy in the fields of ICT and e-business. The SeBW is based on a Framework Contract and Specific Contracts between DG Enterprise and Industry and empirica GmbH.

Within the European Commission, DG Enterprise and Industry has the mission to help improve Europe's economic standing by ensuring that businesses are competitive and that they can compete openly and fairly. In ICT-related fields, DG Enterprise and Industry targets six policy fields: competitiveness of the ICT-producing sector, ICT uptake in ICT-using sectors, legal issues related to ICT uptake, ICT standardisation, e-skills and disruptive ICT.[40]

The services of the SeBW are expected to contribute to policies in these fields. The mission of the SeBW can be broken down into the following main objectives:

- to assess the **impact of ICT** on enterprises, industries and the economy in general, including the impacts on productivity and growth, and the role of ICT for innovation and organisational changes;

- to highlight **barriers for ICT uptake**, i.e. issues that are hindering a faster and/or more effective use of ICT by enterprises in Europe;

- to identify and discuss **policy challenges** stemming from the observed developments, notably at the European level;

- to provide a **forum for debate,** giving researchers, industry and policy representatives the opportunity to discuss the issues at stake.

By delivering evidence on ICT uptake and impact, the SeBW is to support informed policy decision-making in policy domains also beyond ICT, including innovation, competition and industrial policy.

Policy context

The initial "*e-Business W@tch"* programme was rooted in the **eEurope Action Plans** of 2002 and 2005. The eEurope 2005 Action Plan had defined the goal "*to promote take-up of e-business with the aim of increasing the competitiveness of European enterprises and raising productivity and growth*".[41] The **i2010 policy**[42], a follow-up to eEurope launched in 2005, also stresses the critical role of ICT for productivity and innovation, stating that "*the adoption and skilful application of ICT is one of the largest contributors to productivity*

---

[40] See http://ec.europa.eu/enterprise/ict/index_en.htm#policy for more details.

[41] "eEurope 2005: An information society for all". Communication from the Commission, COM(2002) 263 final, 28 May 2002, chapter 3.1.2.

[42] "i2010 – A European Information Society for growth and employment." Communication from the Commission, COM(2005) 229 final.

and growth throughout the economy, leading to business innovations in key sectors" (p. 6).

In 2005, in consideration of globalisation and intense international competition, the European Commission launched a **new industrial policy** (European Commission, 2005) to create better framework conditions for manufacturing industries in the coming years. Some of the policy strands described have direct links to ICT usage, recognising the importance of ICT for innovation, competitiveness and growth. In a **mid-term review** of the new industrial policy in 2007 (European Commission, 2007), the EC identified three particular challenges: intensified globalisation and technical change as well as climate change. In 2009, the EC plans to issue a Communication related to the role of high technology and industrial policy in the **economic crisis**.

By providing empirical evidence about the role and potential of ICT for business, the Sectoral e-Business Watch supports policy formulation by DG Enterprise and Industry in these fields. It has close links with the following other policy action lines and initiatives:

- the e-Business Support Network (**eBSN**), a European network of e-business policy makers and business support organisations,

- **e-Skills** related policies of DG Enterprise and Industry (see European Commission, 2007b)

- activities in the area of **ICT standardisation**, as part of the general standardisation activities of the Commission.

In parallel to the work of the SeBW, the "**Sectoral Innovation Watch**" (see http://www.europe-innova.org) analyses sectoral innovation performance and challenges across the EU from an economic perspective.

The work programme

Since 2001, the SeBW has published e-business studies on about **30 sectors** of the European economy, annual comprehensive synthesis reports about the state-of-play in e-business in the European Union, statistical pocketbooks and studies on specific cross-industry ICT issues. All publications can be downloaded from the programme's website at http://www.ebusiness-watch.org. In 2009, the main studies of the SeBW focus on the following topics:

No.	Study	Sectors in focus
1	ICT and e-business impacts in the energy supply industry	Electricity, gas, steam and air conditioning supply (NACE Rev.2 Division 35)
2	ICT and e-business impacts in the glass, cement and ceramic industry	Manufacture of other non-metallic mineral products (NACE Rev. 2 23.1-6)
3	ICT impacts on greenhouse gas emissions in energy-intensive industries	Energy-intensive sectors (mainly chemical, steel, paper, glass, cement)
4	An economic assessment of ICT-related industrial policy	(cross-sectoral analysis)

In addition, SeBW conducts a number of further, smaller studies on specific aspects of ICT and e-business, such as this study on e-skills developments and challenges.

Annex II: Statistical data sources used for this study

AII. 1) Eurostat Community survey on ICT usage in enterprises

The Eurostat Community Survey on ICT Usage in Enterprises, which has been carried out annually since 2002 (with a pilot in 2001), is – together with the survey on ICT Use in Households – one of the main vehicles in European statistics to collect information society indicators on a European scale. The Eurostat surveys have a major advantage over ad-hoc surveys for specific projects such as the Sectoral e-Business Watch surveys: they have a huge scope. More than 65,000 enterprises have to fill in the questionnaire in the participating Member States.

The Eurostat survey of 2007 included a specific module in the questionnaire (Module E) on e-skills. Companies were asked 16 questions focusing on the ICT competence in the enterprise unit and the demand for ICT skills, such as:

- Did the enterprise employ ICT/IT specialists and, if so, how many;

- Did the enterprise recruit or try to recruit personnel for jobs requiring ICT specialist skills and did it have hard-to-fill vacancies for such jobs; if so, what were seen as the main reasons;

- Were any ICT functions requiring ICT/IT specialists performed by external suppliers and, if so, which functions; further questions on the geographical location of the service provider.

Some of the results of this part of the 2007 survey are used as evidence in this study. The target population of this survey were enterprises with at least 10 employees from a wide range of sectors, covering manufacturing, construction, wholesale and retail, transport and storage, real estate and financial services. Further sectors such as electricity, gas and water supply were optional, i.e. not systematically covered in all Member States.

A challenge for users of the results is that the Eurostat data are not available at case level but only in aggregate format, thus only the pre-defined breakdowns (e.g. by country or by NACE category) are available.

More information about the background of this survey and the results are available via the information society statistics section of the Eurostat website:

http://epp.eurostat.ec.europa.eu/portal/page/portal/information_society/introduction

AII. 2) Sectoral e-Business Watch Surveys of 2009

The Sectoral e-Business Watch has been collecting data relating to the use of ICT and e-business in European enterprises by means of representative surveys since 2002. The surveys of 2009 were carried out among companies from the glass, ceramics and cement sector (676 interviews) and in the energy supply industry (351 interviews), with ICT decision-makers in six EU countries. Interviews were carried out in March 2009, using computer-aided telephone interview (CATI) technology.

Questionnaire: The questionnaire contained about 90 questions which were structured into different modules. One module in both surveys addressed the demand for ICT skills (including questions on recruitment activities, difficulties experienced and outsourcing of ICT services). The results from this module are the basis for the data presented in this study.

Target population: In both surveys, the survey population was defined as companies with at least 10 employees[43] which used computers, were active within the national territory of one of the six countries covered, and which had their primary business activity in the specified sectors. The two sectors were defined on the basis of NACE Rev. 2 Groups.

Exhibit A.II-1: Population coverage and scope of the e-Business Surveys 2009

No.	Sector	NACE Rev. 2 activities covered	Population definition	No. of interviews conducted
1	**Glass, ceramics and cement industry**			
1.1	Glass and glass products	23.1	Companies using computers and having at least 10 employees from six EU countries (Germany, France, Italy, Poland, Spain, UK).	159
1.2	Refractory products	23.2		20
1.3	Clay building materials	23.3		75
1.4	Other porcelain and ceramic products	23.4		60
1.5	Cement, lime and plaster	23.5		25
1.6	Articles of concrete, cement and plaster	23.6		337
	TOTAL			**676**
2	**Energy supply industry**			
2.1	Electricity	35.1	(as above)	212
2.2	Gas	35.2		69
2.3	Heating/cooling	35.3		70
	TOTAL			**351**

Fieldwork was coordinated and conducted by the German branch of Ipsos GmbH (http://www.ipsos.de), in cooperation with local partner organisations in some of the countries covered on behalf of the Sectoral e-Business Watch. Pilot interviews prior to the regular fieldwork were conducted with about 25 companies in Germany in February 2009,

---

[43] Evidence from previous surveys shows that computer use can be expected to be 99% or more in all sectors among medium-sized and large firms.

in order to test the questionnaire (structure, comprehensibility of questions, average interview length).

Sampling: Due to stratified sampling, the sample size in each size-band is not proportional to the population numbers. If proportional allocation had been used, the sample sizes in the 250+ size-band would have been extremely small, not allowing any reasonable presentation of results. Thus, weighting is required so that results adequately reflect the structure and distribution of enterprises in the population of the respective sector or geographic area. The Sectoral e-Business Watch applies two different weighting schemes: weighting by employment and by the number of enterprises.[44]

Confidence intervals: The level of accuracy that can be expected for industry totals (based on all respondents) and for specific break-downs depends on the sector, percentage value and weighting scheme. The confidence intervals[45] are, on average, 3-5 percentage points (+/-, and in both weighting schemes) for the sector total. Confidence intervals are higher for sub-sectors and specific break-downs, typically between 5 and 10 percentage points (+/-) for specific sub-sectors.

A more detailed report about the survey methodology is available in the methodological annexes of the specific studies on these sectors and on the e-Business Watch website.[46]

---

[44] In the tables of this report, data for totals are normally presented as employment-weighted data, while data for size-bands are in % of firms from the respective size-band.

[45] A confidence interval indicates how likely a specified interval is to contain the given parameter. This is determined by the (i) confidence level and (ii) the selected confidence coefficient. For example, in the survey, the result might be that 40% of enterprises use a certain software application. A "90% confidence interval" for the proportion in the whole population of enterprises using the same technology might be "37% to 43%", which means that the actual adoption value will be within this interval with a likeliness of 90%.

[46] Methodology information about the surveys, as well as a detailed Table Report with further survey results, are available at the project website (http://www.ebusiness-watch.org). Researchers who want to use the raw (case level) data for their own statistical analysis can send a request to receive the data via an online form on the website (the conditions for use are also specified there).